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Military Aircraft Crash Sites

Archaeological guidance on their significance
and future management



ENGLISH HERITAGE

Military aircraft crash sites are an important part of Britain's military and aviation heritage. Predominantly dating from World War II, during which there was a massive expansion in air activity over the UK, they comprise the buried, submerged or surface remains of aircraft, most of which crashed either in combat or training.

Some crash sites are visible, for example as spreads of wreckage within upland environments, or are exposed at low tide. In most cases, however, a scatter of surface debris may mask larger deposits, often buried at great depth. The initial impetus for recoveries comes from both eyewitness reports and documentary research. The debris field can be located by systematic walking across ploughed fields to identify surface concentrations of wreckage or with a magnetometer to assess the extent of buried remains, on the basis of which a point or points of impact can be estimated. Given the potential weight of the components, and their depth, excavation is often carried out using mechanical excavators.



Propeller stubs and reduction gear (above) and remains of a wing section (below) from a Halifax that crashed in the Lake District in 1944. Although much depleted by souvenir hunting and recovery, upland crash sites represent the only places in England where recognisable or substantial remains still lie intact on the surface. (Photographs by kind permission of Russell E Brown/Lancashire Aircraft Investigation Team)



Belonging to a period still well within living memory, crash sites have significance for remembrance, commemoration, their cultural value as historic artefacts and the information they contain about both the circumstances of the loss and of the aircraft itself. Crash sites may on occasion also contain human remains, giving them additional value and status as sacred sites and war graves.

It is therefore important that these remains are considered a material matter where they are affected by development proposals and local authority development plan policies and where research- or recovery-led excavations are proposed. Where crash sites are thought to be particularly valuable, for example where they are spatially well-defined and contain the remains of rare aircraft types, such sites may be considered nationally important and should be treated accordingly in line with *Planning Policy Guidance Note 16*. However, all crash sites should be considered of historic significance and the information they contain should not be needlessly destroyed or removed without adequate record.

Loss, retrieval and preservation

In the 1960s, when memories of World War II were still fresh, aviation enthusiasts began to search for the remains of some of the thousands of aircraft lost over southern England, with a particular emphasis upon those destroyed in the summer of 1940 during the Battle of Britain. Early investigations were often cursory, their primary objective being the recovery of highly prized or sought-after artefacts such as the aircraft's control column, and it was not at all unusual for sites to be successively excavated and re-excavated by more than one group or individual over several years. As the accessible Battle of Britain period sites were gradually exhausted, efforts focused on less-easily reached locations, until ultimately attention also turned to crashes from later in World War II.

Documentary sources show us that tens of aircraft were lost on virtually every day of the war. In some cases this may have been due to mechanical failure, in others human error: brought about by fatigue, inexperience or over-confidence. A significant proportion of crashes were the result of damage suffered in combat, whilst the necessity of flying in adverse weather accounted for many more. In exceptional circumstances a pilot might be able to make a forced-landing, saving both the crew and possibly also the aircraft for future use. Often, however, the crew were

forced to take to their parachutes, leaving their aircraft to crash on its own. More commonly still, crew members were unable to escape and remained with the aircraft on impact.

Even during the height of conflict most sites were visited soon after the crash by recovery teams, to remove salvage, human remains, ordnance and, in the case of enemy aircraft, to examine the wreckage for intelligence purposes. The amount of recoverable material was influenced by the size of the aircraft, its speed and angle at impact, the surface into which it impacted, and its location. All of these factors have affected what survives of crash sites today. The period of the crash is also important. World War I aircraft were light, relatively flimsy and, with airframes of wood and 'doped' (varnished) fabric, particularly susceptible to fire. Crashed aircraft from this period tended to remain on the surface and were both simple to recover and more vulnerable to subsequent disturbance. Whilst inter-war period aircraft were slightly larger and more robust, they shared more in design and construction with those of World War I than World War II, in addition to which recovery could be conducted more thoroughly in peacetime than under the pressures of war. During World War II aircraft were much larger, more complex and made extensive use of lightweight but immensely strong alloys. An aircraft from this period hitting the ground at a steep angle and a considerable speed could bury itself many metres deep, leaving large but fragile components such as the wings on the surface and creating a smoking crater, at the bottom of which might be the engine or engines. Above would be the severely compacted airframe, sometimes containing the crew. Salvage crews could easily remove surface wreckage, and where it was known that crew members were unaccounted for strenuous efforts were made to recover their remains, a task made no easier by their depth, the large quantities of aviation fuel and the ever-present risk of fire. Once the crash site had been cleared and made safe the crater would be back-filled before the recovery crew moved on to their next task. As a result of contemporary recovery, even where archaeological traces remain, excavation of lowland World War II crash sites may yield on average only approximately 1 per cent (in weight) of the aircraft. In a very few cases up to 10 per cent may survive, but much of this will be severely distorted and difficult to identify. Most World War I and inter-war crash sites will yield even less.



Because of contemporary recovery operations and subsequent agriculture, survival at most lowland crash sites will often consist of nothing more than a surface scatter of debris. The wreckage in the illustration – all that remains of a Vickers Wellington bomber weighing 12,000kg – represents the result of a careful magnetometry survey followed by systematic recovery. (Photograph by Mark Evans, Midlands Aircraft Recovery Group)



Under certain circumstances, preservation in tidal or inter-tidal zones can be exceptional. The cockpit, centre section and Merlin engine of this Hawker Hurricane, a casualty of the Battle of Britain, were recovered from the beach at Walton on the Naze in Essex, and are now on display at the RAF Museum, Hendon.



