TARGETING THE REICH

ALLIED PHOTOGRAPHIC RECONNAISSANCE OVER EUROPE, 1939-45

DR ALFRED PRICE

I depend on you, Spitfire, here in this world
Of clear attenuated atmosphere.
The fields of France eight miles below
The sky blue-black, mysterious, above
And trailing us, the traitorous path of mist
For every Hun to see.

I depend on you, Spitfire. We have no guns
To spit our hate at Me 109s.
Only our wits with which to dodge the Hun
As, self-dependent like a hunted fox,
We set ourselves above the mark
and watch our camera click.

Along together in the vastness of the sky
The target for a hundred thousand eyes
In each of them the lust to kill
That tiny, potent, speck that's you and me.
I realise now how the fox assuredly
Disdains the efforts of the hounds.

Wing Commander Nigel Tangye

PREFACE

A long-respected military adage assures us: 'Time spent on reconnaissance is seldom, if ever, wasted.' To deploy a fighting force with greatest effect, a commander needs to have accurate intelligence on enemy dispositions, strengths and movements. Aerial reconnaissance (and today that includes satellite reconnaissance) is just one of many sources of intelligence, albeit an important one; others included reports from spies, the interrogation of prisoners, reports from own troops in front line positions, radar intercepts and decrypted and plain language radio transmissions from the enemy. Intelligence officers have the task of assembling the often disparate and sometimes conflicting items, and melding them into a coherent and usable picture. Put simply, their job is to convert information about the enemy into knowledge of the enemy.

During World War II the Royal Air Force published a journal entitled 'Evidence in Camera', containing a spread of interesting and dramatic photographs taken by reconnaissance aircraft or from combat cameras. Modern computerised printing technology has made it possible to lift selected photographs from that journal and reproduce them in this book without loss of quality. Taken together, these photographs convey a series of interesting peeks into the workings of the Third Reich, and of the Allies' increasingly effective efforts to dismantle it.

Fighters and bombers usually flew in formations as they went about their respective tasks. For their crews there was the excitement and spectacle of combat, the sight of falling enemy planes or targets destroyed. Compared with that, a lone reconnaissance aircraft sneaking past a target perhaps several weeks before an attack, and again after it, might have seemed an unnecessary appendage. Yet assuredly that was not the case. It was no exaggeration to say that without successful pre-strike reconnaissance, an air strike on a target of any complexity was unlikely to be effective. Without such reconnaissance, those planning an attack could only guess at the location of those parts of the target that were vulnerable. They could only conjecture on the strength and the layout of the defences around the target that might disrupt an attack. Similarly, without the later post-strike reconnaissance, the planners could not know with certainty whether their attack had been successful or if it needed repeating.

It required a special kind of courage to venture alone deep into enemy territory, to brave the defences and risk all to secure the precious pictures. The reader may gain a flavour of how it felt to fly this mission from Wing Commander Nigel Tangye's poem 'Photographic Reconnaissance', which precedes this Preface.

This book shows how the photographic reconnaissance process evolved in the Royal Air Force and, later, the US Army Air Forces, in Europe during World War II. It also conveys an idea of the wealth of the intelligence that was collected.

Alfred Price, Uppingham, Rutland

THE DEVELOPMENT OF PHOTOGRAPHIC RECONNAISSANCE, 1939 TO 1945

Left, upper picture: The Bristol Blenheim IV, with a maximum speed of 266 mph at 11,800 feet and a ceiling of about 24,000 feet, flew the first long-range photographic reconnaissance missions undertaken by the Royal Air Force during World War II. Heavy losses early in the war forced the service to abandon using the type for this role.

Left, lower picture: Five squadrons of Lysander tactical reconnaissance planes went to France with the British Expeditionary Force in 1939. The type had an excellent short field performance, but its maximum speed of only 230 mph meant it was extremely vulnerable to fighter attack.

