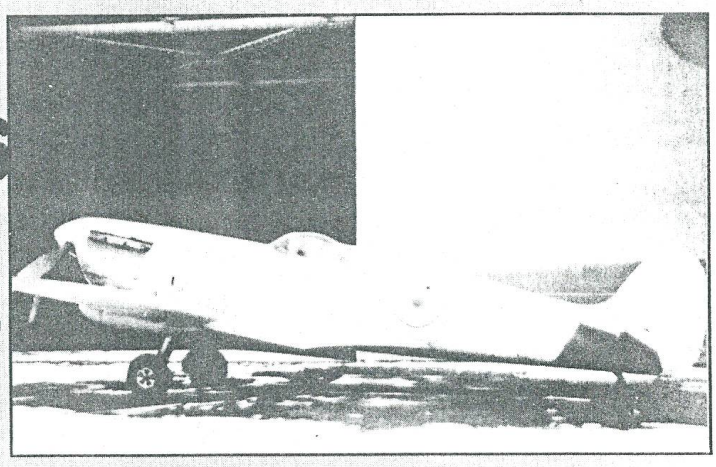
A FOCUS ON KNOWLEDGE



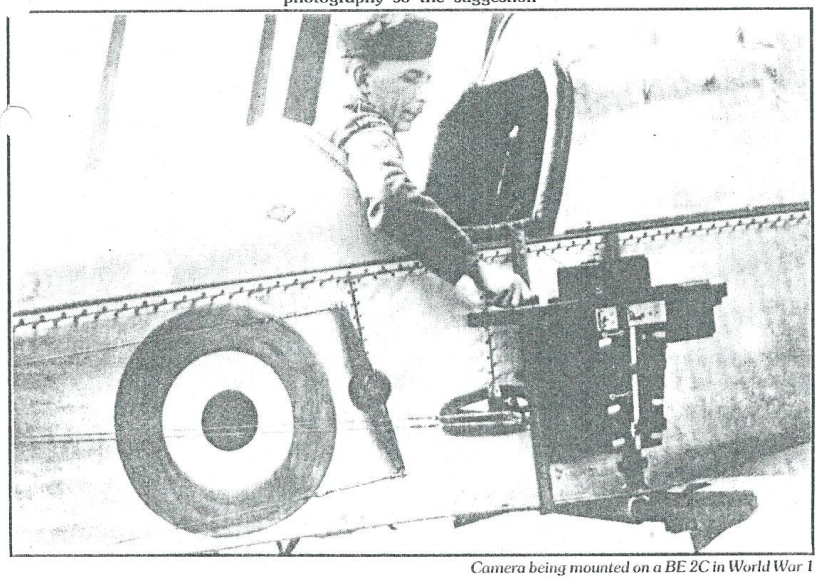
THE STORY OF PHOTOGRAPHIC RECONNAISSANCE

The tactical importance of height has been instinctively understood by hunters and warriors since time immemorial. Concealment, also, plays its part in the serious business of survival. Hill forts, crows nests, balloons and kites; cover, disguise, track erasure, and camouflage - all are examples of two sides of the same coin. David Green traces the early history of the development of photography in air warfare, where overview and subterfuge are mutually opposed.

Pioneers.

The honour of being the first person ever to take an aerial photograph goes, as aviation history so often records, to a Frenchman. He was an 'aviateur du ballon' - one Gaspard Tournachon. It was the Spring of 1858, and his balloon was drifting close to Paris. The Minister for War was quick to discern possible military applications of Tournachon's experiments and pressed the photographer to carry out more work in that area. He was, however, only interested in the artistic and pacific use of photography so the suggestion was politically unacceptable to him.

In 1860 Mr J W Black succeeded in taking a successful photograph of Boston, U.S.A. from a balloon. That was quickly followed by the first military application of airborne photography. In 1862 General McLennan's Northern Army (American Civil War) was besieging Richmond, Virginia. The General was anxious to obtain information on the disposition of Confederate troops and artillery. He therefore ordered a photographer to go aloft in a tethered balloon to take pictures. The intrepid young man was successful in his mission. Two clear prints resulted. With extraordinary inventiveness the General caused them to be marked off in a grid of sixty-four squares. Two of his soldiers took one print aloft in the balloon to 1,500 feet above the battle field. From there, they were able to telegraph to the ground information and grid references concerned with the exact movements of the opposing troops in their attempts to break through the siege lines. As a consequence, McLellan was able to counter all Confederate threats by moving his reserves wherever required. This improvisation foreshadowed to a quite remarkable degree the 'Cab Rank' operations of World War 2 almost a century later.



Camera being mounted on a BE 2C in World War 1

Balloon-mounted experiments continued apace in the U.S.A. and France throughout the years that followed into the 20th Century. On 24 April, 1909, Wilbur Wright recorded the first-ever attempt at aircraft photography when he took off with a photographer he omitted to name from Centocelle, near Rome, New York State. On that occasion some successful cine film was taken. Across the Atlantic, in December 1909, a Frenchman, M. Meurisse managed to take some cine footage which was converted into several readable still shots.

Experiments continued in the U.S.A. and Europe during the years immediately prior to World War 1. The feasibility of using the camera as an adjunct to airborne reconnaissance had been adequately proven before the outbreak of war. Just before that cataclysmic event in 1914

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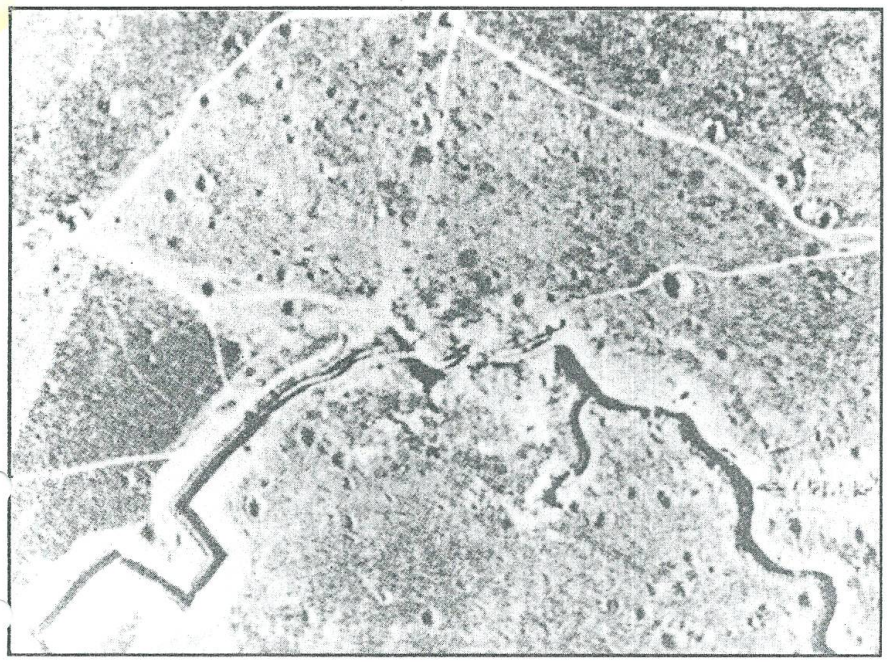


A World War 1 photo of German Trebch Systems in the Hindenburg area.

two British Army officers flew to a height of 5,600 feet. From that vantage point they were able to take pictures of the Isle of Wight and the Solent, exposing the entire defence network. Furthermore, they developed the negatives in the air so that they were able to make prints on landing. The principle of timely response in intelligence gathering had been clearly demonstrated.

