

EYES IN THE SKY

Photo-Reconnaissance Technology, 1940/1945

Even during the First World War, aircraft had been used to take photographs of the enemy's lines. And although prewar developments were left largely to private initiative, it was quickly accepted at the outbreak of war that aerial reconnaissance had a vital part to play

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When the Second World War began, photo-reconnaissance was not, of course, a new technique. It was used in the First World War, when (despite initial fears that it was 'unsporting' to take pictures of the enemy's rear lines) many important pictures were taken, and indeed by the end of that war photo-reconnaissance was well established as a necessary adjunct of strategic planning. Not only that; later it was being used widely for mapping previously unexplored territories. By the time that a second war was becoming increasingly likely—certainly by 1938—there was a good deal of effort on all sides to revive and improve the techniques of photo-reconnaissance; and by the outbreak of war the opposing factions were all, in their different ways, prepared for action in this field.

In Germany the Luftwaffe's programme of expansion went hand in hand with improved photographic techniques. The Germans had developed long-focus lenses and, by perfecting fine-grain developing techniques, they were able to take high-quality photographs of unprecedented accuracy. These photographs were examined with lenses giving a magnification of several diameters, and calculations of height were done by simple trigonometry from length of shadow and other related factors. After the war, when the British unearthed large stores of photographs near the German town of Bad Reichenhall, they admitted, with much surprise, that the detail was excellent. Stacked neatly in large crates, hidden in a barn, these photographs gave a good indication of the intelligent use of photographic technology which the Germans had evolved. Photographs of bombing targets in England, of troop movements at the front—both were equally impressive.

The Luftwaffe records in detail were never seen, however. Most of them were stored away in the crypts of the Lady's Chapel in Dresden. This was indeed a beautiful church, and so the Germans felt that the security offered was great. But in the bombing of Dresden on February 13 and 14, 1945, the film library was ignited by incendiaries dropped by Allied planes. The fire raged throughout the following night, and so intense was the heat that the sandstone pillars were cracked asunder and the entire dome of the church fell in, destroying the Luftwaffe's records.

The French were the first among the Allies to use aerial photography in the war. The effort was not very seriously undertaken, but the *Deuxième Bureau* was, before the beginning of the war, already collecting pictures taken from passenger aircraft during normal scheduled flights. The results were useful and interesting, though not of course as technically competent as would be achieved by a full-scale effort in photo-reconnaissance. There

was, however, one important lesson that the experience taught us all: secrecy. There was no difficulty at all in obtaining pictures from a civilian aircraft shortly before the outbreak of hostilities, and so it was quickly realised by the British that the effort would have to be secret to succeed. Not a word was said outside official circles; and although there was every reason to suppose that the British were carrying out photo-reconnaissance (to do so in some form was, after all, perfectly obvious) the Germans were never aware of the extent of the coverage—nor, more important, the skill of the technicians who interpreted the photographs.

Startling British results

Interpretation was one sphere where the British experts were well ahead of the Germans and, unknown to the enemy, they were obtaining more and more information about German installations. The reason for this was basically simple. The German and French pictures were merely vertical views of the ground (highly detailed views, in the German case); interpretation was done by visual inspection and measurement; and the results were plotted accordingly. The British system, however, relied on the use of stereoscopy—three-dimensional examination which could reveal far more detail than a mathematically-interpreted two-dimensional cover could ever hope to show. The results were startling.

The British photo-reconnaissance effort began, in fact, before the war, and the story is worth recording. It centres on an Australian, Sidney Cotton, who had a lucrative aerial-survey business. Cotton, on a strictly unofficial basis, set up the first photo-reconnaissance outfit with the complete blessing of the Chief of Air Staff. He was provided with a Lockheed 12A, a small airliner with a ceiling and range that were ideal for the purpose, and three cameras, carefully concealed, were mounted to scan the strip of ground beneath the aircraft as it flew. The aperture through which they scanned the ground beneath was closed by a sliding hatch so that, from the ground, it was in this state quite impossible to know that there was anything odd about the aircraft at all. To finish the job, the plane was painted a pale, greenish blue colour—just the shade one might expect to be chosen by an extrovert Australian joy-rider. But of course, it was also exactly the colour to make the plane as inconspicuous as possible when in flight.

As a cover the Australian set up a company called 'Aeronautical Research and Sales Ltd' of St James's Square, London; the business was stated to include the marketing of colour film (which indeed it did) and it involved much travelling around the European business network—including frequent trips over German factories and



Imperial War Museum

△ In September 1944, after heavy bombing, subsequent reconnaissance shows the damage; the flak guns have been moved
▽ A German picture of Liverpool. Superimposed are targets for attack (in rectangles) and damage inflicted (in circles)



Sado-Opera Mundi

large industrial cities. And during the trips, the Lockheed was busily collecting thousands of exposures of the ground it covered.

