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Historical aerial imagery; a wasted resource?

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Abstract

This paper looks at the surprisingly long history of aerial photography and at the vicissitudes of its development in the UK. We look at a few of the uses of 'historic' aerial imagery today, for example UXO risk mapping, contaminated land assessment, and assisting 'forensic' archaeology. We end with a look at the complex archive legacy which the taking of this imagery created.

Introduction

Most users of aerial imagery work with covers of modern photography, but for a variety of tasks a spread of imagery giving 'time depth' can be more valuable than a single cover. However, finding historic aerial imagery is not always straightforward. This paper looks in brief at the long history of air photography, explores some new uses of old aerial imagery, and considers the pitfalls one meets in accessing it.

Early air photography

Aerial photography is nearly 150 years old. In the decades following the taking of the first photographs by Joseph Niépce in the 1820's and the development of more practical techniques by Daugerre in the later 1830's, progress was rapid. As exposure times fell from half an hour or more to moments, photographers began to develop cameras which could be used out of doors, and started to capture the natural world. In 1840 the first exposure short enough to include a recognizable person was taken and by the end of the decade people were beginning to think of taking cameras into the air. The man who first did so was the serial entrepreneur, cartoonist and society portraitist Gustave Tournachon, better known at the time as 'Nadar'. Tournachon took the earliest aerial photographs in 1858 from a captive balloon tethered over the lush landscape of the Bievre valley, southeast of Versailles. They do not survive, although a later Nadar image does. This was taken over Paris, looking towards Montmartre. The earliest aerial image known from the New World was taken in May 1860 by the painter James Wallace Black, and Samuel King from the captive balloon 'Queen of the Air' over Boston, Massachusetts. In 1873 Louis Triboulet took the first aerial photographs from a balloon in free flight over Paris, while the earliest in the States were taken of Philadelphia in 1893. It is not clear when aerial photographs were first taken in the UK. Despite the alacrity with which the new hobby was taken up by wealthy enthusiasts such as Henry Fox Talbot, the oldest known aerial image in the UK dates to 1897.

For most of the sixty-five years between the earliest experiments in making air photographs and the outbreak of the First World War, aerial photography was comparatively rarely taken. It was made either as a curiosity on special occasions, or more usually, by military units responsible for observation and cartography, such as the Royal Engineers. The military connection is long. As far back as 1840 the French Deputy François Arago proposed using photography for the purposes of mapping and in 1859 Nadar was in conversation with the French military over the taking of photos for the military campaign in Italy, some of which would have been from a balloon. From the 1870's to 1900 the balloon and less commonly, the kite were the platforms for air photography, with the former considered the best from which to take aerial

photographs for mapping. In this UK dominions played a role. In 1890 for example, Charles Close (later Sir Charles Close, Director General of the Ordnance Survey) of the Survey of India, took photo balloons to the sub-continent for the purpose of recording old cities as part of the Survey's work.

In addition to the United Kingdom several nations including the US, Italy, and France, energetically pursued balloon photography. In Italy successful mosaics were made from imagery taken in 1902-3 of the course of part of the river Tevere, while in 1911 a complete survey of Venice was made from a balloon, a survey repeated in 1913 when the surrounding lagoon was also photographed (Guerra and Scarso 1999). During this decade a rival to the balloon appeared; the aeroplane, which first took to the air in 1903 at Kittyhawk. Well before the end of the decade the ungainly interlopers were serving as camera platforms.

Rapid though the pace of development was in the first years of the 20th century it increased greatly after the outbreak of the First World War. The aeroplane was quickly seen to be a more appropriate platform than vulnerable tethered balloons for taking photographs and already by 1914 the UK government had commissioned the first of what turned out to be several 'Reconnaissance Experimental' aircraft. At first these carried cameras externally on brackets, but as series picture taking became the norm the cameras grew correspondingly more complex and were brought inside the aeroplane. At first the area photographed was of a comparatively narrow strip, corresponding to the front lines of the opposing forces and their immediate rears, but following the French lead, the Royal Flying Corps began taking imagery to map trench systems by early 1915. By the end of the First World War aerial photography was being taken in enormous quantities and millions of prints were being turned out each month for mapping, tactical, and strategic purposes. All of the techniques of aerial survey in use today had been developed or thought of.

By the end of the war a vast archive of photography had been created of Europe and the Middle East. The war had also created, and thrown onto the market place at a time of deepening economic depression, an international cadre of trained individuals, pilots, observers, and technicians, well-versed in the requirements necessary to produce aerial photographs and passionate advocates of their use.

RAF personnel had been in contact with the Ordnance Survey in 1918 over taking aerial survey photography of the United Kingdom, and the RAF experimented with aerial mapping in the early 1920's flying from Duxford. But these overtures led nowhere. From the O.S. point of view any aerial survey would need to be flown mainly for the purposes of updating their 1:2,500 scale mapping, but it had to be more economic than terrestrial survey which then seemed doubtful (Macdonald 1992, 249-54). Worse still, following the wielding of the Geddes axe, map revision cycles were being *lengthened*. Commercial pioneers had a thin time of it in the 1920's. But if the OS was not favourable to the RAF's initiatives in this area, it also remained to be convinced of the navigational abilities of civilian survey organizations. As time passed the situation became more favourable. In the 1930's, tests in the Birmingham area indicated that it was feasible to carry out small scale map revision using air photography, and some experimental contracts were awarded. Elsewhere however, matters were different. In several overseas British dependencies large areas were being surveyed from the air, as were parts of the United States, and in Continental Europe organizations such as *Hansa Luftbild* with covert German Air Ministry support, were flying and publishing 1: 25,000 and 1:10,000 survey cover of the German Reich.