The Camera goes to War.

When, finally, war became a reality on 4th August 1914, the roles of the embryonic air forces already in existence were as yet undefined. The Royal Flying Corps (RFC), the air arm of the British Army, arrived in France on 13 August when Lt H D Harvey-Kelley preceded thirty-seven aircraft of Nos 2, 3, 4 and 5 Sqns to Amiens. They were all that were available - a mix of Bleriots, Farmans and BE 2s.

At that time there was almost no conception of how, or even if, aircraft could be employed to the greater good of the British Expeditionary Force. The only practical possibility seemed to concern reconnaissance arising from the exercises of the few years previously. There was no question yet to seriously consider either defensive or offensive roles for aircraft. Visual air observation began to make a positive contribution after 23rd August, 1914 when the Germans began their powerful offensive from Mons, Belgium. Throughout the Allied withdrawal the polyglot elements of the RFC managed to produce so much accurate information that Field Marshal Sir John French quickly became convinced of its value.

There were, of course, many teething problems. One concerned the identification of friend or foe. Anyone in the air - German, French or British - became the target of enthusiastic ground fire from all sides. Aircraft recognition and recognised symbols were at that time virtually non-existent, although British ground-crews worked long hours painting the national flag beneath the mainplanes. In practice it was a complicated device which could not be quickly recognised in the short time available to an entrenched infantryman. Its effect was therefore negligible Once again it was the French who came up with the answer. It was they who discovered that their red, white and blue tricolour, painted in the form of a roundel, was distinctive enough from the German black and white crosses to be readily recognised. Logically, then, the RFC decided to reverse the order but keep the design. In that way the blue, white and red of the British roundel was adopted, and has remained on British military aircraft ever since.

It was not long before the Germans realised that they were being spied upon from above, whereupon they directed their small arms fire, and shortly afterwards, their artillery fire at the new target. That hostile reaction quickly became known amongst British aircrews as 'Archie', the forerunner of the ack-ack and flak of World War 2 and today's triple-A. The considerable discomfort thus produced forced the fliers to seek greater security by attempting to fly higher, thus presenting a smaller target at greater range. But that worked both ways, which resulted in the airborne observers becoming less able to discern details on the ground with sufficient accuracy. Conversely, a more positive result was that they could actually see a much greater expanse of the surface.

All of which gave rise to the use of the camera, which was able to record the passing scene for subsequent analysis. It was not of course, able to provide a professional assessment of the meaning of the images. So it was that, from those earliest days the need, and the development of photographic analysis was established. Indeed, in World War 2 that skill became the essential partner to aerial photography itself.

Like most things connected with military aviation, still a constantly developing science with a cutting edge which must always be exploratory and innovative, aerial photography started at grass roots level, with the pioneers identifying the need and seeking the answers. Some of the aircrews of No 3 Squadron began by taking their own folding cameras aloft with them. To compliment this Lt C C Darsley turned the stables of their commandeered chateau into a dark room. He bought chemicals in Bethune and

The standard F24 camera as used in early PR'Spitfires

developed the plates of the German trench dispositions over which the squadron aircraft flew daily.

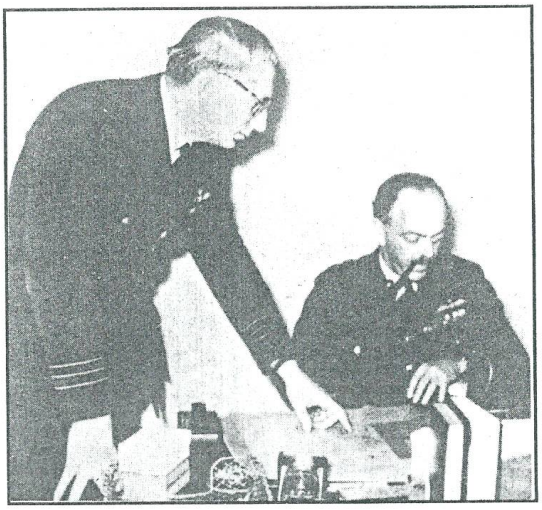
His efforts attracted instant interest with the Allied staffs who promptly ordered coverage of the entire area confronting the BEF at Neuve Chapelle. The information thus revealed was traced on to 1,500 scaled maps prior to the British attack on 10th March, 1915. In the meantime an official RFC Photographic Section had been formed under the guidance of Lts J T C Moore- Brabazon and C D M Campbell. Their first task was to produce the first RFC camera, a box-like affair which could be hand-held by the observer by means of leather straps and brass handles. Later, it was sometimes fitted to an orifice cut through the floor of the observer's cockpit.

The final refinement arising from World War 1 was an aerial camera which fitted to the side of the aircraft which had a designed capability of changing the photographic plates semi-automatically.

Peacetime Stagnation.

With the coming of peace in 1918 came predictable reactions to the disciplines of national defence. The horrifying price which the previous four years had exacted from the United Kingdom in terms of the cream of its youth, its industry and its national treasure had left it in desperate economic straits. As we have seen previously ("Per ardua ad Astra", Vol 3, No 1) about the only positive step forward between the Armistice and the mid-'30s' had been the foundation of the world's first independent military air arm, the Royal Air Force. It was, it is true, a sickly infant for many years, with few opportunities for growth and development. Nevertheless, its very independence under its great father-figure, Lord Trenchard, protected it from near extinction which, given the economic circumstances of the day, would have almost certainly have been the fate of military aviation had it been left in the hands of the two traditional armed services, themselves beset by stringent economic circumstances.

It also permitted some original thinking and planning, even though most of it remained at desk level. Little actual advance could be made in the areas of photographic reconnaissance and interpretation for several reasons. Firstly, the latter had been seen and developed as far as it had gone as being of primary assistance to the Army on the ground. Despite the advent of the RAF it remained as an activity largely organised by and for the soldiers. The aircraft involved directly in support of the Army were, it is true, owned and operated by the RAF but the supporting ground operations, sometimes described as 'integrated' were very much Army-led. That was hardly surprising as the concept of close inter-service co-operation did not develop overnight with the birth of the RAF. Indeed, the essential co-operation and co-existence of air and ground forces had to await the Western Desert campaigns (1940-43) before being thoroughly honed and understood by those in authority within the Army and the RAF.