At the outbreak of World War II, in September 1939, the RAF planned to use its twin-engined Bristol Blenheims to fly the long-range photographic reconnaissance mission. Short-range photographic missions in support of the army were to be flown by single-engined Westland Lysanders. Accordingly, when war broke out, four squadrons of Blenheims and five of Lysanders went to France as part of the Air Component of the British Expeditionary Force. Other Blenheims, belonging to Bomber Command and based in England, were to take the photographs necessary for targeting bombing attacks and for bomb damage assessment.

The RAF soon realised that with its current equipment, photographic reconnaissance was a far more costly business than it had anticipated. Between the start of the war and the end of 1939, Blenheims set out on 89 reconnaissance sorties into German airspace. Sixteen of those aircraft failed to return. Moreover, due to the frequent harassment from anti-aircraft guns and fighters, only about half the sorties yielded useful photographs.

The obvious lesson was that an unescorted Blenheim flying over enemy territory at heights between 10,000 and 20,000 feet, by day and in the clear skies needed for photography, had a poor chance of survival. Although they produced some useful photographs of portions of the German defences in the west, the cost had been great and the intelligence picture was far from complete. There were no photographs of the all-important Ruhr industrial area, or of targets deeper in German territory. The slow Lysander army-cooperation aircraft, intended to fly tactical reconnaissance missions to support the army, failed to produce any useful photographs of enemy territory.

If the RAF was not to fight its battles 'blind', it needed much better equipment to secure photographs of targets in enemy territory. Fortunately, in the autumn of 1939, a better system had already been proposed. Shortly before the outbreak of war, Flying Officer Maurice 'Shorty' Longbottom had written a detailed memorandum on strategic aerial reconnaissance, which passed up the chain of command to the Air Ministry in London. In it he stated:

'This type of reconnaissance must be done in such a manner as to avoid the enemy fighters and AA defences as completely as possible. The best

method of doing this appears to be the use of a single small machine, relying solely on its speed ... and ceiling to avoid detection.'

Today this concept is firmly accepted, but in 1939 it was a radical departure from the accepted thinking. Longbottom wanted to convert a high performance fighter plane – he suggested the Spitfire – into an unarmed high-speed high-flying reconnaissance aircraft. The latter would dart into enemy territory, take the photographs and speed home, all with a minimum of fuss and avoiding the defences whenever possible.

Longbottom went into detail on the modifications necessary to prepare the Spitfire for the long-range reconnaissance role. It would have to be stripped of its guns, radio and other unnecessary equipment, which would reduce its weight by about 450 pounds. Since a rapid rate of climb was unnecessary for a reconnaissance aircraft, he thought the proposed reconnaissance Spitfire could get airborne at an all-up-weight some 480 pounds heavier than the standard fighter version. That gave the modified Spitfire 930 pounds of lifting capacity for the battery of cameras and the extra fuel to extend its range. He argued that the reconnaissance version of the Spitfire could carry three times as much fuel as the standard fighter version, giving it a range of 1,500 miles.

Senior RAF officers read Longbottom's paper with interest, though initially nothing could be done to prove or disprove his arguments. The service was desperately short of modern fighters, particularly Spitfires, and the entire production of the latter was allocated to Fighter Command for the defence of Britain. At first Air Chief Marshal Sir Hugh Dowding, the head of Fighter Command, refused to release precious Spitfires for other roles no matter how persuasive the arguments.

The breakthrough for Longbottom's ideas came with the growing realisation that the RAF lacked any effective long-range photographic reconnaissance capability. Following strong representations from the Air Ministry, Dowding reluctantly agreed to release a couple of Spitfires for modification as reconnaissance aircraft. Two Mark I fighters off the production line were flown to Heston airfield north of London, for the highly secret reconnaissance unit known as the 'Heston Flight'. Wing Commander Sidney Cotton commanded the unit and, appropriately, one of the first officers posted in was 'Shorty' Longbottom himself.