The Second World War, like the first, was a period of very great technical development, with many of the taking and survey techniques developed during the period of the First World War having to be learned anew. The pace of camera and airframe development was comparable –in 1939 the Bristol Blenheim struggled to return even small scale imagery of Germany but only six years on, in 1945 aircraft with nearly three times the range were capable of taking hundreds of exposures from a height of c 40 000 feet. All sides developed rapidly, and once more an enormous amount of imagery was amassed. Between 1939 and 1945 some 50 million air photographs were taken by the Axis and the Allied powers for survey, bomb damage, survey, and other purposes.

As their predecessors realized in 1919, Allied Central Interpretation Unit (ACIU) personnel –particularly those seconded from Academia- were aware that they were curating a treasure house of imagery, the peacetime uses of which were limited 'only by the human imagination'. A more enlightened policy had to

prevail than had done at the end of the First World War after which, in the words of OGS Crawford, there had been a 'holocaust of imagery'. Prodded by continued inquiries Ivor Thomas, the Under Secretary of State for Air, announced in 1946 that '...the best arrangements for their future use were under review' In the event, a committee set up to review the problem decided that it was not feasible at that time to set up a National Library of air photographs. But there were smaller scale initiatives. In Italy, the Air Ministry allowed much of the print Library taken by Allied forces, and lodged at San Severo to remain in theatre, passing it to the British School at Rome, from which it has recently passed to the ICCD Aerofototeca. But in the reconnaissance interpretation centers (RIC's) in some other theatres imagery fared less well. In the Far East the original film library was destroyed and the print library fared poorly as well, with only comparatively few print sets appearing to have got back to the UK. Similar losses appear to have happened in North Africa, where an accidental fire in 1953 also destroyed the film library. Much Axis material, mainly German, but Italian and Japanese too, disappeared at the end of the war, but most of the German imagery which was captured in 1945, survives for the most part although the UK portion of it is not easily accessible.

Imagery of the UK did not survive the war unscathed. The largest historic collection of pre-war photography of the British Isles, some 20,000 photographs gathered at the Ordnance Survey headquarters in Southampton was destroyed in an air raid in November 1940, but this loss is partly offset by print sets of some training material and bomb damage assessment photography which was stored elsewhere, and which survives. In the latter half of 1944, UK Government attention was directed towards the use of air photography for post-war reconstruction projects, and money was granted for the production of imagery of the UK. Once more commercial organizations found themselves out in the cold, as the task of flying it was awarded to the RAF. Operation 'Review' began in 1945, and from then until 1950, the RAF flew UK cover, at different scales as part of this programme, and for other bodies. This included the OS, whose sheets of 1:10560 photo-mapping did not sell well, and were finally discontinued in the early 1950's.

Historic aerial photography in modern use

Some 35 years ago, in 1966, the archaeologist Dr J K St Joseph edited a survey on then-current uses of air photography (St Joseph 1966). Thirteen contributors indicated that aerial imagery was routinely being used in the fields of geography, geology, soils, plant ecology, plant disease, zoology, game management, cartography, archaeology, history, towns and monumental buildings, and contemporary town planning. At this time accurately mapping interpretations made from aerial imagery would have required a substantial investment, and be restricted to those with photogrammetric facilities.

Today the desktop computer and GIS have made these lengthy processes largely redundant and allowed a wide number of organizations to map from imagery. As a result, historic imagery is now being sought out and used for a wider variety of purposes than ever before. Today we can add to the 1966 list in no obvious order, climate change monitoring, land use change, environmental survey (mapping e.g. hedgerow loss), contaminated land assessment, UXO mapping, tracing former rights of way, and forensic archaeology. Of these I want to look very briefly at three: UXO risk mapping, contaminated land assessment, and forensic archaeology.

UXO risk mapping

On the face of it one of the more surprising uses to which wartime reconnaissance imagery has been put in the past thirty or so years is UXO mapping. Since the mid-19th century munitions expenditure rates in time of war have increased exponentially but their reliability has not. As a result landscapes which have been fought over in the past century or so have been increasingly heavily devastated. Ever since the Second World War various European and Asian countries fought over or heavily bombed in 1944-45, have faced a legacy of unexploded ordnance – a contaminated land threat defined as being from 'Explosive Remnants of War' (EROW). Nor is this threat minor. The failure rates of air dropped weapons (bombs, usually) in the 1939-45 conflict ran at 10% and can often be as high as 1 in 6. In a deal with the British Government and the University of Keele in the 1980's West German bomb disposal authorities were loaned over one million images which were made available via Hamburg Kampfmittelraumdienst, to the West German Länder for

copying, and return. While the earliest of this photography, dating to 1939-40, is of comparatively small scale and often of doubtful value progress with cameras, lenses and aircraft was rapid and by 1944-45, when the bombing campaign was at its height, there was routine reconnaissance cover of many operations including 'strike-attack' and post raid cover. This imagery, often at taking scales of between

1:8000 and 1:12000, is often of considerable value for it is possible in many instances to see on these images not only craters of exploded bombs but also the impact marks of 'low order' detonations and of bombs, which failed completely. Interpreted and mapped, these data contribute substantially to elucidating areas of UXO risk.