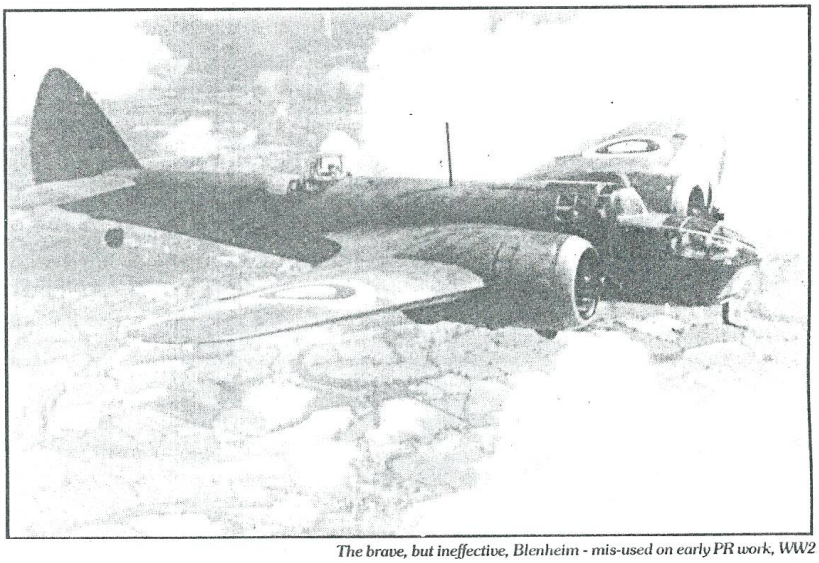
Sydney Cotton (l) with AVM Barratt

So it was that upon the outbreak of World War 2 (3rd September 1939) the RAF had no specialised units which could boast an expertise in aerial photography. It had no specialised aircraft, nor adequate cameras, nor high-speed, quantity film developing equipment, nor any skills or training in the art of photo-interpretation. Only six months from the outbreak of hostilities Air Chief Marshal Sir E Ludlow-Hewitt, as C-in-C Bomber Command, produced a report ("Readiness for War") in which he stressed the vital importance of providing crews with as much target detail as possible. He emphasised the need for the provision of fast, specialist reconnaissance aircraft complimented by the finest photographic equipment possible.

In the hurly-burly of the dreadful realisation of the wasted, cloud-cuckoo land years since the curtain had fallen on the 'war to end wars' - the end of an act, not of a play - it is heartening to note that there was, despite all, some cool thinking in high places. It was even more fortunate that, as has been the case on many occasions throughout the turbulence of British history, the right man moved quietly into the position of influence at the right time.

Never mind the rules - do something...

In the late 1930s, somewhere, along the miles of twilit, musty corridors of the Air Ministry there was a door marked Air Staff Intelligence. Whilst many thought this to be a denial in terms it produced, nevertheless, a man of the moment. His name was Frederick Winterbotham. During World War 1 he had been a pilot in the RFC, and had witnessed the early days of aerial photography. Some twenty or so years later it had fallen to him to undertake many visits to Germany (the reasons remain rather vague). There, he was fortunate enough to cultivate the friendship of many people in influential positions. In that privileged position it was natural



The brave, but ineffective, Blenheim - mis-used on early PR work, WW2

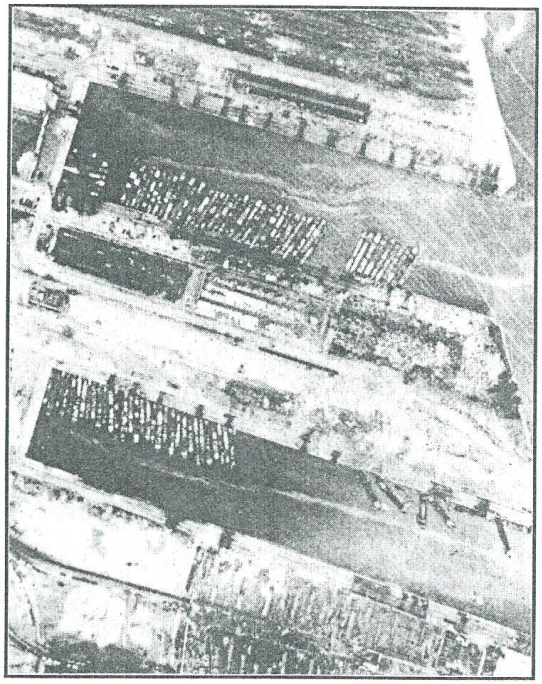
that he became the recipient of much off-the-record news and views about the inner workings of Hitler's 3rd Reich.

Winterbotham was aware of the fact that the French Deuxieme Bureau had a record of taking photographs from civil aircraft. It seemed only logical that the British should follow suit. By chance and good fortune he met, in 1938, an innovative, mercurial man of Australian origin, Frederick Sidney Cotton. He had served in the Royal Naval Air Service in World War 1, during which time he had become widely known as the inventor of the Sidcot suit, designed to provide an element of comfort for aviators in open cockpits. Later, as a civilian, Cotton 'flew the mail' in Newfoundland and, with the aid of a camera, carried out some aerial survey work.

Cotton was clearly well-qualified to assist Winterbottom with his plan to undertake some hush-hush aerial photography as a purely civilian activity. Winterbotham sought the blessing of the Chief of the Air Staff, Sir Cyril Newall, who gave his approval, and the authority to buy aircraft on the civilian market. Cotton already had business contacts in Germany genuinely concerned with colour photography. The partners now set up a company with offices in St James's Square bearing the name Aeronautical Research and Sales. Surveying the aircraft market worldwide, they decided to purchase in Cotton's name a high performance Lockheed 12A. Behind locked hangar doors Cotton designed a frame which would support three cameras, two angled to take obliques on either side, and one pointing directly downwards. All cameras were capable of taking pictures in continuous sequence. The frame was mounted beneath the passenger cabin floor and were concealed, when not operating, by a sliding panel flush with the aircraft's skin.

The visits to Cotton's German business contacts kept the smart duck-egg blue aircraft so busy that its flights became routine to the civilian aeronautical authorities. It was based at Heston, a grass field which still can be seen - just - almost at the edge of London's giant Heathrow. The company was joined by a Canadian, Robert Niven, at the end of his short-service commission.

With the Hudson came one of the first problems associated with aerial photography - extreme cold at height frosting the lenses. Cotton overcame that by bleeding and re-directing some of the warm cabin air. Then there was a need for extended range, which called for the fitment of extra fuel tanks. That enabled Cotton and Niven to fly from Heston direct to Malta. Using the island as a base a great quantity of film was exposed high over Eritrea, Libya, Sardinia, Sicily and southern Italy. It was to prove invaluable in just a few months time.



(Ack. Air Ministry) Vertical photography - German invasion fleet assembling at Dunkirk, 1940

In the meantime the Mediterranean adventure which had resulted in so much successfully exposed film had, by its very nature, highlighted another operational shortcoming - an inability to interpret the prints in anything like the time which would shortly be required for the provision of timely intelligence. The years between the wars had not been utilised in this field, as in so many others. Aerial photography had been regarded as an almost secondary duty by those in Bomber Command who, in reality, stood to gain most from it. The Blenheims of No 2 Group suffered from inadequate performance at height, and they were slow and desperately vulnerable. They were equipped with old F.24 cameras with an 8-inch lens which produced a scale of 1/48,750, quite unsuitable for intelligence purposes. Even the skills required for competent photographic interpretation had been assessed at far too low a level. It was assumed that any Station Intelligence Officer (SIO) could do the job after one week's course. At the time when Cotton's Lockheed 12 was bringing back mountains of new photography there was only one experienced interpreter available, Flt Lt Walter Heath, whose job it was to organise the SIOs' courses.