The first priority was to carry out the minimum of modifications necessary to enable the Spitfire to photograph targets in enemy territory, and show there were no insurmountable problems if it was used in this role. In place of the wing-mounted guns and ammunition boxes, each Spitfire had two fixed F.24 cameras with 5-inch lenses mounted to look vertically downwards with a slight overlap in cover. The empty gun ports were covered with metal plates, then all joints in the airframe were filled with plaster of Paris and rubbed down to give a smooth finish and squeeze the

Right: Seclin, France, 18 November 1939. Flight Lieutenant Maurice 'Shorty' Longbottom about to take off on the first Spitfire photographic reconnaissance mission. The aircraft had had its armament removed, and an F.24 camera with 5-in lens installed in the gun bay in each wing.

last ounce of speed out of the aircraft. Due to the need to test the new concept as rapidly as possible, the first two reconnaissance Spitfires carried no additional fuel tanks.

Sydney Cotton devised a novel colour scheme for his Spitfires. Earlier, he had noticed that aircraft seen in the distance from below invariably appeared as a dark silhouette against the lighter background of the sky. Thus, he reasoned, at a distance a light coloured aircraft was less visible than a dark one. Cotton had his two Spitfires painted in a shade of pale green, which he thought would make them less conspicuous to an observer looking in their direction from below.

In the autumn of 1939 Cotton's unit was renamed 'No 2 Camouflage Unit' to explain the odd colouring of its Spitfires. One aircraft was detached to Seclin near Lille in France to begin operations. On 18 November 'Shorty' Longbottom, now a Flight Lieutenant, flew the first Spitfire reconnaissance mission. His target was the German city of Aachen and the fortifications nearby. As he ran through the target area at 33,000 feet he found that navigation was more difficult than expected, for while taking photographs with the wings horizontal he had no view of the ground below the aircraft. When his films were developed, they showed a strip of ground on the Belgian side of the frontier to the south of Aachen.

For his next mission Longbottom revised his technique, and planned to navigate through the target area using ground features more than ten miles away on either side of track. On the 22nd, he successfully photographed the Belgian-German border defences to the east of Liege.

During the six weeks that followed, long periods of cloud cover prevented high altitude photography of enemy territory. Then at the end of December the skies cleared sufficiently to allow the Spitfires to resume

their operations. In short order they photographed Aachen, Cologne, Kaiserslautern, Wiesbaden, Mainz and parts of the Ruhr. Significantly, this was done without loss and with little interference from fighters or AA guns.

By the end of 1939, the two Spitfires had flown fifteen sorties without loss. Moreover, two-thirds of their sorties yielded photographs of enemy territory. Of the five abortive Spitfire sorties, four were due to cloud cover at the target and only one was due to enemy interference. The flights proved the soundness of Longbottom's concept for using the Spitfire for reconnaissance, and Air Chief Marshal Dowding reluctantly agreed to release a dozen more of these precious fighters for the new role.

Those early experimental flights pointed out the path for the future of long range photographic reconnaissance, but some major problems remained to be overcome. Foremost among these was the fact that the Spitfire's high altitude performance exceeded the capabilities of the cameras it carried. The F.24, the RAF's standard reconnaissance camera in 1939, had been designed more than a decade earlier to photograph targets from altitudes around 10,000 feet. From there, its 5-inch lens provided photographs with a scale of 1:24,000. This meant that 1 inch on the print represented 660 yards on the ground, sufficient to allow photo interpreters to identify military installations, troop positions and individual vehicles. When the F.24 took photographs from a Spitfire at 30,000 feet, it produced prints with a scale of 1:72,000. This meant that 1 inch on the print represented just over a mile on the ground, which was too small for the interpreters to extract much useful military intelligence from the pictures. Enlargement of the prints did not solve the problem because the details sought – typically troops positions, individual vehicles or bomb damage – were about the same size as the grain of the film and could not be seen even using high magnification.

Another problem was that of having cameras freeze up during

Left: Flight Lieutenant Maurice 'Shorty' Longbottom (right) had proposed the use of the Spitfire for the long-range photographic reconnaissance role before the war, and flew the initial operational sorties with this type.

flight at high altitude. That difficulty was cured by ducting hot air from the engine cooling system through the camera bays.