Submerged crash sites perhaps offer the best potential for the future. The remains of a Wellington bomber which crashed in Loch Ness on New Year's Eve 1939 are seen here being recovered in 1985. Carefully restored, the aircraft is now displayed at Brooklands Museum and is one of only two complete Wellingtons known to survive out of a total production run of 11,500. (Photograph by kind permission of Brooklands Museum)

Preservation is generally better for crash sites in the uplands, in the inter-tidal zone, or for those completely submerged in rivers, lakes or in the sea. As with more conventional archaeological sites, the inaccessibility of upland crash sites has contributed to their survival, and although much depleted by souvenir hunting and recovery they represent the only places in England where recognisable or substantial remains still lie intact on the surface. The English Channel and the North Sea were the focus of a significant proportion of air activity during the last war, with many hundreds of aircraft being abandoned or crash-landed close to the coastline due to combat damage or technical failures. For example, 234 aircraft of RAF Fighter Command crashed into the sea during the four months of the Battle of Britain, whilst the log for the Skegness lifeboat records that it was called out to aircraft crashes on sixty-one occasions between 1939 and 1945. Given the relatively low speed of impact in many cases, aircraft which crashed at sea were often largely intact as they came to rest on the sea floor and may have remained so, though subsequent damage by trawler nets, salt corrosion and storm action is often severe. The same is true of crash sites in the inter-tidal zone. As with other types of archaeological deposits, preservation within these environments has been generally good, while the majority of the more visible sites have become depleted through souvenir hunting and amateur excavation. It is likely that in submerged and inter-tidal contexts some previously unidentified sites will remain intact and in a good state of preservation.

In general terms preservation is often best in waterlogged contexts, where anaerobic conditions slow the oxidation of metals and allow the survival of organic materials such as wooden airframe structures, wooden and fabric coverings, parachutes, documents and clothing. Heavy clay soils also aid survival by sealing the debris in pockets of oil or aviation fuel, thus retarding deterioration. Airframes and engines often contain a large amount of aluminium alloy. Although aluminium is in itself relatively resistant to decay, the metal with which it is alloyed has a significant bearing upon its survival.

In many cases investigation may reveal nothing more than small surface scatters of debris. In others, however, substantial pieces including engines, portions of airframes and the equipment and effects of crew members may survive. At a very few sites – chiefly those in inaccessible areas such as mountains, marshland or inter-tidal zones – large components still lie where they fell.



Many crashes involved fatalities. It is estimated that in the region of 80,000 aircrew of all nationalities were killed flying from or over the UK during WWII. Not all of these losses occurred as a result of combat; RAF Bomber Command alone lost 8,000 aircrew in training accidents. The photograph shows a common wartime scene: RAF aircrew from a Midlands-based Operational Training Unit being buried with full military honours (Photograph by kind permission of the estate of the late Jack Clark)

Why are crash sites important?

Crash sites are a tangible reminder of the extent of air activity over and around the UK during World War II; a series of battles and raids which are gradually fading from living memory. Given the losses with which they are often associated (sometimes represented by *in situ* human remains), crash sites frequently also provide a focus for commemoration and remembrance. Alongside contemporary documentary

records and eye witness accounts, the physical remains also provide a means of reconstructing and in some cases re-assessing our understanding of this aspect of the past.

Crash sites constitute a unique archive of World War II and earlier military aircraft. Many aircraft preserved in museums have either undergone major restoration or are late production models which have been converted to resemble



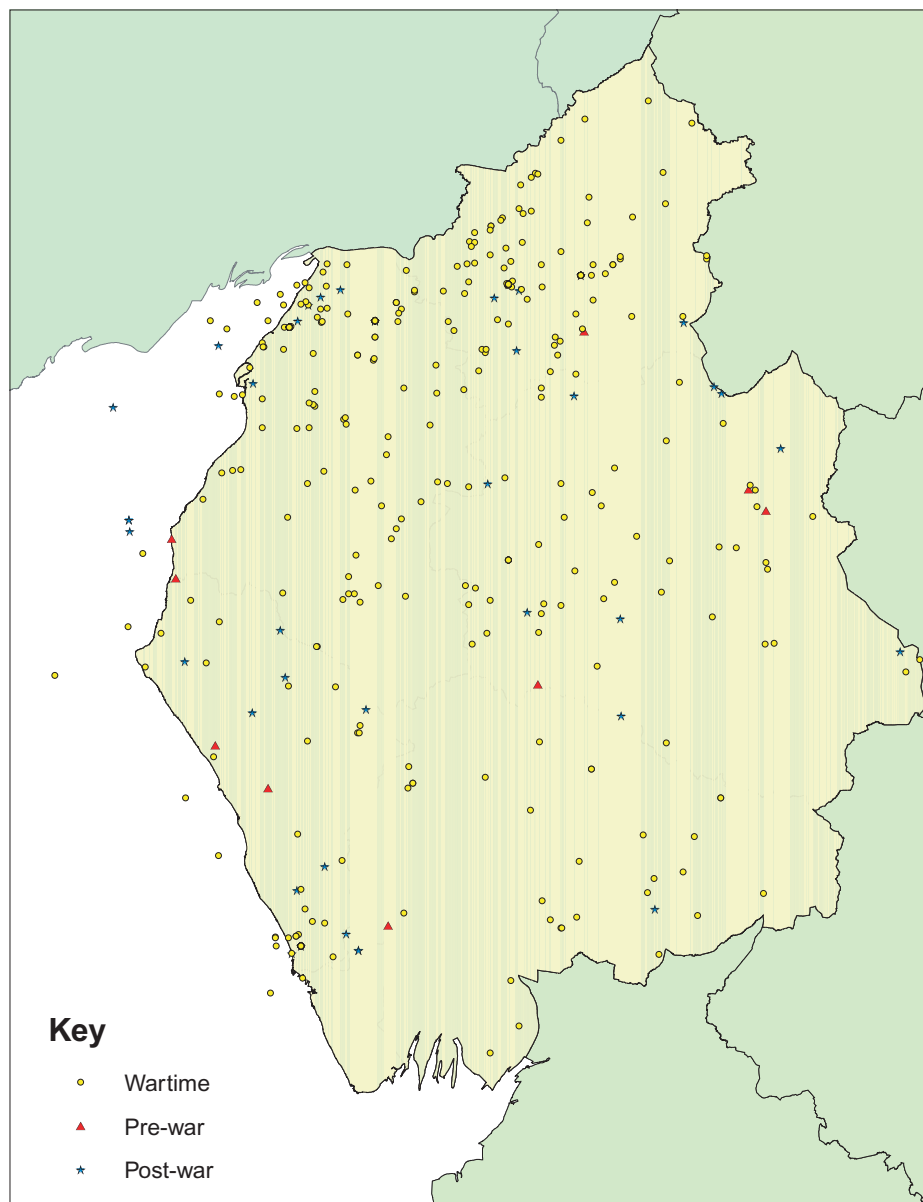
Civilians and an RAF guard gather around the wreckage of a Luftwaffe Messerschmitt 109 fighter which broke up in mid-air and fell on a London street during the Blitz. After being assessed for intelligence purposes, most such wreckage was sent for scrap.