Contaminated land assessment.

Today, in the developed world interest –whether legally enforced or not- in the consequences of industrialization, and the problems associated with the redevelopment of Brownfield sites has never been higher. For a variety of reasons much UK industry is mapped in symbolic, rather than realistic form and consequently much important information is simply not recorded. Old aerial imagery, therefore, can show detailed information about many classes of industrial site recorded nowhere else; for example, locations of tips, dumps of spoil, waste, impermanent structures, and so on, all of which are of potential importance. Sometimes no mapped data is available at all. Used with text, map, and eyewitness information, historic imagery can result in a much more detailed desktop which can guide field teams in designing most appropriate assessments.

Forensic archaeology.

In 1979 CIA analysts Dino Brugioni and Robert Poirer examined wartime reconnaissance imagery of the I.G. Farben camps at Monowitz and Auschwitz. Their ground-breaking study opened people's eyes to the forensic use of Imagery. The value of comparative cover –of having imagery of an area prior to an event such as a ground disturbance, or taken shortly afterwards when vegetation has not re-established itself, is impossible to over-estimate, and knowing what 'overhead' intelligence can give away may inhibit people from committing crimes in time of war. Today In the wake of the Poirer and Brugioni study captured German imagery has been used to elicit additional information on one of Gorbachev's famous 'blank spots' in USSR history - the Katyn massacres (Godziemba-Maliszewski 1995). Other massacre sites have been studied, and now recent imagery –this time space-borne- has been used to help locate mass grave sites in the Balkans.

A class apart? Issues of access and preservation

Most of us, if we think about the issue at all, assume that old air photographs are kept in massive, topographically-ordered filing systems with computerized finding aids and attentive staff. This may be true of the purpose-built facilities at the English Heritage's National Monuments Record at Swindon, or the Royal Commission on the Ancient and Historical Monuments of Scotland, to name two, but elsewhere the reality is closer to the Stephen Poliakov play 'Shooting the Past' –a harassed staff of one or two people, one of whom acts as the finding aid, and a decomposing archive.

Unlike maps, photographs –particularly reconnaissance imagery- are not stored topographically by scale or edition but in a variety of ways. If prints, they are stored in box or Library number order. This requires a concordance which takes you to a sortie. But you begin with a coversearch. If you are fortunate, it may be possible to search using a computerized system, but often there are only fifty year old, brittle acetates, boxed by degree square with equally elderly AMS mapping bases (these, by the way, may have to be ordered from another archive). Usually crucial cover traces are missing. Then one has to extract a reconnaissance sortie number (from unit records also kept elsewhere) in the hope that a search on *that* may prove fruitful.

Even when the right sortie is located and bought out for examination, the battle is only half won: prints may require extensive conservation, if stored badly there are irretrievably tightly curled, or have emulsion lifts and spotting, or are flat but deteriorating having been poorly fixed in the first place. Film often has an

interesting final pitfall: the can in which the film is kept has been severely dented years ago and no amount of tugging will get the lid off. When extracted, it is also very brittle.

Historic images are not like maps or books, which are printed in the hundreds of thousands, or even millions. Aerial photographs are not 'published' at all. So what you have in your hands is usually unique. It is also worth remembering that probably not more than 20% of all photographs taken before 1950 survive either as prints, or as film.

Aerial images taken during the 19th century are vanishingly rare, and losses are continuing. The fate of the oldest UK image referred to above is poignant. Taken from a captive balloon over Norwich on the occasion of the Queen Victoria's jubilee in 1897 it was identified for what it was by the air photographer Derek Edwards only in 1987. The archive did not possess the facilities to copy it, but allowed the image out on loan for one day. It was immediately returned, only to be destroyed by fire in 1994. The First World War saw the taking of aerial photographs on an enormous scale, but much was destroyed at the end of hostilities, and in 1924, and only remnants survived to be presented to the Imperial War Museum. Much pre-Second World War imagery of the United Kingdom amassed at the Ordnance Survey Headquarters in Southampton was destroyed during an air raid in November 1940, while, ironically, much Luftwaffe cover of the UK was destroyed as a result of Allied action, when the main store of German aerial imagery, the Archiv der Fliegerfilm, was destroyed in 1945 (Going 2001, 24-5).

One could list many more such things. Today historic aerial photographs of over one hundred countries are preserved in various archives in the United Kingdom (see the NAPLIB directory 1999). But many of these archives are under-resourced and under-funded. It would be a great pity if further losses of irreplaceable material occurred just when technology can make it more easily accessible and its value for so many different purposes is realised.

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