So it was that the long, hot summer days of 1939 ticked steadily away into history. Much was being achieved in preparation for the war which most people of these islands could now see as inevitable. Arrangements for civil defence were put in hand. The RAF busied itself with re-inforcement, re-equipment, training, control and reporting, airfield construction and a thousand other matters - but in the order of priorities the business of taking and interpreting aerial photographs remained at a lamentably low level.

Had it not been for Cotton's 'company' with its lovely Lockheed, joined now by a Beechcraft, the whole process might easily have been consigned to the "Too Difficult" tray. As it was, the photography continued day after day until the very outbreak of war itself. Pictures of the new Frankfurt airfield, shipping in Wilhelmshaven, Mannheim and many other potential targets appeared in the Air Ministry, successes in sharp contrast to the brave efforts but poor returns of the Blenheims.

The Heston Flight.

Matters came to a head some two weeks after the declaration of war. The Director-General of Operations, Air Vice-Marshal Richard Peck and the Deputy Chief of the Air Staff, Air Vice-Marshal Richard Peirse met Cotton at the Air Ministry. They told him of the difficulties they were experiencing in getting good aerial photography - a story already familiar to Cotton. In particular, the First Lord of the Admiralty, Winston Churchill, was demanding proof of the whereabouts of the German fleet, a task which the Blenheims had been unable to complete.

Cotton arranged to return on the following day to discuss the problems with an RAF camera specialist and some of the operational aircrew. Immediately, however, he reacted in typical fashion. He drove to Heston where he had the Lockheed rolled out. He then told Heston tower and HQ Fighter Command that he was taking the aircraft for a lengthy test flight over the North Sea. Instead, he and Niven coasted out over Ramsgate and made straight for the Dutch coast. A few hours later the Lockheed was safely hangared at Heston and Cotton was studying some very clear pictures of the German fleet. He was able to present them at the meeting on the following morning, enlarged with explanatory overlays. His 'confession' that the photos had been taken just a few hours previously was greeted with amazement.

The extraordinary demonstration of efficiency convinced the Chief of the Air Staff, Sir Cyril Newall, that immediate action could produce the results so desperately needed. He was persuaded that putting Cotton in charge of the existing, creaking machinery would not be the answer. Instead, he authorised Richard Peck to establish at Heston what amounted to a secret RAF unit. To formalise the position Cotton was commissioned in the acting rank of Wing Commander, Niven became a Flight Lieutenant, and Fg Off Longbottom, who Cotton had met in Malta, joined the team.

What became known initially as the Heston Flight took over a hangar, the flying club and some

of what had been the Airport Hotel. For administrative purposes it was decided that the unit should be parented directly by HQ Fighter Command.

Enter the Spitfires.

Despite the continuing failure of the cumbersome Blenheims to deliver what was required, the official Air Ministry view was that such an aircraft was needed to provide the necessary range, to carry the cameras, and to accomodate a pilot and a navigator to find and identify the targets and to operatre the cameras.

Sidney Cotton, on the other hand, had long been convinced that the future of aerial photographic reconnaissance would lie in the provision of high performance, fleet aircraft - unarmed and relying for security on their ability to fly very high and very fast. Such an aircraft, suitably modified, already existed in the elegant shape of the Spitfire. With CAS' authorisation that he could pick his team and equipment he confidently put his request for Spitfires to Air Vice-Marshal Tedder, then in charge of aircraft supply.

But such matters are rarely that simple, even in wartime. Senior members of Tedder's staff were adamant that it would be impossible to modify the fighters to carry cameras, and that the Blenheim was the only real answer. Tedder advised Cotton to accept their advice and then proceed to demonstrate that the unwieldy twin-engined aircraft would not do the job. Doubtless, Cotton was of the opinion that the Blenheim losses had already proved the point, but even in desperate times Service channels could not be avoided.

The Blenheims duly arrived at Heston, and Cotton did his level best to prepare them for the task. By removing as much weight as possible and giving them a beeswaxed, gleaming finish it became possible to coax an additional eighteen miles per hour out of the aircraft but nothing could be done to provide the Blenheims with the overall performance the exacting task demanded.

They were, nevertheless, very superior aircraft of their type which attracted much attention when spotted by other Blenheim users. C-in-C Fighter Command, Air Chief Marshal Sir Hugh Dowding heard about them, so, wishing to improve the performance of his own long-range fighter force, he visited Heston to see what could be done. He was sufficiently impressed to give the order that eight of his fighters should receive the treatment. He also offered his assistance to Cotton in other ways.

True to form, Cotton seized the opportunity of asking the C-in- C Fighter Command for the loan of two Spitfires. Perhaps to his own surprise, his request was granted. The following morning two Spitfires were delivered to Heston.

Modifications and Achievements.

With no time to waste Cotton made contact with Harry Stringer at Farnborough. His experience with cameras stretched back to the days of More-Brabazon. He was, of course, fully aware of the wasted years between the wars when so much could have been done given the will. Stringer did what he could by recovering crashed and written-off aircraft to use experimentally with camera fittings. Ironically, one such was the wreckage of the ill-fated Spitfire prototype K5054 which had crashed on 4 September 1939.

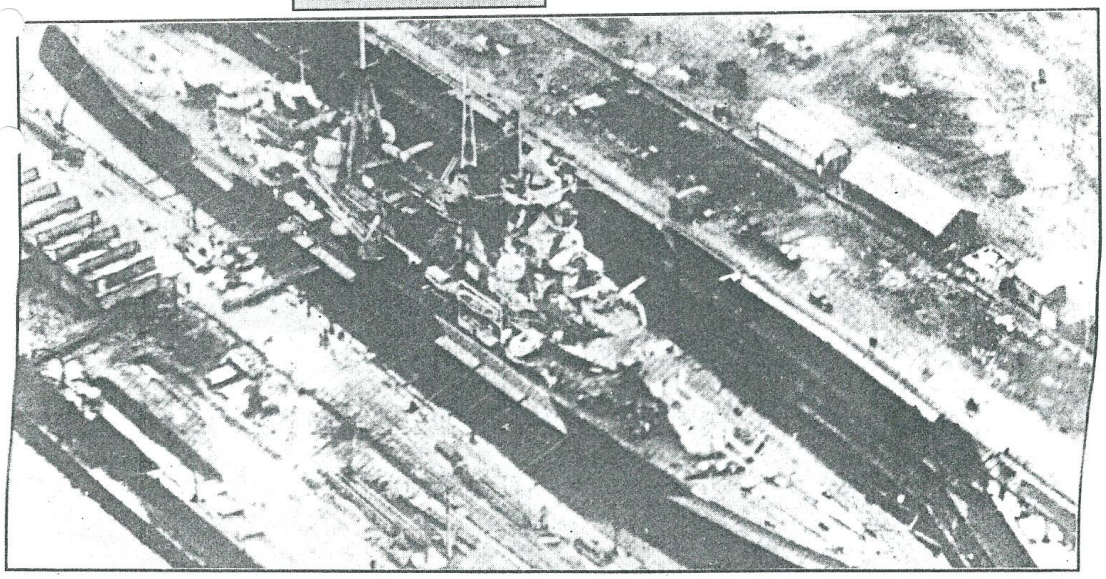
Fortunately, Stringer refuted the claims of those who said that cameras could not be fitted in the fighter. In consequence, in the space of a few days Fg Off Longbottom touched down at Heston in a sleek, pale green Spitfire carrying a camera in each mainplane. The first PR Spitfire, N3071, had arrived at its unit, with its new number-plate of 212 (PR) Sqn. On 18 November, 1939, the aircraft made its first photographic sortie over Aachen, Germany, in the safe hands of 'Shorty' Longbottom.