wartime examples. Although the research and skills underlying such restorations are often considerable and serve a valuable purpose in showing what the aircraft may have looked like originally, the remains within crash sites can offer information on manufacturing processes, materials, internal fittings, modifications and even paint finishes that is not available from other sources. Whilst the airframes at most crash sites are fragmentary, significant ancillary items such as engines, electrical, radio or navigational equipment and armament often survive. In some cases these may have a rarity value independent of the aircraft in which they were installed.

The work of English Heritage

Since 1986 English Heritage has been undertaking a national review of England's archaeological resources with the aim of securing their future management – the Monuments Protection Programme (MPP). As part of the MPP and following on from earlier work on 20th-century military remains in England, English Heritage carried out a survey of crash sites in consultation with the Ministry of Defence (MoD).

The first stage of this survey was to estimate the total number of crash sites in England. There are no precise figures available for the number of military aircraft lost over Britain or within its territorial waters during World War I, World War II and the inter-war period. However, whilst records for World War I are particularly fragmentary, those for World War II are better and allow a general estimate to be made. For example, between 1939 and 1945 RAF Bomber Command lost 1,380 aircraft within the UK whilst either outward or inward bound on operational flights and, along with its Operational Training and Heavy Conversion Units, a further 3,986 aircraft in non-operational accidents. The Luftwaffe is known to have lost 1,500 aircraft in and around the UK. American losses are harder to establish because contemporary statistics made no distinction between those aircraft lost in combat over continental Europe or those crashing on their return. However, the UK-based VIIIth Army Air Force reported 1,084 aircraft destroyed through non-operational causes. With the addition of losses for RAF Fighter, Coastal, Army Co-operation and Transport Commands, the Royal Navy's Fleet Air Arm, the Italian Regia Aeronautica, the US IXth Army Air Force, the US Navy and the VIIIth Air Force's operational losses, the combined total figure for World War II might be



Contemporary records provide the primary source of information on the location of crash sites and, although of variable quality, may provide basic data. This distribution plot of known crash sites in Cumbria is not exhaustive, but readily illustrates the size of the resource and the extent of air activity during WWII in comparison to other periods. (Matthew Wright)

expected to be considerably in excess of 10,000 aircraft.

Although records relating to actual crash locations are often imprecise, during World War II a significant number clustered along the southern and eastern margins of England where the majority of air activity took place. For example, there are estimated to have been around 1,000 wartime crash sites in Suffolk, compared to the 500 aircraft believed to have crashed in Warwickshire.

Research for the MPP survey indicated that crash sites are likely to contain the largest and most intact remains of twenty-one (22 per cent) of the ninety aircraft types which operated over the UK during World War II, for which no complete examples survive (see Tables). Of the British military aircraft used in the UK prior to World War II, sixty-seven (72 per cent) of the ninety-three types are extinct, and crash sites pertaining to any of these

aircraft would therefore be particularly valuable. Aircraft in the post-war period have generally been produced in much smaller numbers and have fared better in terms of preservation, with intact examples of all major types surviving. This is because the high cost of producing new aircraft means that existing airframes are more likely to be successively upgraded and modified than replaced, with the result that they remain in service far longer than their predecessors. When aircraft go out of service they tend now to be offered to museums and collectors in comparatively large numbers. Also, since the 1960s lobbying by the aircraft conservation movement has ensured that the MoD has given greater consideration to preservation when disposing of aircraft. Crash sites from this post-war period are therefore considered to have less archaeological merit than those of earlier date.



In exceptional circumstances, normally where the speed and angle of impact caused the wreckage to be buried at much greater depths, lowland crash sites may yield much information. The dark circular patch in the centre of the photograph is the entry hole created by a Supermarine Spitfire hitting the ground vertically at a speed of 400 mph. Although the wings broke off on impact, subsequent excavation recovered the complete fuselage, from engine to tail section, compacted from 9m to less than 1.5m.

Criteria for selection of important sites

English Heritage recognises the importance of sites in terms of survival, rarity or historic importance, and would wish to minimise unnecessary disturbance to examples that meet a combination of the following criteria:

- The crash site includes components of an aircraft of which very few or no known complete examples survive. Examples of the commonplace may also be considered of importance where they survive well and meet one or more of the other criteria.
- The remains are well preserved, and may include key components such as engines, fuselage sections, main planes, undercarriage units and gun turrets. Those crash sites for which individual airframe identities (serial numbers) have been established will be of particular interest.
- The aircraft was associated with significant raids, campaigns or notable individuals.
- There is potential for display or interpretation as historic features within the landscape (for example as upland crash site memorials), or for restoration and display of the crashed aircraft as a rare example of its type.