In January 1940 a slightly improved photographic reconnaissance version of the Spitfires became available, the PR IB. To distinguish it from the earlier variant, the latter was renamed the PR IA. The PR IB carried one 8-inch focal lens camera in each wing, giving a useful improvement in the scale of the photographs (1:45,000 from 30,000 feet) compared with those taken with 5-inch lens cameras. Also, the PR IB carried an extra 29-gallon fuel tank in the rear fuselage to give a useful increase in range.

In February 1940 'Shorty' Longbottom demonstrated the improved capability of the PR IB when, taking off from Debden in Essex, he photographed the important German naval bases at Wilhelmshaven and Emden. In the following month, one of these aircraft photographed almost the whole of the Ruhr industrial area in a single flight. The mosaic made of prints taken during that sortie would become the standard briefing aid for sorties over this all-important area.

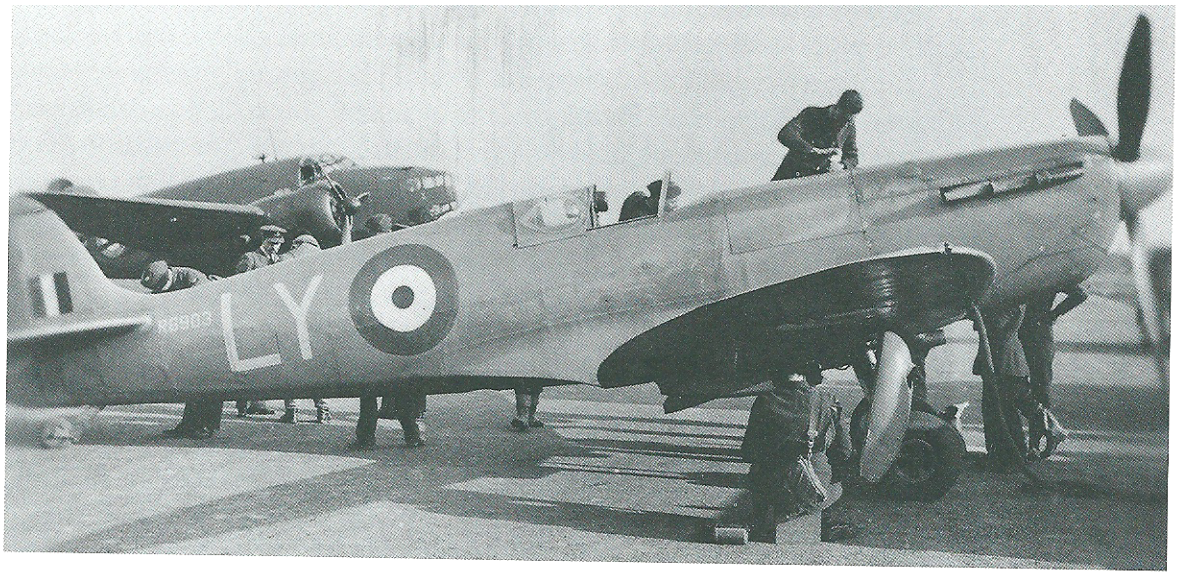
During the early Spitfire operations, Cotton's light green camouflage scheme was found to be too light for operations at high altitude. A medium blue scheme was therefore adopted and it became standard for all high-flying RAF reconnaissance planes.

Also during the early part of 1940, Cotton's unit was renamed the Photographic Development Unit (PDU). For the first time, its title to revealed the true nature of the unit's activities. Early in 1940 the reconnaissance operations in France were formalised and a new unit, No 212 Squadron, was created at Seclin to fly them.

The reconnaissance Spitfire underwent further modification. In March 1940 the PR 1C appeared, with a 30-gallon blister tank under the port wing, counterbalanced by a pair of cameras with 8-inch lenses in a similar blister under the starboard wing. With the extra a 29-gallon tank in the rear fuselage, this version carried 59 gallons more fuel than the fighter version.

On 7 April 1940, 'Shorty' Longbottom flew the prototype PR IC to Kiel. His photographs revealed numerous ships in the harbour, and lines of Junkers 52 transport planes drawn up on the nearby airfield at Holtenau. Since there had been no previous photography of the port or the airfield, it was impossible to know whether those concentrations were normal or if they signified that a large-scale operation was in the offing. Two days later German troops invaded Denmark and Norway, and the significance of concentrations become clear. The incident demonstrated the vital need for regular reconnaissance of important targets, so that major changes in dispositions would be recognisable.

