

Aerial Photographs

There are two main kinds of aerial photograph; oblique images which are taken specifically to record archaeological sites and vertical photographs which are usually taken for other purposes.

Vertical photography

Vertical photographs are taken with the camera pointing straight down to the ground and provide a plan view. The camera is usually fixed to a mount inside the aircraft over an opening in the fuselage. Vertical photographs are taken at a specific nominal scale, for example 1:5,000 (which means that an object in the photographs is 5,000 times smaller than it is on the ground). In order to achieve the nominal scale, vertical sorties are flown at a specific height above ground level.

The photographs are taken at set intervals so that each frame overlaps the next by 60%. This ensures that all parts of the ground are covered by at least two photographs taken from slightly different positions. When viewed through a specially designed optical instrument called a stereoscope, these two photographs are combined to form a single three-dimensional image. Using computers accurate plans and measurements can be made from these stereoscopic models; this technique is known as photogrammetry.



A vertical photo taken for military reconnaissance purposes by the United States Air Force in 1944. Many American troops were housed in temporary camps in this area – the countryside around Chacewater – during the build up to the D Day invasion. This photo provides a unique and historic record of the landscape at that time. © English Heritage. NMR. US 7PH/GP/LOC213/3053

Vertical photographs are not usually taken for archaeological purposes, but for reasons such as military and cartographic reconnaissance and civil engineering projects. Numerous vertical sorties were (and still are) undertaken by the Ordnance

Survey who use them to update their mapping. Some sets of vertical photos cover the whole county; these include photos taken by the RAF during training flights after the Second World War in the 1940s and 1950s. Cornwall County Council also commissioned county-wide flights for Census purposes in 1988, 1995-6 and 2005/6.

Vertical surveys usually provide complete cover of a wide area of landscape. This, and the regularity with they have been carried out over the last 60 years, means that they often capture and record changes in the landscape over time, changes which may not be recorded on modern maps.



The river Fal between Falmouth and Penryn in 1946 and 1996. Although little has changed on the north bank, on the south bank the post-war expansion of Falmouth, including housing, industrial units and the marina, is very striking. © Cornwall County Council

Oblique photography

Oblique photographs are usually taken specifically for archaeological purposes and are very simply those taken at an oblique angle, usually from the open aircraft window. For this reason archaeological aerial reconnaissance flights are always undertaken in high-winged aircraft so that the wing does not obstruct the view of the ground.



Steve Hartgroves, an aerial archaeologist with Cornwall County Council's Historic Environment Service, photographs the Hayle Estuary through the open window of a Cessna light aircraft. Photo © Cornwall County Council Historic Environment Service

The oblique view is more familiar than the vertical plan view. However, the effects of perspective mean that the scale of the image varies across the photograph; the background being of smaller scale than the foreground which is closer to the camera.



Vertical shot of Caer Bran hillfort and associated features. © Crown copyright. NMR.



A similar area of Caer Bran taken as an oblique image. Photo © Cornwall County Council Historic Environment Service

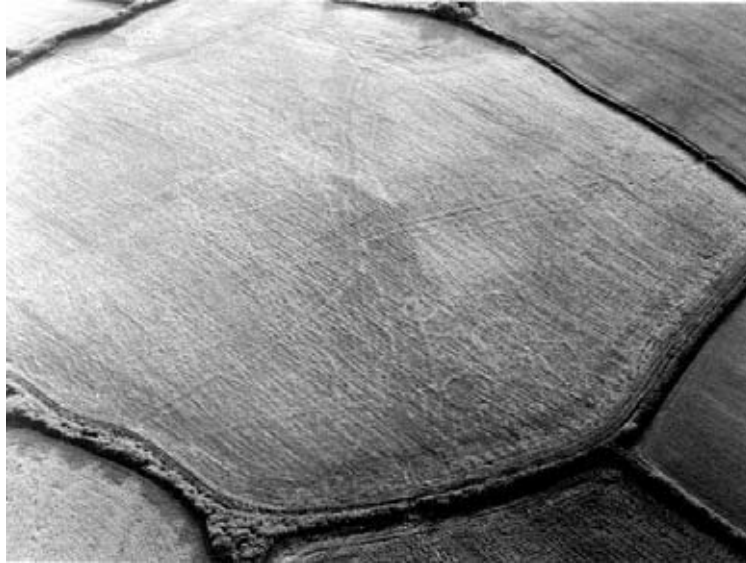
Because they are taken specifically to record archaeological sites and are therefore taken from the most rewarding angles, oblique photographs usually offer much clearer images than verticals. Oblique reconnaissance flights are undertaken from lower altitudes than vertical sorties; consequently the sites are much bigger on the resulting photographs and more detail can be seen. Unlike vertical sorties which are unselective and therefore offer complete cover of a wide area, during oblique sorties the archaeological air photographer only photographs those sites which he or she decides is worthy of a photograph. This is a very selective process and if a site goes unnoticed at the time of flying it will not be photographed. Photo interpreters sometimes identify archaeological sites on the periphery of oblique photographs; sites that were not seen at the time the image was taken.