In general terms, sites meeting any three of these criteria are sufficiently rare in England to be considered of national importance.

Management options

All crashed British aircraft in the UK or its coastal waters are deemed Crown property, all Luftwaffe crash sites are considered captured property surrendered to the Crown, and for US aircraft the MoD acts as the representative of the US government. Under the 1986 Protection of Military Remains Act (PMRA) anyone wishing to excavate or recover a military aircraft is first required to apply for a licence. Licensing for the PMRA is administered by the Central Casualty Section, a part of the Royal Air Force Personnel Management Agency (PMA). Many crash sites still contain live ordnance and, although efforts were made to remove them at the time, a few may also contain the remains of the aircrew. The MoD

wishes to minimise the potential risks to excavators and has a moral obligation to the families of dead servicemen to protect their relatives' remains from disturbance, hence applications for a licence to excavate will be refused where there is a risk that such operations may disturb either ordnance or human remains. Even where a licence is granted, however, aircraft wreckage may include items of equipment other than weapons and ammunition that can pose a potential danger, even though they were not regarded as hazardous when the aircraft was lost. For example, the dials of many aircraft instruments were painted with radium-based luminous paints; instruments so treated are now regarded as posing a significant radiological hazard. A note of guidance, available on application



Crash sites are places of loss and commemoration. In 1980 building work for a school-based community centre in Wigston, Leicestershire, uncovered the remains of a Polish Air Force Avro Lancaster which had crashed on the site in 1946, killing the crew. Today, a memorial plaque in the school is the focal point for an annual service conducted by members of Leicester's large Polish community. (Photograph by kind permission of the Polish Air Forces Association)

from the PMA, further explains the procedures and terms for obtaining a licence.

English Heritage fully supports the MoD in its aims, but also recognises the historic importance of the remains. For these reasons, in addition to the terms of the PMRA and depending upon their nature and significance, crash sites could also be dealt with in one of the following ways:

- There is a presumption that nationally important sites should be preserved *in situ*. Scheduling will have a limited and specific role to play, however, due to the difficulties of establishing the extent of buried deposits and because it will offer little protection to smaller – and therefore portable – surface artefacts. Scheduling will only be considered where the extent of the site is known, is demonstrably of national importance, and where English Heritage seeks to control works or damaging activities (perhaps including excavation) through the Scheduled Monument Consent procedures. In the case of larger surface wreckage in upland areas preservation *in situ* may be a viable option, particularly if used in conjunction with interpretation in the form of a guide, trail or signage. (*See Scheduled Monuments: a guide for owners and occupiers*, EH Product code 50403, for an explanation of the role of scheduling).
- In the majority of cases, even for nationally important sites, excavation and recording will be the appropriate response, and close attention should be paid to the methodology adopted. In part this will be determined by the circumstances of the crash and the nature and extent of deposits but, in conjunction with contemporary documentary sources, excavation should aim to recover as much information as possible about the circumstances of the loss. Sampling should take into account the distribution of surface debris in relation to sub-surface remains; together these are strong indicators of the point or points of impact. Records of all excavations and field surveying should routinely be made available to the local Sites and Monuments Record (SMR), and to the National Monuments Record. Excavation of any aircraft crash site should be undertaken in accordance with the Institute of Field Archaeologists' (IFA) *Code of Conduct*, and should comply with its *Standard and guidance for archaeological excavation*. The British Aviation Archaeological Council's (BAAC) *Code*

of Conduct offers additional guidance on methods and techniques, and also provides a useful summary of the information that excavation should be expected to obtain.

Although there is no general database available, advice as to the likelihood of crash sites within a given area can be sought from the BAAC, whose regional members have specialist local knowledge. Basic data on crashes may also be available in local SMRs. In all cases, where the presence of a crash site has been indicated and it is believed that works may disturb it in any way, a licence must be obtained from the PMA before work commences.

- In some cases previously unknown remains will be uncovered during development. In such circumstances there is a strong likelihood of the presence of either ordnance or human remains, and the local police should therefore be informed immediately. If necessary an MoD Explosive Ordnance Disposal Team will be called in to ensure that the site is safe, and until this has been done it is advisable to cease any work in the vicinity. In any excavation where human remains are or are likely to be encountered, whatever the archaeological or historic merits of the crash sites, the feelings of relatives should be respected.

For those wishing to either obtain a licence to excavate or perhaps merely to research in more depth the circumstances leading up to a particular crash, it will be necessary to establish the aircraft type, its serial number, the date of the incident, the unit to which it belonged and the identities of any aircrew involved. There are various sources from which this information may be obtained:

Royal Flying Corps (RFC) and Royal Air Force (RAF) Records relating to the RFC within the UK are fragmentary, but basic data on 'Home Service' losses after October 1916 are preserved at the Public Record Office (PRO) under AIR 1/10,15/1/38 and AIR 1/11,15/1/38. The RAF Museum also holds some 70,000 record cards pertaining to World War I RFC and RAF casualties. RAF aircraft lost in accidents during the inter-war period, World War II and post-war were recorded on Air Ministry Form 1180. Copies of these forms, sorted by type and date, are held on microfilm at the RAF Museum and in many cases also give information on aircrew. The inter-war collection, however, is incomplete. Details of missing aircraft and aircrew can also be found at the PRO in Operational Records Books for squadrons (under AIR 27), stations (AIR 28) and miscellaneous units (AIR 29). Details on losses, usually by aircraft type, command or unit, are also summarised in a variety of specialist publications (*see Further reading*).