From that small beginning Spitfire PR had come of age. It would serve the the Allies ground, maritime and air forces and had arrived in the nick of time. It was destined to steadily develop throughout World War 2, to form the backbone of a photographic intelligence service of supreme efficiency.

Into Business.

The arrival of the first of the 'high and fast' aircraft which had for so long been advocated by Sidney Cotton might have been seen as the first step in a specialist wartime career such as had later been achieved by people like Air Vice-Marshal Donald Bennett of Pathfinder fame. But life in the R.A.F., struggling to grow in effectiveness and size in the earliest months of war, was not that simple. Cotton, a single-minded man accustomed to jumping inumerable hurdles in order to get his way had usually been successful. He firmly believed that the end always justified the means. His admirable progress in a field so long neglected should have been proof enough.

Firstly as a civilian, then in his new rank of Wing Commander, he had been given the trust of very senior R.A.F. officers including the Chief of Air Staff and Commanders-in-Chief of operational commands. Their confidence had apparently not been misplaced as he had been proved right in theory and operationally. In a positive sense the early returns from the work already carried out by the Lockheed 12s had established the proper direction for the future development of photographic reconnaissance. It had also emphasised the urgent need for a new approach to interpretation in scale and quality. On the negative side



Oblique photography. The "ADMIRAL HIPPER" in dry dock, Brest 1941. Taken by Plt Off J.D. Chandler.

further proof of the efficacy of Cotton's vision was daily being proved by the grim reality of the inadequacy of the Blenheims.

But in a disciplined society the end does not always justify the means. The fledgling independent air force had always been regarded with great suspicion by the two older services, both sure that they could run the show perfectly well themselves. Resources of all kinds were scarce and in great demand - and that included finances. Then there was the basic matter of adherence to a stringent service code of discipline vital to the smooth running of a task of fundamental importance to the nation, and rarely understood in civilian circles. For those reasons, plus a habitual asperity in his dealings with lesser but perfectly worthy colleagues, Sidney Cotton was unwittingly sewing the seeds of discontentment.

In the meantime the infant Heston Flight, as its founder claimed, was day by day growing into a kicking baby. In his anxiety to see it properly nourished Cotton turned to one of his most influential supporters, Air Marshal Sir Arthur Barratt, now, in early 1940, the Air Officer Commanding the British Air Forces in France (HQBAFF). Cotton was keen to establish his new photographic reconnaissance facilities to all three services on the Continent. There were good operational reasons for so doing as such a deployment would provide an improved radius of action, much needed by the newly acquired Spitfires. Typically, however, his keenness was fuelled by his own desire to run the show himself.

Cotton was already suffering a degree of frustration caused by what he perceived as time-consuming Whitehall bureaucracy He felt that a good, professional deputy could run that part of the operation thus freeing him to go to France. He put this to Sir Arthur Barrett who readily took the point. The consequence was that Sqn Ldr Geoffrey Tuttle was posted to take charge at Heston. This seemed a neat and tidy arrangement, particularly as the unit had lost its rather unusual name in November, 1939 to become, temporarily and for the sake of security No 2 Camouflage Unit. That name was swiftly followed by the Photographic Development Unit.

Into France.

Cotton, as he had planned, went to France. After constructive talks with the AOC a plan emerged whereby the PR force in France would be expanded to a number of detachments each would contain a Spitfire, a Lockheed Hudson (a direct descendant of the ubiquitous Lockheed 12), and a number of vehicles to include a mobile radio communications unit. With the weight of Barrett's support behind it the agreement of the Air Staff in London was assured. The total conglomorate was designated 212 Squadron. To further the ideal of timely intelligence Cotton's advanced headquarters was to be located at Tigeaux, a few kilometres from the HQBAFF. It was also closely located with the headquarters of the French CAS at Meaux, a formation with which Cotton had already established a good raport.

That liaison proved to be most fortuitous at a very early stage. Cotton visited Col. Lespair, in charge of French photo interpretation, and was much impressed by their efficiency. There already existed very fully annotated photographic coverage of the Siegfried Line. Seeking to make use of the French expertise Cotton arranged for Plt Off Douglas Kendall to pack his bags at Heston in readiness to attend the French interpretation course. That young officer had already had some experience with the Aircraft Operating Company as an aerial surveyor. Building on that experience came easily; he later became one of the Allies leading photographic interpreters.

A strong element of mutual profit arose from the liaison. The early Spitfire coverage provided for the French areas of the Siegried Line which were new to them. In return Lespair, carried along by enthusiasm for Cotton's work, prepared a brief which showed that, so far, regular elements of the R.A.F.in France (mainly Blenheim) had photographed 2,500 square miles of enemy territory, losing 40 aircraft in the process. The French had photographed twice the area losing 60 aircraft. **The Heston detachment had photographed 5,000 square miles without damage or loss to the one Spitfire that had done the whole task.**

Eyes for the Fleet.

News of these early successes travelled fast. It spurred their Lordships at the Admiralty to demand intelligence which was beyond the unfortunate Blenheim force to provide. 'What was going on at Wilhelmshaven? Was the Tirpitz still in graving dock or not? If not, where was she?'.

By February, 1940 the PDU had four Spitfires. They were all in various stages of modification, but one of them had provision to carry sufficient fuel to get to Wilhelmshaven and back. So it was arranged for 'Shorty' Longbottom to set off to obtain the information so desperately needed. The aircraft was brand new, tanked to the top, shining and spotless. The pilot clambered aboard, and before long he was flying at over 30,000 feet at more than double the speed which could be achieved by the Blenheims.

He was back on the ground some three hours later having successfully photographed both Wilhelmshaven and Emden. The negatives were rushed to Wembley; it took a matter of minutes before the analyst Michael Spender was able to confirm that the 'Tirpitz' was still incarcerated in the graving dock.

This accurate and timely intelligence so impressed the Chief of Naval Staff and, later, the First Lord himself (Winston Churchill) that Sir Dudley Pound asked Cotton if the whereabouts of certain other ships could be accurately determined. Cotton replied that it should be possible to cover the locations by Spitfire in one sortie. Having received that assurance the Chief of Naval Staff replied that he proposed to hold a meeting on the following day with the Air Staff to formalise the whole business, and would Cotton please be present?