Just over a month later, on 10 May 1940, German forces launched their powerful *Blitzkrieg* attack on France, Holland and Belgium. During the hectic weeks that followed, No 212 Squadron flew numerous sorties



charting the relentless progress of the German Panzer columns through France. The latter quickly reached the English Channel, slicing the defending allied army into two.

The Spitfires' photographs could do nothing to avert defeat. However, by keeping Allied commanders aware of the enormity of their predicament, this source of intelligence prompted a timely start to preparations for the successful evacuation of troops from Dunkirk. It is no exaggeration to say that the photographs from the reconnaissance Spitfires played a major part in preventing the defeat in France from becoming an irretrievable disaster.

After No 212 Squadron withdrew to England, the unit disbanded and its surviving aircraft and personnel were incorporated into the PDU at Heston. In July 1940, the PDU underwent yet another name change, and became the Photographic Reconnaissance Unit (PRU). At the same time, Wing Commander Geoffrey Tuttle replaced Sidney Cotton as commander. The changes of name and commander made no difference to the way the unit operated, however.

At the end of July a further Spitfire reconnaissance variant appeared, the PR 1F. This carried a 30-gallon blister tank under each wing and a 29-gallon tank behind the pilot, giving 89 gallons more than the fighter version. To provide additional oil for the increased duration of its flights, the new variant carried an enlarged oil tank beneath the engine. The cameras, mounted in the rear fuselage, initially comprised two F.24s with 8-in lenses. Later these were replaced by cameras with 20-inch focal lenses, which gave a further improvement in the scale of photographs (1:18,000 from 30,000 feet). The additional fuel increased the radius of action of the PR IF by about 100 miles, compared with the PR IC. Exploit-

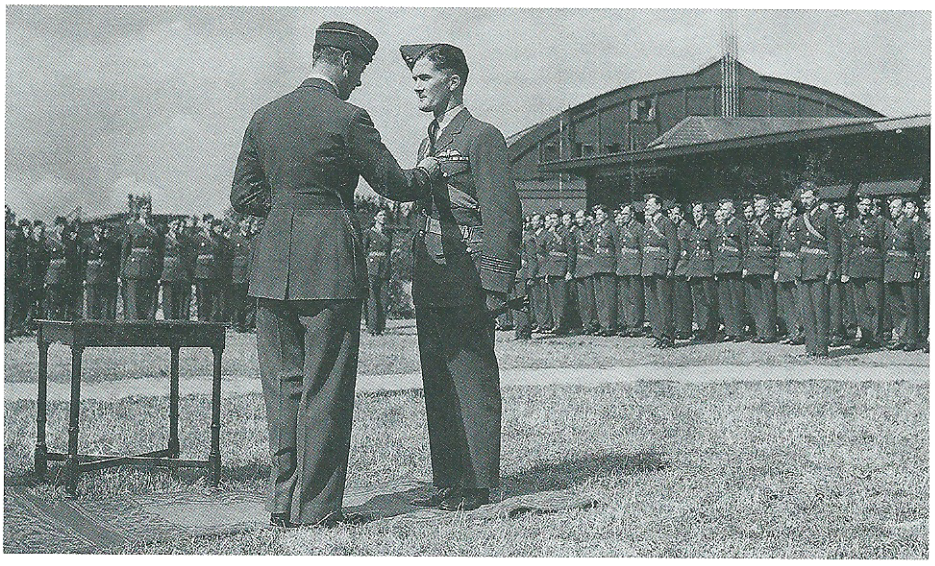
Above: Spitfire PR IC. This variant was fitted with an additional 30-gallon blister tank under the port wing, and a 29-gallon tank in the rear fuselage. Counterbalancing the fuel tank on the port side was a blister under the starboard wing, seen here open, which covered a pair of F.24 cameras with 8-in lenses. In April 1940 one of these aircraft carried out the first photographic reconnaissance mission of Kiel harbour in Germany.

ing the additional range to the full, a PR IF flew the first photographic reconnaissance sortie to Berlin.