The low earthworks of medieval strip fields associated with the deserted settlement of Carwether, St Breward are clearly visible as shadow marks in low sunlight. Photo © Cornwall County Council Historic Environment Service

Media used in archaeological aerial photography

Colour photographs are far better than black and white images for photographic interpretation as they allow the recognition of subtle colour changes in cropmark sites. For a long time, however, black and white was the preferred film in the profession with colour used only sparingly. This was in part due to cost, but also to the unpredictable nature of colour film; incorrect exposures affecting colour balance and saturation, and producing disappointing images. Recent improvements in film and cameras have meant that colour film has increasingly been more widely used. Today with the advent of the digital camera, digital images and computer facility to alter colour balance after the image is taken, colour images are predominant.



Cropmark ring ditches and field boundaries at Moyles, St Minver. A comparison of black and white and colour imagery. Photo © Cornwall County Council Historic Environment Service



Some aerial archaeologists use false colour infra red film. Its emulsion is sensitive to the near-infra red portion of the light spectrum. It is often used in the study of vegetation as it can pick up changes in vegetation including that which is dead or diseased. It has been used for archaeological purposes although its advantages over normal colour photography are debatable.



This image of a prehistoric settlement at Smallacombe, St Cleer has been taken using false colour infrared film. © Crown copyright. NMR

An exciting recent development in aerial archaeology is LIDAR (Light Detection and Ranging). This uses an airborne laser to measure the distance of the aircraft from the ground and produces an extremely accurate digital model of the landscape over which the plane has flown. In the computer the landscape model can be viewed from any position and lit to produce 'shadows'.

Its very high resolution means that the smallest variations in surface height can be recognised, even those of only a few centimetres. It has great potential uses for aerial archaeology as the most subtle of archaeological earthworks can be identified. Whilst in its infancy and still a relatively expensive method of aerial survey, LIDAR is likely to become an invaluable tool to the aerial archaeologist in the future.

Photographic Collections

The two principle national archives which specialise in archaeological aerial photographs are those held at English Heritage's National Monuments Record in Swindon and at Cambridge University's Unit for Landscape Modelling. In addition to these there are two archives held locally in Cornwall at the County Council offices in Truro.

The Cambridge University Committee for Aerial Photography (CUCAP) was first set up by Professor J K St Joseph who started taking aerial photographs after the war. The collection of photographs is the result of annual survey conducted since 1947 and is now in the care of the university's Unit for Landscape Modelling; the collection currently holds half a million images.

The aerial photograph collection of the National Monuments Record (NMR) is located at the National Monuments Record Centre in Swindon. This public archive was taken over by English Heritage in 1999 and is currently home to two million vertical

prints, mainly taken by the RAF, and to more than half a million specialist oblique photographs, making it the largest collection of aerial photographs in the country.



A recent digital photo of St Ives held at the National Monuments Record Centre in Swindon. © English Heritage. NMR. 23892.20

The Historic Environment Service of Cornwall County Council holds an archive of oblique aerial photographs as part of the Historic Environment Record. This is housed in the Old County Hall campus in Truro. The Historic Environment Record is a public archive and consultation is encouraged.



A photo from our collection of the Lizard Life Boat Station. Photo © Cornwall County Council Historic Environment Service

The Support Services of the Planning, Transportation and Estates department of Cornwall County Council holds complete vertical coverage of the county. It holds copies of RAF sorties undertaken in 1946 as well as colour images from Census flights undertaken in 1988, 1995-6 and 2005/6. This collection can be viewed by the public by prior arrangement.



A colour vertical photo from 1996 of Lands End © Cornwall County Council