Even Cotton questioned the wisdom of the proposal. He pointed out that it might not be deemed diplomatic for the senior officers of the Air Staff to learn from the CNS that, however important it might be, work had been done for the Admiralty on the authority of a Wing Commander. On being told that Winston Churchill wished him to attend, Cotton had no alternative but to do so.

The meeting was attended by Air Vice-Marshal Pierse, who was predictably taken aback to see Cotton present. The matter was temporarily smoothed over by the personal support of Sir Dudley Pound. In the event it was fortuitous that all were present because it brought to the fore the importance of the part being played in the business of interpretation by the Wild photogrammetric machine operated by the still civilian Aircraft Operating Company at Wembley.

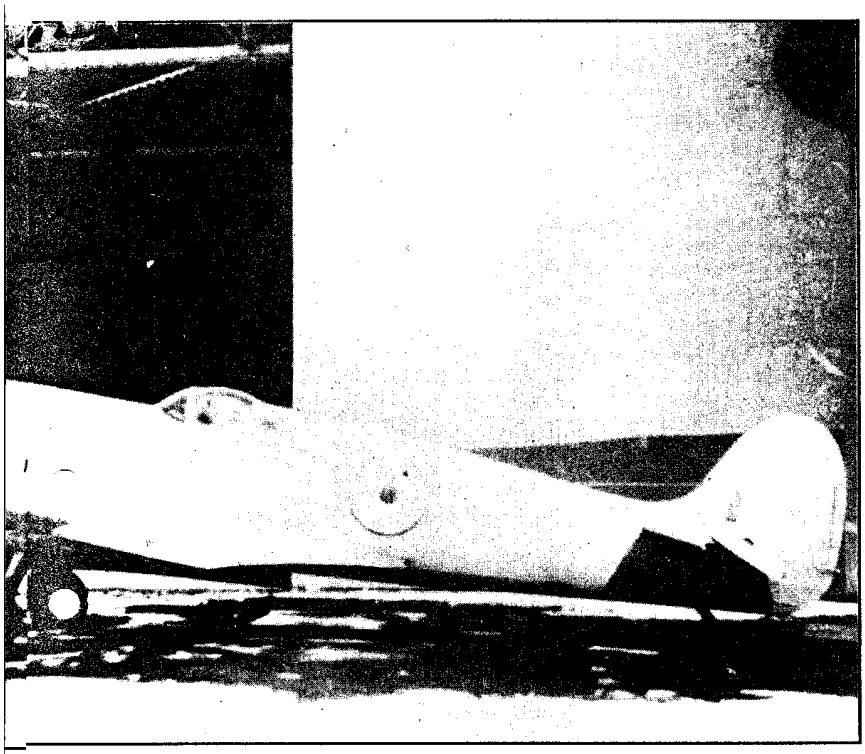
It turned out to be another lesson for Cotton on the inadvisability of ploughing his own lone furrow. Pierse was understandably incensed at having been side-tracked. He demanded of Cotton a complete run-down on the advanced Swiss supplied survey equipment. The briefing complete, he turned to Cotton to observe that, had he known about the importance of the photogrammetric equipment he would have had it requisitioned forthwith.

The position was resolved in short order when Churchill wrote to his opposite number at the Air Ministry that the Air Operating Company was of such national importance that it should immediately be taken over by one of the Service Departments, and that if Sir Kingsley Wood declined to do so for the Air Ministry, he - Churchill - would.

Six weeks later the organisation was safely in the hands of the Air Ministry.

Consolidation.

As the winter of '39/'40 ticked slowly away the growing need for more photographic intelligence became steadily more paramount. It was now Bomber



An early PR Spitfire at Heston. Note the specially moulded canopy for improving cockpit vision and the underwing blisters.

Command's turn to press for something more than its own Blenheims could produce. It was clear that Germany's industrial heartland, the Ruhr, would become a prime target, and accurate and up-to-the-minute information was vital. At the same time Cotton realised the importance of ensuring that his specialised service retained its operational independence in order to meet the requirements, on a priority basis, of all potential 'customers' - be they Army, Navy or Air Force. The best way to do that was to assess the priorities himself as they came into being.

It was clear that the Ruhr would never get the coverage it called for from the Blenheims. Furthermore, the grievous cost in lives was approaching disaster point. Thus it was that on the morning of 2 March Bob Niven trundled heavily out at Heston, tanked up to the gills, took off and headed for Germany and the Ruhr valley. At 30,000 feet above Duisberg he started up his cameras and kept them going all the way to Dortmund. Turning on the reciprocal he took a parallel track back to the German frontier. The enemy made no serious attempt at an interception.

Back on the ground the results were duly processed so that Cotton was able to display a mosaic to the C-in-C, Bomber Command, Sir Edgar Ludlow-Hewitt. His satisfaction was obvious, to the extent that he made an immediate proposal to take over the PDU at once. His suggestion was turned down with equal immediacy.

Au Revoir, France.

The 'phoney' war in France enabled the PDU Detachment to develop its own expertise on the ground and in the air. It also provided more time for increased photographic coverage of potential targets in France and Germany. The opportunity was also taken to obtain covert photography of the neutral countries in the north-east on the principle that, when things did blow up, their neutrality status would quickly disappear.

A number of new pilots were added to the strength, attracted by the call for volunteers adept at navigation and the prospect of flying fast aircraft. By the early Spring of 1940 there were now a number of camera-equipped Lockheed Hudsons on strength in addition to the Spitfires. Despite the increasing amount of flying being undertaken, and the relative inexperience of some of the pilots, losses remained low. It was therefore a matter of great sadness when one of the Hudsons was shot down over southern England having been mistaken for an enemy aircraft.

In France the Army also found itself poorly served with photographic intelligence. The Blenheims and the Lysanders did their best, but even their results proved too much for the only two expert analysts, and unit intelligence officers had not the expertise to cope. Realising the position Air Marshal Barratt summoned Sidney Cotton, and together they called on Lord Gort at his headquarters where they presented a series of excellent enlargements complete with fully annotated overlays. The Army commander responded to the initiative with alacrity. Realising full well the danger to which the so-called neutral countries in the north-east were exposed, and the hopelessly inadequate mapping existing, he asked if it would be possible to obtain new photographic coverage of that area. of potential operations.

The outcome was that by March 1940 a flight of 212 Sqn moved itself to Lille and managed covertly to produce completely new coverage of Belgium.

Meanwhile, back in the United Kingdom, the decision to modify Spitfires to undertake the photographic reconnaissance role occasioned much interesting activity at the Air Ministry, Heston Aircraft Ltd., and Vickers Supermarine. All early Spitfire PRU aircraft derived from the Mk I fighter, with its eight .303 ins machine guns, ammunition bays and 85 gallon internal fuel capacity. The required changes and the urgency to produce results meant that the development process from short-range interceptor fighter to maximum range, high-speed camera carrier went through a number of quick changes which provide those students with a retrospective desire for knowledge with a confusing array of Supermarine type numbers, marque numbers and sub-marque letter designation from A through to G, bracketed with SR (short range), LR (long range), and SLR (special long range). Those designations basically concerned modified fuel systems, but in practically every case there are other differences brought about by a variety of cameras (also designated by letters and numbers such as F8 and F24) and their fitments, and a range of power plants ranging from Merlin II, through III, XII, XX to 45 and 46. For the purposes of this article it is only necessary to advise readers with an avid desire to go into such detail to refer to the superb reference book by Morgan and Shacklady entitled "SPITFIRE - The History".