In the summer and autumn of 1940, reconnaissance Spitfires kept close watch on the progress of German preparations for the invasion of Britain. In those perilous times the PRU, with a strength comparable to a normal RAF fighter squadron, made a contribution to the national defence far greater than any other unit of comparable size. Each day when the weather allowed, its Spitfires photographed every German-occupied port along the Channel Coast. The regular counts of ships and barges at each port provided vital intelligence on the progress of the German invasion preparations.

At this time the British operation to decrypt high-grade German signals traffic, code-named 'Ultra', was producing a stream of useful information on German plans and deployments. Unknown to their pilots, a growing number of Spitfire reconnaissance sorties were targeted as follow-ups to Ultra decrypts. Once the Germans had seen a British reconnaissance aircraft pass over a particular area, whether or not its cameras had seen anything useful, British knowledge of activity there was assumed. Thus on many occasions, the Spitfires' sorties helped preserve the secrecy of the cipher breakers successes.

During the great air battle on 15 September 1940, Battle of Britain Day, the losses inflicted on the Luftwaffe convinced Hitler that RAF Fighter Command would not be defeated before the weather broke in the autumn. Accordingly, the Führer gave orders that the invasion be postponed until the following year. On 20 September, a reconnaissance Spitfire returned from Cherbourg with the first photographic evidence of the German change of plan, showing that five destroyers and a torpedo boat had left the port. In the weeks that followed, successive photographic sorties



Right: Wing Commander Geoffrey Tuttle assumed command of the Photographic Reconnaissance Unit at Heston in June 1940. He is pictured receiving the OBE from the King during a parade at the airfield that August.

revealed progressive reductions in the numbers of ships and barges assembled at the invasion ports. The threat to the nation had passed.

TO THE BALTIC AND THE MEDITERRANEAN

The Types C and F reconnaissance versions of the Spitfire opened new vistas for reconnaissance, yet with more extensive changes the modified fighter could do even better. The Supermarine Company re-designed the entire leading edge of fighter's wing to form a large integral fuel tank with a capacity of 114 gallons. In October 1940 the new Spitfire variant appeared, designated the PR ID. With a 29-gallon tank in the rear fuselage, it had a total internal fuel capacity of 228 gallons – two and a half times more than the standard Mark I fighter. In the rear fuselage the PR 1D carried two 8-inch or two 20-inch focal length cameras.

The additional tankage of the PR ID gave a dramatic increase in the area of German-held territory where it could operate. On 29 October 1940 a PR ID photographed the port of Stettin on the Baltic (now Sczecin in Poland) and returned after 5 hours and 20 minutes airborne. Other remarkable missions followed in rapid succession: to Marseilles and Toulon in the south of France, and to Trondheim in Norway.

When carrying its full load of fuel the PR ID was not an easy aircraft to fly, however. Flight Lieutenant Neil Wheeler, one of the early Spitfire reconnaissance pilots, recalled:

'You could not fly it straight and level for the first half hour or hour after take-off. Until you had emptied the rear tank, the aircraft hunted the whole time. The centre of gravity was so far back that you couldn't control it. It was the sort of thing that would never have got in during peacetime, but war is another matter.'

Below: The Spitfire PR ID, later redesignated the PR Mark IV. This variant carried 133 gallons of extra fuel in a tank built integrally with the leading edge of the wing, which gave rise to the unusual spectacle of a Spitfire being refuelled almost at the wing tip.