On one occasion it is told that Cotton flew to Germany during a Nazi rally, and while waiting for his colour-film agent to arrive from Berlin, he agreed to take some inquisitive German officers for a flight. They were impressed by the large aircraft that he used, and were most agreeable to the suggestion that they should fly along the Rhine. This the pilot was glad to do and, with the cameras collecting information silently as they went, he took them for a round tour of many military installations, flying everywhere at only a few thousand feet. The results, needless to say, were invaluable.

Each time he made the trip to Germany, Cotton would vary the route and so broaden the aerial cover obtained, and this continued until August 1939. Suddenly, Cotton was grounded in Berlin. At first he was worried, but then found that all civilian aircraft had been stopped from flying. The implications were clear, and when he was eventually allowed to fly out, just a week before Hitler invaded Poland, he was given a route that he must follow—and if he left it by as much as a mile, he would be shot out of the sky.

It was with much trepidation that Cotton made his last flight as an unofficial aerial spy. But within a few months, this time within the official fold of the RAF, he was back at work, with 'Shortie' Longbottom, the RAF pioneer aerial photographer. Two Spitfires were obtained and fitted with cameras in each wing and, by November 1939, good quality photographs were being taken from over 30,000 feet. They showed many leading centres of German activities with graphic clarity, despite the formidable height at which they were taken. Yet there were drawbacks still: the vapour trail which the plane produced was often clearly visible from the ground and—more important—it was well-nigh impossible to find a way of gleaning enough information from the results to be really useful.

It was at this point that, once again, free enterprise raised its head. This time it was in the form of Michael Spender, who had done more work than most in the interpretation of aerial photographs taken for survey purposes. Spender used a large stereoscope which enabled the contour of the ground to be not simply revealed but magnified many times. It showed that a tiny dot, for example, might in reality be a flat disc or a tall tower . . . it was an invaluable technique. Alongside the viewing plane on which the photographs were mounted was a hinged pointer which drew out special selected points, indicated by the examiner, on a separate sheet of paper. From ▷ 2968



- 1. Bomb explosions
- 2. Hangars
- 3. Assembly shops
- 4. Store houses
- 5. Repair shops & store houses

- 6. Workshop
- 7. Briefing hall
- 8. Barrack huts
- 9. Power station
- 10. Administration block
- 11. Dispersed aircraft

such details as size, location, and many other parameters of the objects on the photographs could be accurately measured.

Early in 1940, as the Allied group responsible for air photography took shape, they moved to a base some 40 miles east of Paris. And it was here that the British and French photo-reconnaissance experts put their heads together for the first time. The French had relied on large-scale, detailed photographs and at first were sceptical about the British efforts, taken from such great heights. But of course the stereoscopy technique, which was by then becoming routine, showed how much more detail was possible. A Colonel Lespair was in charge of the French group, and he is said to have produced a chart which he told Cotton to take to London whenever he felt the need for some evidence to advocate his case for improved equipment or conditions. The gist of the chart was a set of statistics: Bomber Command had photographed, it was said, 2,500 square miles for the loss of 40 aircraft; the French had covered 6,000 square miles for the loss of 60—but Cotton and Longbottom with the Photographic Unit, using one Spitfire, which remained intact, had covered 5,000 square miles without loss!

This approach worked. When Cotton returned to England to ask for the expansion of his organisation, the agreement was forthcoming—despite the jealousy of Bomber Command, which continued to take its own reconnaissance and 'result of attack' pictures.

An incautious press release

Within a few weeks this situation began to change. Bomber Command had been unable to photograph properly several areas in Germany, all important to future strategy. Cotton sent one of his new Spitfires to the area, and the photographs were taken without a hitch; indeed, when German fighters did materialise the pilot simply opened the throttle and sped homewards, leaving the Messerschmitts behind him—proof, if any were needed, of the importance of the Spitfire's greater speed in photo-reconnaissance. Distinguished Flying Crosses were awarded to some of these pilots at the time—and an incautious press release sent to the aircraft magazines nearly wrecked the secrecy of the results. It spoke of 'a new method of aerial photography' and mentioned 'overlapping photographs'—but fortunately the Germans did not appreciate the significance of this statement.

By now the value of the technique was clear to all concerned, and not only did the Photographic Development Unit take over the detailed air-photography for the RAF, but also for the army. However by June 1940 the Germans were getting close; and, after several moves to areas of France that were further out of range of the advancing German tide, the unit was eventually forced to return to England and to Heston, the base where it had all started.

At about the same time, in the former offices of the Aircraft Operating Company, the first British training school for photo-interpreters was set up—and then Cotton was relieved of his post by an Air Ministry decision. It was felt, said the official notification, that photo-reconnaissance had passed the experimental stage and so should become a unit of the RAF, rather than a separate entity. Commander Geoffrey Tuttle was put in charge, the name of the unit was changed to Photographic Reconnaissance

Unit—PRU for short—and so the machinery was ready for the more serious developments in the later stages of the war. It was this unit, incidentally, which supplied the details of 'Operation Sea Lion', when nearly 2,000 Axis ships were massed along the European coast facing the shores of England, and ready for invasion . . . but the Battle of Britain changed the course of the war, and the threat was averted for the time being.