These matters are only mentioned here to illustrate to the reader the sort of extreme activities necessitated by years of peacetime neglect and parsimony in high places. The damage can only be overcome if a clear thinking catalyst, such as Sidney Cotton, happens along to show the way. Then, once the go-ahead has been given from above, the clamour for speed of reaction reaches constant and deafening proportions. Fortunately, national realisation of great danger has opened many doors in the past. Let us hope that it always will.

For our part we need only take note of the fact that the PR detachments in France and at the Heston headquarters (for such it remained under the efficient eyes of Geoffrey Tuttle) reacted busily to an increasing number of task demands which by now had dictated a system of response priorities. For example, on 7 April, 1940 the irrepressible

Longbottom flew a return trip from Heston to secure pictures of German shipping at Kiel. To do so he was required to fly at greater than 30,000 feet in an unpressurised, unheated cockpit for over four hours.

The timing of the sortie was perfect. Photographs revealed a harbour crammed full of shipping, and a nearby airfield equally stuffed with Ju 52 transport aircraft. Two days later Germany invaded Denmark and Norway. One month later, on 10 May, it was the turn of the Low Countries to witness the arrival in their midst of the paratroopers, tanks, infantry carriers and horse-drawn transports. They represented the spearhead of the aggressors' forces which were to mercilessly occupy a great part of Europe for the next four years.

The story of the unstoppable advance of Hitler's forces through northern France to Dunkirk has been well-documented elsewhere. Suffice it to say that there were unceasing demands for the services of the Spitfires and Hudsons of 212 Sqn. throughout that short period of just one month. Operating from a series of constantly changing bases, supported by Cotton's mobile processing and interpretation facilities, the PRU element was, perhaps, one of the brighter aspects of an increasingly worsening situation. By sheer professionalism this one specialist unit, itself working under the most arduous conditions, was able to provide the sort of intelligence required by the hard-pressed front line. There is no doubt that PRU's efforts, virtually unnoticed by those not in the forefront of the battle during those four weeks, contributed to an enormous degree to the relatively orderly withdrawal of the British and French armies in the face of the enemy. It helped to preserve more or less intact the British forces until they could undertake the final phase of their return to the United Kingdom through Dunkirk, to retrain and re-equip to fight another day.

A Sting in the Tale...

As with the British nation as a whole, the defeat at Dunkirk was not the end of the tale. Everyone, everywhere knew that there were many lessons to be learned before a real come- back could even be contemplated. The 'miracle' of the most incredible military withdrawal the world has ever seen - or is ever likely to - was evidenced mainly in a nationwide refusal to feel defeated. There was a feeling abroad that (to use a naval expression) we had now cleared the decks for action. Perhaps it was best summed up by the normally withdrawn 'Stuffy' Dowding when he said that we were now, at least, on our own.

Plt. Off Sydney Dowse, P.R.U., Benson, returns from a sortie. Just visible is the moulded canopy and the oblique camera housing above the wing root fairing.

Although the business of PR had suffered its birth-pangs and infancy during the nine months since 3 September 1939 it had developed along healthy lines, and confirmed the essential rightness of Cotton's original principles. The pressure of events had enabled him to 'sell' his ideas (as a civilian, let us remember) to service officers at a very senior level. He was ready to accept the personal responsibility and action to prove his claims. The transference of PR from the Heston Flight to a well-formed service element of the R.A.F., under Cotton's guidance, had been undertaken with remarkable efficiency during a period when development of operating principles, equipment and training were heavy commitments. Indeed, it can be said that the whole operation emerged from the trauma of withdrawal from the Low Countries and France not only with honour, but with the ring of success about it. It was one of the few plusses.

Such an aircraft already existed - the elegant Spitfire

Some of the lessons which had been taken on board were to be fundamental to the future of this exciting (and still growing) story of airborne reconnaissance - today's 'high ground'. They include the need for aircraft, or extra-terrestrial vehicles, and specialist equipment of superior performance capabilities: a matching and immediate means of processing the vast amount of information provided: its equally rapid distribution to the right areas: and the willingness of the financiers to underpin the sometimes formidable expenses required by new ideas, necessary research and technological advances, and re-training which will, in the end, allow for the economical application of fighting equipment and people. The list is not exhaustive.

So - back once more with our feet on the ground - was everything in the PR garden lovely in June, 1940?

It was not - for Sidney Cotton, at least. He remained in France for a week after the Dunkirk withdrawal. During that period the future of the Photographic Development Unit was considered in Whitehall on a tri-Service basis. The interests of the Army were self-evident. The Admiralty wanted to take control so that PDU could watch enemy ports and shipping as its first priority. In the R.A.F., C-in-C Bomber Command took the view that, now, the only offensive action which could be taken would fall to his Command during the years before a second front could even be contemplated. The answer was the best possible compromise. Coastal Command, whose tasks already included the provision of long distance visual reconnaissance for the Admiralty, was already familiar with - indeed, part of - maritime operations. It therefore seemed totally rational to hand over the running of PDU and its subsequent operational development to Coastal.

Cotton arrived back at Heston on 17 June 1940. He found in his in-tray a letter from the Permanent Under-Secretary for Air. It said, in part, "that this (PD) Unit...which you have done so much to foster, should now...take its place as part of the ordinary organisation of the R.A.F.

"It should be constituted as a unit...under the orders of the C-in-C Coastal Command...commanded by a regular serving officer. Wg Cdr G W Tuttle DFC has been appointed."

A few more vicissitudes followed which probably did nothing to lessen the deep feeling of rejection which Cotton must have felt at that moment. One wonders, also, what reaction this inventive, loyal (if unpredictable) Australian must have experienced when his name appeared in the 1941 Honours List appointing him an Officer of the British Empire. Perhaps his life's experience had taught him to accept such changes of fortune with equanimity. Perhaps he himself felt that, having brought everything in the world of PR to apparent fruition it was time for him to go, anyway.

Who knows? And does it matter anyway? Life, particularly in wartime, is full of casualties, and there would be many more. But by his determination to make good the damage done by years of neglect the name of Sidney Cotton will always be related to a success story which is continuing to this day.

Perhaps that is reward enough.

It's worth explaining about how the RAF started it's journey into photographic reconnaissance at this period of time. I will only cover this area very loosely, there are a number of very good books and even websites that go into greater detail about this subject. The idea is to show you that at the out-break of World War, the British military had a very young and maturing photographic reconnaissance capability

The Beginning

Because of the lack of photographic reconnaissance during the build up to War and the fact that the RAF's dislike of specialist Units and men, the Secret Intelligence Service (MI6) working with the French commissioned the Australian Sidney Cotton to fly clandestine photographic surveillance missions using Cotton's Aircraft Operating Company based at Heston airfield.