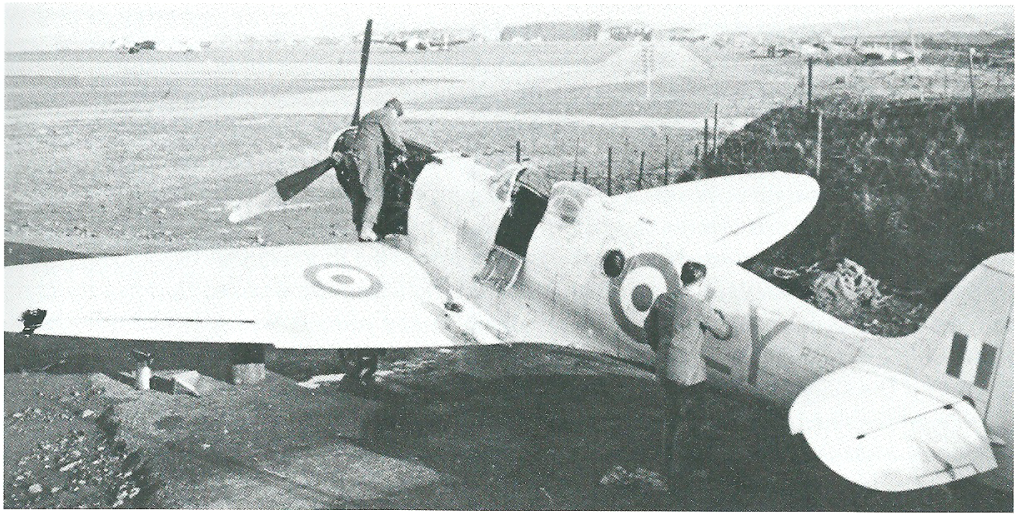
As the rear fuel tank emptied, the Spitfire's normally pleasant handling characteristics gradually returned.

OBLIQUE CAMERAS

Initially the reconnaissance Spitfires photographed their targets from vertically above, from medium or high altitude. Most photography would continue to be done that way but another technique, using a fixed oblique-mounted camera, allowed close-up shots to be taken of small targets from low altitude. The technique also allowed aircraft to photograph targets from below a blanket of low cloud.

The first Spitfire fitted with the fixed oblique camera installation was the PR IE. This aircraft had a streamlined fairing under each wing, which housed an F.24 camera with a 5-inch lens pointing downwards at 13 degrees to the horizontal, and outwards at right angles to the line of flight. This installation was not successful, however, and only one Spitfire was so modified. It was soon replaced by the Type G, which became the main variant used for low altitude photography. The PR IG retained the fighter's armament of eight .303-inch machine guns, to give a self-defence capability if it encountered enemy fighters. The PR IG carried a three-camera installation in the rear fuselage comprising one 5-inch oblique camera looking to port, and one 14-inch and one 5-inch lens camera mounted vertically. To provide some extra range this variant carried a 29-gallon fuel tank in the rear fuselage. A few PR IGs were finished in normal day fighter camouflage, but the majority were painted a very pale shade of pink, barely off-white, which was effective in concealing them it they flew immediately below a layer of cloud. When there was no cloud cover, however, this colour scheme made the aircraft highly conspicuous from above.

Below: A pink painted Spitfire PR IG, later redesignated the PR Mark VII, used for low altitude photography below cloud. The window for the oblique F.24 camera is near the top of the outer ring of the fuselage roundel. This variant also carried two vertical cameras in the rear fuselage.



In November 1940 the Photographic Reconnaissance Unit was redesignated No 1 Photographic Reconnaissance Unit, to distinguish it from No 2 Photographic Reconnaissance Unit then forming in the Mediterranean theatre. Soon afterwards, No 1 PRU moved from Heston to Benson near Oxford, a permanent RAF airfield that would remain its base for the rest of the war.

Despite the progressive improvements made to the early reconnaissance Spitfires, life was never comfortable for their pilots. Pilot Officer Gordon Green, who flew with the PRU during 1941, commented:

'During the early [photographic reconnaissance] missions there was no such thing as cockpit heating in our Spitfires. For the high altitude missions we wore thick suits with electrical heating. Trussed up in our Mae West and parachute, one could scarcely move in the narrow cockpit of the Spitfire.