Royal Naval Air Service (RNAS) and Fleet Air Arm (FAA) The RAF Museum holds records on early World War I RNAS casualties, whilst incomplete returns for RNAS aircraft losses and casualties between 1917 and 1919 are held at the PRO under AIR 1/105,15/9/280 and AIR 1/106,15/9/282. All individual records relating to aircraft in RNAS/FAA service prior to 1952 were officially destroyed in 1956, but basic FAA squadron operational records for World War II are preserved in the PRO in the ADM 207 series and contain general information on losses. Using a variety of other sources the Records and Research Centre at the Fleet Air Arm Museum, Yeovilton, has compiled a computerised database of FAA losses which is available for public consultation.

Luftwaffe Records of Luftwaffe losses in or around the UK were kept in the Luftwaffe Quartermaster General's daily returns, microfilm copies of which are held at the Imperial War Museum, London. Additional data on crashed Luftwaffe aircraft are to be found at the PRO in the form of RAF Fighter Command combat reports (AIR 50) and extracts from RAF Air Intelligence reports (AIR 22/266, AIR 267, AIR 40/45 and AVIA 15/737). All Luftwaffe losses within the UK have been summarised in a series of publications (*see Further reading*).

United States Army Air Force (USAAF) and United States Navy (USN) USAAF losses were detailed in the daily listings of 'Mishaps', in the weekly or monthly intelligence summaries compiled at Squadron or Group level, in official accident reports and on the individual record cards pertaining to the aircraft, all of which are obtainable on microfilm from the USA via the US Air Force Historical Research Agency. US Navy aircraft accident summaries for the period 1920-69 and aircraft history cards are held on microfilm by the US Naval Historical Center, Naval Aviation Historical Branch. Copies of accident reports and aircraft record cards are also available from a number of commercial organisations within the US.

Information on individual crashes was also recorded at a local level by the Air Raid Precautions, Fire Brigade and Police and is usually held in County Record Offices. Local newspapers can occasionally also be a good source of information, but in wartime were subject to heavy censorship. For fatal crashes involving British or Commonwealth aircrew the registers of the Commonwealth War Graves Commission are also particularly useful.

Table I The 21 'extinct' military aircraft in use over the UK in the late 1930s/early 1940s

Manufacturer/Type	Period of Service	Role	Power Plant	Weight (Kg)	Airframe Construction	Total Produced	Notes
Airspeed Horsa	1942–45	Trans,TC	–	3,800	Spruce, plywood covering	3,655	Principal British assault glider of WWII. Used in Sicily, D-Day, Arnhem and the Rhine Crossing. Some surviving sections, but no complete examples
ArmstrongWhitworth Albemarle	1941–44	Trans, Tug	2x Bristol Hercules	10,260	Tubular steel frame, spruce and plywood covering	602	First British military aircraft with tricycle undercarriage. Constructed in wood and steel to save on alloys. Used in Sicilian and D-Day airborne campaigns
ArmstrongWhitworth Whitley	1937–44	B, MR, Trans	2x AS Tiger or RR Merlin	8,800	Metal monocoque fuselage, fabric covered wings	1,466	First full-production RAF heavy bomber, equipped 4 Group RAF Bomber Command until replaced by Halifax from 1941. Deployed in MR role for the Battle of the Atlantic and later as a glider tug and paratrooper transport
Avro Manchester	1940–42	B,T	2x RR Vulture	14,150	Metal monocoque fuselage, all metal	209	First of new generation of RAF heavy bombers to enter service. Revolutionary engines and extensive use of hydraulics caused constant problems. Important precursor to the Lancaster. Relegated to training June 1942
Blackburn Botha	1940–42	TB, GR,T	2x Bristol Perseus	5,366	All metal	580	Chosen as main torpedo bomber for RAF Coastal Command in 1939. Numerous problems with suitability and handling. Rapidly relegated to training duties
Blackburn Firebrand	1944–53	F,TB	Bristol Centaurus	11,357	All metal	300	FAA carrier-based fighter and torpedo attack aircraft. Rendered obsolete by jets
Brewster Bermuda	1943–45	Tug	Wright Cyclone	4,440	All metal	1000+	Ordered as a land-based dive bomber. 950 were delivered for RAF service, most of which are believed to have served in the UK as target tugs; none are known to have flown operationally
De Havilland Don	1937–40	T, Comms	Gipsy King	?	Tubular metal frame, linen covering	50	Single-engined monoplane trainer and communications aircraft used in small numbers up to the outbreak of WWII
Dornier 17/215	1937–42	B	2x BF	5,210	All metal	1,700	Significant Luftwaffe medium bomber in the Battle of Britain and early Blitz period
Dornier 217	1941–44	B	2x DB 603	9,065	All metal	1,905	Significant Luftwaffe later-war bomber operating over UK
General Aircraft Ltd Hotspur	1941–45	T	–	1,375	Spruce, plywood covering	1061	Principal glider pilot trainer. Tandem seats with room in fuselage for troops. Used purely in training by the Army Air Corps
Handley Page Harrow	1937–45	Trans	2x Bristol Pegasus	10,430	?	100	Transport aircraft which, whilst hurriedly deployed in the Middle East as a bomber, saw limited use in the UK as a transport and communications aircraft with RAF and FAA
Hawker Hector	1937–42	AC,Tug	Napier Dagger	1,694	Tubular steel frame, plywood and canvas covering	178	Interim two-seater biplane, replacement for the Audax. Last biplane to enter RAF service (with 4 Sq RAF in early 1937). Remained with auxiliary squadrons until 1940 with a handful of aircraft carrying out dive bomber attacks against Germans in that year. Relegated for use as glider tug within the UK
Heinkel 177	1944–45	B, MR	2x DB 610	16,800	All metal	1,169	Heavy bomber, made its debut over England in January 1944 during the 'Little Blitz'. Novel engine layout and unreliability caused constant problems
Junkers 86	1936–42	B, GR	2x J 207	6,700	All metal	810-1000	High altitude GR and B versions operated by Luftwaffe over southern England 1941–42
Junkers 188	1943–45	B	2x J 213 or 2x BMW 801	9,900	All metal	1,100	Operated by Luftwaffe over UK 1944 onwards as a night intruder
Percival Petrel	1939	Comms	2 x DH Gipsy Six	1,588	Tubular metal frame, canvas and metal covering	8	Twin-engined communications aircraft which saw limited use with 24 Sq RAF and 781 Sq FAA
Saunders Roe Lerwick	1939–42	MR	2x Bristol Hercules	5,060	All metal	21	Flying boat used in limited fashion by 422 Sq RCAF in RAF Coastal Command
Short Stirling	1941–46	B, Trans, RCM	4x Bristol Hercules	17,659	All metal	2,374	The first of the RAF's four-engined heavy bombers to enter service. By mid-1943 it had been relegated from the primary bombing role due to its limited service ceiling and heavy losses. Reused as a transport, glider tug and by 100 Grp RAF in the RCM role
Vickers Warwick	1943–46	MR,ASR, Trans	2x Bristol Centaurus	12,700	Aluminium and steel geodetic structure, fabric covering	700	Intended replacement for the Wellington. Used mainly by RAF Coastal Command for ASR and MR duties, also subsequently as a transport
Westland Whirlwind	1940–43	FB	2x RR Peregrine	3,699	All metal	112	Innovative fighter bomber. Suffered engine problems and only ever equipped 2 RAF squadrons, used in support of bombing operations and for attacks on France