A picture of Sidney Cotton taken in 1941 and one of his Lockheed 12A that was used to fly covert reconnaissance sorties over Europe and even Berlin before the start of the War.

Flying Officer Bob Niven joined Cotton in early 1939 to act as his co-pilot and flight engineer. Cotton first had fitted to the Lockheed, 3 Leica cameras, 1 in the vertical position and the other 2 at an angle each side. However, it was found that the picture format was to small for the detail required when flying at 20,000 feet, so these were replaced with the standard RAF camera at the time, the F24. The pair were mounted in a frame and set so that each camera's imagery overlapped, thus from 21,000 feet they could almost cover a 11 mile wide strip. Also the cameras were light enough so after completing a sortie, they could be removed and carried in a suitcase pass any customs officers. From the outside the camera port holes were covered by panels, thus making them almost impossible to see.
Sidney Cotton's Company was formally taken over by the RAF in September 1939, the secret Flight at Heston became No.2 Camouflage Unit. Cotton was given a commissioned rank of Squadron Leader with the action rank of Wing Commander. He then went on to fight for the best he could obtain from the Air Ministry in both equipment and men. In a period of 12 months, Cotton revolutionised the role of photographic reconnaissance in the RAF. Sadly, the Air Ministry in their minds could see that Cotton's Unit was becoming his own private airforce, 'Cotton's Circus' it has been called, so on the 16th June 1940 Cotton was handed a letter stating that he had been dismissed as Officer Commanding of the Unit and it was being placed under the command of Commander-in-Chief Coastal Commander with Wing Commander G W Tuttle appointed has the new CO.

Goto RAF Photo Reconnaissance Units to see how Cotton's reconnaissance dream developed

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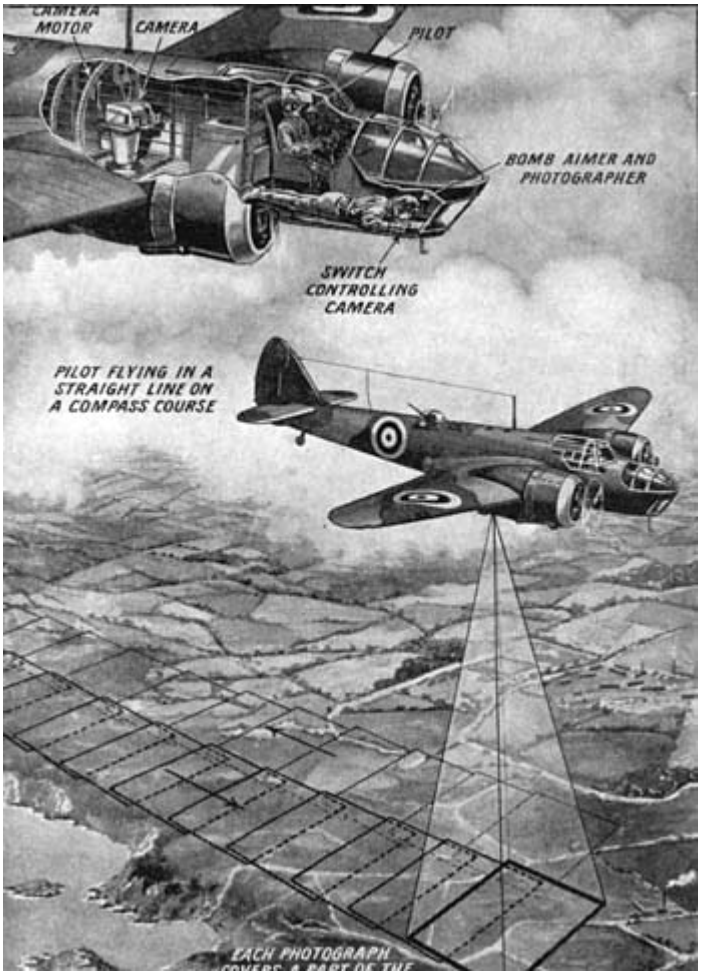
If it had not been for Sidney Cotton and his ideas the Royal Air Force's ability to obtain any form of aerial intelligence would have been found to be wanting. Prior to Cotton tactical photo-reconnaissance for the Army was in the hands of Squadrons of Lysanders, with long-range strategic reconnaissance being undertaken by a number of Squadrons of Blenheim IV bombers of No. 2 Group.

An example of a Lysander.

On the right is a drawing showing very basically the role of the Blenheim flying in the reconnaissance role. On an operational sorties, reconnaissance aircraft would not have flown in pairs.
Both these types of aircraft were slow and because of the heights they had to flight to obtain the best imagery, they became easy targets for the Luftwaffe.
The first operational sortie of the War was undertaken by a photographic reconnaissance Blenheim of 139 Squadron from RAF Wyton. However, flying at 24,000 feet froze the camera and the aircrafts radio and it returned to base.



The Spitfire in the Photographic Reconnaissance Role

Mk XIX (Mk 19) (types 389 and 390)

The Mk XIX was the last and most successful photographic reconnaissance variant of the Spitfire. It combined features of the Mk XI with the Griffon engine of the Mk XIV. After the first 25 (type 389s) were produced, later aircraft were also fitted with the pressurised cabin of the Mk X and the fuel capacity was increased to 256 gallons, three-and-a-half times that of the original Spitfire This version was the type 390.[36]

The first Mk XIXs entered service in May 1944, and, by the end of the war, the type had virtually replaced the earlier Mk XI. A total of 225 were built with production ceasing in early 1946, but they were used in front line RAF service until April 1954. In fact, the last time a Mk

19 was used to perform an operational sortie was in 1963 when one was used in battle trials against an English Electric Lightning to determine how best a Lightning should engage piston-engined aircraft. This information was needed in case RAF Lightnings might have to engage P-51 Mustangs in the Indonesian conflict of the time.[37]

The PR Mk XIX was the only Griffon powered reconnaissance Spitfire. It was produced by taking the Mk XIV fuselage, adding the PR Mk XI wings and PR Mk X cabin. It could carry 254 gallons of fuel internally, using space in the wings that had originally held cameras. It could also carry a 170 gallon drop tank, although this was limited to 90 gallons on operations. It had a top speed of 445 mph and a service ceiling of over 42,000 feet, putting it out of the range of Luftwaffe. All but the first 22 of the 225 produced were equipped with a pressurised cockpit.

The PR XIX could carry two vertical and one port side oblique camera, the vertical cameras were either F8s with a 14 or 20in focal length or F52s with a 20in focal length. The oblique camera was an F24 with either an 8 or 14 inch focal length. It entered service in May 1944. The last operation flight by an RAF Spitfire was made by a PR XIX on 1 April 1954.

Three PR XIXs continued to fly with the Temperature and Humidity Flight, performing meteorological research, until they were finally retired on 10 June 1957. However, a number still do remain flying, namely PS915 & PM631 both with the RAF's Battle of Britain Memorial Flight. Rolls Royce maintain and fly a PR XIX, PS853. These aircraft can be seen around the UK at various air displays.