Expansion continued; new departments were founded and the headquarters moved from Wembley to Danesfield, a large country house at RAF Medmenham. It was then that the Americans—who had at the time no photo-interpreters at all—sent trainees for instruction and, by 1942, the USA was also taking and interpreting photographs by stereoscopy. The fact that the Germans were using radar was spotted at this time, too, by the discovery of a dish-shaped direction aerial at Bruneval. Subsequently the installation was attacked, and the RAF planes also began the defensive practice of dropping aluminium foil from their normal flight positions to confuse and 'dazzle' the enemy radar detectors. 'Window' was a successful ruse, and saved a great many lives during the war.

An epic of aerial detection

By mid-1942 photo-reconnaissance was an established part of the Allied war effort—and it was in the middle of May in that year that one of the greatest epics of aerial detection began. A Spitfire on another mission—it was flying along the Baltic coast—happened to pass over a relatively small river-mouth island. The pilot, Flight-Lieutenant Steventon, noticed with interest a large number of buildings, obviously in active use and apparently surrounded by much new building work. Nearby were several rounded constructions, which the interpreters noted before moving on to the more serious work in hand—these pictures were, after all 'extras' to the sortie, and were not really interesting enough to spend too much time on. The island itself was seen to lie on the mouth of the Peene river; and the developments were taking place on Peenemünde—home of the V-rockets.

Previously the so-called 'Oslo Report' had suggested that Peenemünde was the site of important rocket developments, and scattered Intelligence had tended to confirm it. But even so (and notwithstanding the singular nature of the Peenemünde constructions that were photographed) the idea was taken no further. Yet, as we have seen, even by this time the rocket establishment was well under way. In February 1943 a note was sent to the RAF Medmenham headquarters; rocket development had been reported, it said; could the interpreters keep a look out for a rocket projector of any kind?

When Dr R. V. Jones, a senior Intelligence official, was informed of these first few shreds of information he insisted that the news should be kept secret—even within official circles—until confirmed or finally disproved. The War Office was not so sure, however, and called in two scientists, Professor C. D. Ellis and Dr A. D. Crow. After much negotiation and discussion, it was decided to call in an independent investigator to examine the facts impartially. His appointment was, as it turned out, somewhat controversial, since many of the experts involved were not convinced that he had the



hand-held camera for oblique pictures



△ An expert examines pictures of Germany through a stereoscopic viewer

seniority, the experience, or indeed the years to be competent. The man concerned was Duncan Sandys.

Sandys was then 35, and Joint Parliamentary Secretary to the Ministry of Supply; and, despite what the critics said, he was clearly in an excellent position to infuse a note of greater urgency into the investigation. However, the opposition continued; Sandys had been invalided out of service after a car crash in Wales during his earlier Z-battery days; he had married Diana Churchill shortly afterwards, and so had become the Prime Minister's son-in-law. The critics probably felt that the situation smacked of nepotism, but though the marriage may well have helped the Prime Minister and Mr Sandys to get to know each other better, there can be little doubt that he was, in fact, right for the job.

After seeing the coverage of Intelligence photographs that had been ordered, it was Duncan Sandys who, in April 1943, asked for a more detailed coverage of the Peenemünde area—though even he, at the time, had no notion of just how important the move would prove to be. As a result, Flight-Lieutenant Kenny of RAF Medmenham found himself looking at the Peenemünde photographs again. Alongside the buildings on the island he noted an elongated structure which he could only interpret as sludge-ways for dredging operations. Everyone else in his section agreed. In reality the objects were rather more sinister—these were the first V-1 launching ramps ever to be seen by English eyes. Indeed, a few days later a photograph revealed the vapour cloud of a rocket test, and even the rocket itself was visible.

In May several 'cylindrical objects' were photographed. Yet, despite the attention being devoted by British experts to the possibility of German rocket attack, and the general knowledge of what, roughly, a rocket would have to look like, still no definite diagnosis was forthcoming. In the following month more pictures were taken, and once again the interpreters were looking at the German rockets ready for firing. (One of them was actually shown by Flight-Lieutenant Kenny to the Prime Minister during an official visit to Medmenham!) It was in July that Dr Jones observed that, unless he was very much mistaken, there appeared to be large rockets in some of the photographs. As a result the interpreters eventually conceded that giant 'torpedoes' might be the explanation after all.

One obvious answer was near at hand. Within weeks there were heavy raids on Peenemünde, and with the recognition of the nature of the threat it was possible to keep a more constructive watch on German progress. As V-1 and V-2 installations were spotted, they were bombed; and there can be no doubt that the aerial photographs—which by the end of the war would be able to show the presence of people from a height of over 30,000 feet—were a leading factor in the British onslaught against the German secret weapon establishments.

Certainly it is true to say that the lessons learned during the war years have been taken to heart since. Many of the technical developments have since been applied by the new generation of rocketeers—the space explorers, and the satellite-based Intelligence investigators—that mark the endeavour of the modern world.

[For Brian Ford's biography see Vol 3, p. 117.]