Table 2 The ten most common (in terms of surviving examples) military aircraft in use over the UK in the late 1930s/early 1940s

Manufacturer/Type	Period of Service	Role	Power Plant	Weight (Kg)	Airframe Construction	Total Produced	Survivors: Global (UK)	Notes
Avro Anson	1936–68	MR, T	2x AS Cheetah	2,440	Tubular steel, spruce and plywood covering, Bakelite and plywood wings	11,000	30 (16)	Introduced as GR aircraft, later adopted as principal trainer. Only one wartime military version (Mk I) survives. First RAF aircraft with retractable undercarriage
De Havilland Mosquito	1941–50	F, B, NF	2x RR Merlin	6,394	Spruce, plywood and fabric covering	7,781	20 (6)	Significant bomber and multi-role aircraft from 1942. Took part in many famous raids such as attacks on Amiens prison and Gestapo headquarters in Bergen
De Havilland Tiger Moth	1931–47	T	DH Gypsy	525	Tubular steel and spruce, plywood and fabric covering	8,565	400+ (42)	Principal biplane elementary flying trainer in UK and Commonwealth training schools. Adaptation of a civilian design. Many survive
Douglas Dakota/ C-47 Skytrain	1942–50	Tug, Trans, TC	2x PW R1830	7,657	All metal	10,691	550 (16)	Conversion of pre-war civilian airliner type. A total of 1,920 delivered for RAF use and became the principal transport aircraft for this and the US IX AAF. Took part in the D-Day and Operation Market Garden campaigns and saw action in all theatres
Gloster Meteor	1944–61	F	2x RR Welland or RR Derwent	3,995	All metal stressed skin	3,875	47+ (42)	First RAF jet fighter to enter service (July 1944) to counter the V-1 flying bomb. Used extensively post-war. Wartime versions are rare
Hawker Hurricane	1937–45	F, FB	RR Merlin	2,118	Tubular steel and aluminium alloy fuselage frame, light wooden formers, canvas covering. Steel and stressed aluminium alloy wings	14,533	45+ (29)	Most numerous RAF fighter in Battle of Britain, from 1941 relegated to Mediterranean and Far East in fighter bomber and anti-shipping roles. Also adapted as a convoy protection fighter on Russian and Atlantic routes, launched from merchantmen. Served on 17 battlefronts including Battle of France, Norway, BoB, Malta, North Africa, Sicily, Adriatic and Burma campaigns
Miles Magister	1937–45	T	DH Gypsy	583	Spruce and plywood	1,227	14 (8)	Two-seater training and communications aircraft
North American Harvard	1942–56	T	PW Wasp or A1340	2,549	Steel frame fuselage, fabric and plywood, later alloy, covering	9,577+	400 (23)	5,125 delivered for RAF and Commonwealth usage as trainers. Equipped many flying training schools in the UK and overseas
North American P-51 Mustang	1942–47	F, FB, AC	Allison 1710 or RR Merlin	2,858	All metal	15,586	257 (8)	2,517 delivered for RAF use. Initially ordered as a fighter, mostly used by 2 Tactical Air Force in the fighter bomber/Army Co-operation role. Principal USAAF fighter in Europe from 1943–44. Operated by VIII AAF as long range fighter and by IX AAF in tactical role
Supermarine Spitfire/Seafire	1938–50	F	RR Merlin or RR Griffon	2,545	All aluminium monocoque fuselage and wings	22,928	300+ (59)	Principal RAF day fighter from early 1941 until the end of the war. Operated in all theatres and in all major campaigns and also adapted for use on aircraft carriers as the Seafire

Key to tables

Period of service Total period of service with respective air force (as opposed to period of usage over the UK – see Notes column)

Role Military role in which the aircraft was utilised (often not the role for which it was designed):

AC = Army Co-operation, **ASR** = Air Sea Rescue, **B** = Bomber, **Comms** = Communications, **F** = Fighter, **FB** = Fighter Bomber, **GR** = General Reconnaissance, **MR** = Maritime Reconnaissance, **NF** = Night Fighter, **RCM** = Radio Countermeasures, **Recon** = Reconnaissance, **TB** = Torpedo Bomber, **T** = Trainer, **TC** = Troop Carrier, **Trans** = Transport, **Tug** = Glider/Target Tug Power plant **AS** = Armstrong Siddeley, **BF** = Bramo Fafnir, **DB** = Daimler Benz, **DH** = De Havilland, **JJ** = Junkers Jumo, **PW** = Pratt and Whitney, **RR** = Rolls Royce

Weight Total weight of airframe and engines, unloaded; intended to give general indication of relative size

Airframe construction Basic data on construction and major materials, where known

Survivors Number of complete airframes (ie more than 66% intact) known to survive globally (inclusive of UK).

Figure in brackets = number surviving within UK. Global figures represent estimates; UK figures are accurate and based upon 16th edition of *Wrecks and Relics* (Ellis 1998)

Notes General information on background, importance and currency (ie use within UK)

What the sources tell us: the Handley Page Hampden

Documentary sources can combine to provide numerical data relating to particular types of aircraft. For example, the Handley Page Hampden entered RAF service in 1938 as a heavy bomber. Before 1942, when the type was removed from front line use with Bomber Command and relegated to training, 424 (25.2 per cent) of the 1680 produced were lost in combat over Europe and the North Sea, while the Air Ministry form 1180s record 997 accidents (affecting 59.3 per cent of the aircraft produced) within the UK, of which 631 resulted in the loss of the aircraft. A further 159 aircraft (9.5 per cent) were scrapped. Further analysis of these records suggests that 326 of recorded accidents – representing 19.4 per cent of the Hampdens produced – might be expected to have left archaeological traces (that is, they are described as having crashed rather than force-landed, since the latter often resulted in the complete recovery of the aircraft and frequently its repair to flying condition). A brief analysis of statistics relating to other British aircraft types suggests that the figures for the Hampden are broadly representative.

Further information

English Heritage

23 Savile Row
London
W1S 2ET
Tel: 020 7973 3000

English Heritage is the government's statutory advisor on archaeology and the management of the historic environment in England. Further information can be obtained from the address above, or from:

National Monuments Record Centre

Kemble Drive
Swindon
SN2 2GZ
Tel: 01793 414600

We also have nine regional teams, each of which includes archaeologists. In addition to the team at the London address, they can be contacted at:

South East

Eastgate Court
195–205 High Street
Guildford GU1 3EH
Telephone: 01483 252000

South West

29/30 Queen Square
Bristol BS1 4ND
Telephone: 0117 975 0700

East of England

Brooklands House
24 Brooklands Avenue
Cambridge CB2 2BU
Telephone: 01223 582700

West Midlands

112 Colmore Row
Birmingham B3 3AG
Telephone: 0121 625 6820

East Midlands

44 Derngate
Northampton NN1 1UH
Telephone: 01604 735400

North East

Bessie Surtees House
41–44 Sandhill
Newcastle-upon-Tyne NE1 3JF
Telephone: 0191 261 1585

North West

Suites 3.3 and 3.4
Canada House
3 Chepstow Street
Manchester M1 5FW
Telephone: 0161 242 1400

Yorkshire

37 Tanner Row
York YO1 6WP
Telephone: 01904 601901

Website: www.english-heritage.org.uk

The Association of Local Government Archaeological Officers (ALGAO) represents local authorities that maintain archaeological services across England. A list of members is available on request from:

ALGAO
c/o Heritage Consultation Group
Planning Division
Essex County Council
County Hall
Chelmsford CM1 1LF
Telephone: 01245 437676
Website: www.algao.org.uk

The British Aviation Archaeological Council, founded in 1978, represents amateur aviation archaeological groups within the UK. The Council produces a newsletter through which groups are able to exchange views, news and information and has produced a voluntary *Code of Conduct*. The aims of the Council are to improve and maintain standards within aviation archaeology, to provide advice to member groups, and to promote the preservation of aircraft relics and associated artefacts.

BAAC Honorary Secretary
Spring View
Kenilworth
Warwickshire
CV8 2JS
Email: baac@couplandbell.com



The Commonwealth War Graves Commission is charged with managing the graves and memorials of the 1,700,000 men and women of the Commonwealth forces who died in World War I and other 20th-century conflicts. Amongst the services it provides is a searchable online database of casualties.

The Commonwealth War Graves Commission
2 Marlow Road
Maidenhead
Berkshire
SL6 7DX
Telephone: 01628 634221
Website: www.cwgc.org

The Fleet Air Arm Museum holds a wide range of documents from official and private sources, related to British Naval Aviation. Researchers may conduct their enquiries either in person or by post. Visitors should contact the Centre in advance to book an appointment.

Records & Research Centre
Fleet Air Arm Museum
Box D6
RNAS Yeovilton
Near Ilchester
Somerset
BA22 8HT
Telephone: 01935 840565
Fax: 01935 842630
Website: www.fleetairarm.com
Email: enquiries@fleetairarm.com

The Institute of Field Archaeologists (IFA) is the professional body for archaeologists and promotes best practice in archaeology. Its *Code of Conduct*, by-laws and standards and guidance documents set out requirements and advice relating to archaeological work and apply to aviation archaeology.

Institute of Field Archaeologists
University of Reading
2 Earley Gate
PO Box 239
Reading RG6 6AU
Telephone: 0118 931 6446
Fax: 0118 931 6448
Website: www.archaeologists.net
Email: admin@archaeologists.net

The Public Record Office (PRO) is the national archive of the United Kingdom, bringing together and preserving the records of central government and making them available to all who wish to consult them. A database of PRO holdings can be consulted via their online catalogue, PROCAT.

Public Record Office
Ruskin Avenue
Kew
Richmond
Surrey
TW9 4DU
Telephone: 020 8876 3444
Fax: 020 8392 5286
Website: www.pro.gov.uk
Email: enquiry@pro.gov.uk

The Royal Air Force Museum, opened in 1972, is Britain's only national museum dedicated solely to aviation. The Department of Research and Information Services is responsible for the Museum's Archive and Library collections which are available to the public. Access is by appointment only and arrangements to view material should be made well in advance of proposed visits.

Department of Research & Information Services
Royal Air Force Museum
Grahame Park Way
Hendon
London
NW9 5LL
Telephone: 020 8205 2266
Fax: 020 8200 1751
Website: www.rafmuseum.org.uk
Email: info@rafmuseum.com

The Royal Air Force Personnel Management Agency is responsible for the licensing of aircraft excavations. Information on licensing and the procedure for applications is contained in the leaflet *Notes for Guidance of Excavators*, which is available from the following address:

Ministry of Defence
PMA (CS) 1b1a (RAF)
RAF Innsworth
Gloucestershire
GL3 1EZ
Website: www.raf.mod.uk/ptc/pmacasualty.html

The US Naval Historical Center, Naval Aviation History Branch deals with subject matter relating to US Naval Aviation from 1911 to the present.

Naval Historical Center
Naval Aviation History Branch
805 Kidder Breese SE
Washington Navy Yard
Washington DC 20374-5060
USA
Website:
www.history.navy.mil/branches/nhcorg4.htm

The US Air Force Historical Research Agency holds over 70,000,000 pages devoted to the history of the service. Except for documents that are classified, the Agency's collection is open to the public and visitors are welcome. The Agency's collection is also recorded on microfilm, with copies deposited at the Air Force History Support Office, Bolling Air Force Base (USA).

Air Force Historical Research Agency
600 Chennault Circle
Bldg 1405
Maxwell AFB
Alabama 36112-6424
USA
Telephone: +1 334 953-2395
Website: www.maxwell.af.mil/au/afhra/
Email: AFHRANEWS@maxwell.af.mil

The US Air Force History Support Office can be contact by email (via the website address below) or by post. Those wishing to visit should email or telephone beforehand to make an appointment.

Air Force History Support Office
AFHSO/HOS
Reference and Analysis Division
200 McChord Street
Box 94
Bolling AFB
DC 20332-1111
USA
Telephone: +1 202 404 2261
Website: www.airforcehistory.hq.af.mil/

Further reading

Information on the background to English Heritage's approach to the management of crash sites and other 20th-century military remains is given in:

Dobinson, C, Lake, J and Schofield, A J 1997 'Monuments of war: defining England's 20th-century defence heritage'. *Antiquity* 71(272), 288-99

English Heritage 1998 *Monuments of War: The Evaluation, Recording and Management of Twentieth-Century Military Sites*. London: English Heritage

English Heritage 2000 *Twentieth-Century Military Sites*. London: English Heritage

Holyoak, V 2001 'Airfields as battlefields, aircraft as an archaeological resource: British military aviation in the first half of the 20th century' in Freeman, P W M and Pollard, A (eds), *Fields of Conflict: Progress and Prospect in Battlefield Archaeology*. (Brit Archaeol Rep Internat Ser 958). Oxford: Brit Archaeol Rep, 253-64

Holyoak, V 2002 'Out of the blue: assessing military aircraft crash sites in England, 1912-1945'. *Antiquity* 76(293), 657-63

Lake, J 2002 'Historic airfields: evaluation and conservation' in Schofield, J, Johnson, W G and Beck, C M (eds) *Matériel Culture: The Archaeology of Twentieth-Century Conflict*. (One World Archaeology 44). London: Routledge, 172-88

The background to aviation archaeology and accounts of some amateur excavations are covered in:

de la Bédoyère, G 2000 *Battles over Britain – The Archaeology of the Air War*. Stroud: Tempus.

McLachlan, I 1989 *Final Flights – Dramatic Wartime Incidents Revealed by Aviation Archaeology*. Sparkford: Patrick Stevens

Information on crash site locations is available in many publications, of which the following are examples:

Chorley, W R 1998 *Royal Air Force Bomber Command Losses of the Second World War, Vol. 6: Aircraft and Crew Losses 1945*. Leicester: Midland Publications

Cummings, C nd *Final Landings: A Summary of RAF Aircraft and Combat Losses 1946-9*. Yelvertoft: Nimbus Publishing

Franks, N L R 1997 *Royal Air Force Fighter Command Losses of the Second World War, Vol. 1: Operational Losses, Aircraft and Crews 1939-41*. Leicester: Midland Publications

Ramsey, W (ed) 1989 *The Battle of Britain Then and Now*. Mk V. London: Battle of Britain Prints International

Ramsey, W (ed) 1987 *The Blitz Then and Now, Vol 1*. London: Battle of Britain Prints International

Smith, D J 1997 *High Ground Wrecks and Relics – Aircraft Hulks on the Mountains of the UK and Ireland*. Leicester: Midland Publications

Contemporary documentary sources in the Public Record Office are discussed in:

Fowler, S et al 1994 *RAF Records in the PRO*. London: Public Record Office

Further copies of this leaflet can be obtained from:

English Heritage
Customer Services Department
PO Box 569
Swindon
SN2 2YP
Telephone: 0870 333 1181
Fax: 01793 414926
E-mail: customers@english-heritage.org.uk

Please quote product code 50704

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Cover image: The wreckage of a German Junkers 88 A-6 bomber, shot down over Lostock Gralam, Cheshire, at 23.45 hours on 3 May 1941, by 256 Squadron RNZAF (Hu 72709 photograph courtesy of the Imperial War Museum, London)

Below: The upside-down wreckage of Wellington LP981, which crashed into the sea off Fleetwood, Lancashire, in April 1945, killing five of its seven crew (Picture courtesy of The Gazette, Blackpool)



ENGLISH HERITAGE