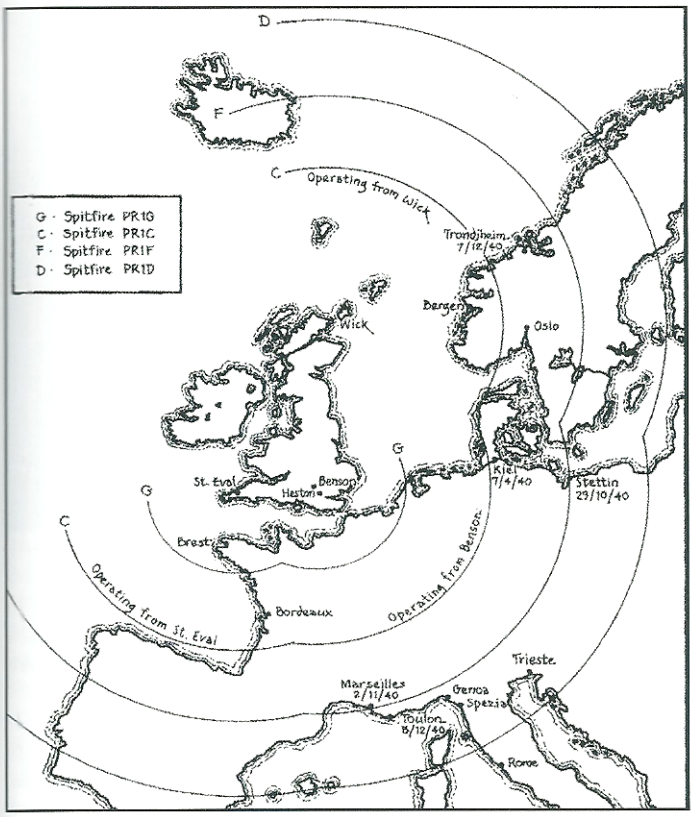
'When flying over enemy territory one had to be searching the sky the whole time for enemy fighters. On more than one occasion I started violent evasive action to shake off a suspected enemy fighter, only to discover that it was a small speck of dirt on the inside of my Perspex canopy!

'A big worry over enemy territory was that one might start leaving a condensation trail without knowing it, thus pointing out one's position to the enemy. To avoid that we had small mirrors fitted in the blisters on each side of the canopy, so that one could see the trail as soon as it started to form. When that happened one could either climb or descend until the trail ceased. If possible, we liked to climb above the trail's layer because then fighters trying to intercept us had first to climb through the trail's layer themselves and could be seen in good time.'

KEEPING WATCH ON THE GERMAN FLEET

Early in 1941, following a destructive foray into the north Atlantic to attack British shipping, the German battle cruisers *Scharnhorst* and *Gneisenau* and the heavy cruiser *Admiral Hipper* put into harbour at Brest in western France. If these warships put to sea again, the Admiralty needed to know as soon as possible so it could concentrate forces to meet the threat. No 1 PRU received a top priority task to photograph the port three times each day. To provide the best chance of achieving that requirement, whatever the weather, pairs of Spitfires took off from St Eval in Cornwall and flew to Brest independently. One of the aircraft was a blue-painted Type C or Type F, which ran in at high altitude to photograph the port if the skies were sufficiently clear. The other aircraft was a pale pink Type G, which ran in to photograph the port from low altitude if there was a blanket of cloud. For this assignment six-tenths' cloud was regarded as 'no-man's land': too much cloud to permit much chance of

Right: Map showing the rapid increases in the radius of action of successive versions of reconnaissance Spitfires, between March and October 1940. The map shows the combat radii for aircraft operating from Heston near London, Benson near Oxford, St Eval in Cornwall or Wick in Scotland. The Spitfire PR 1C appeared in March 1940 and could reach as far as Kiel in Germany. The PR 1F, the next major variant, entered service in July 1940 and could reach as far as Marseilles in the south of France. The PR 1D, the definitive Mark 1 reconnaissance variant, entered service in October 1940 and could reach as far as Stettin on the Baltic coast. The low-flying armed reconnaissance variant of the Spitfire, the PR 1G, carried less fuel than the C, D or F variants and its coverage extended only to the north coast of France and a small distance inland.



successful photography from high altitude, and too little to conceal a pink Spitfire running in below cloud. If there was insufficient cloud cover, the pilots flying the low-altitude PR 1Gs were ordered to abandon their mission.

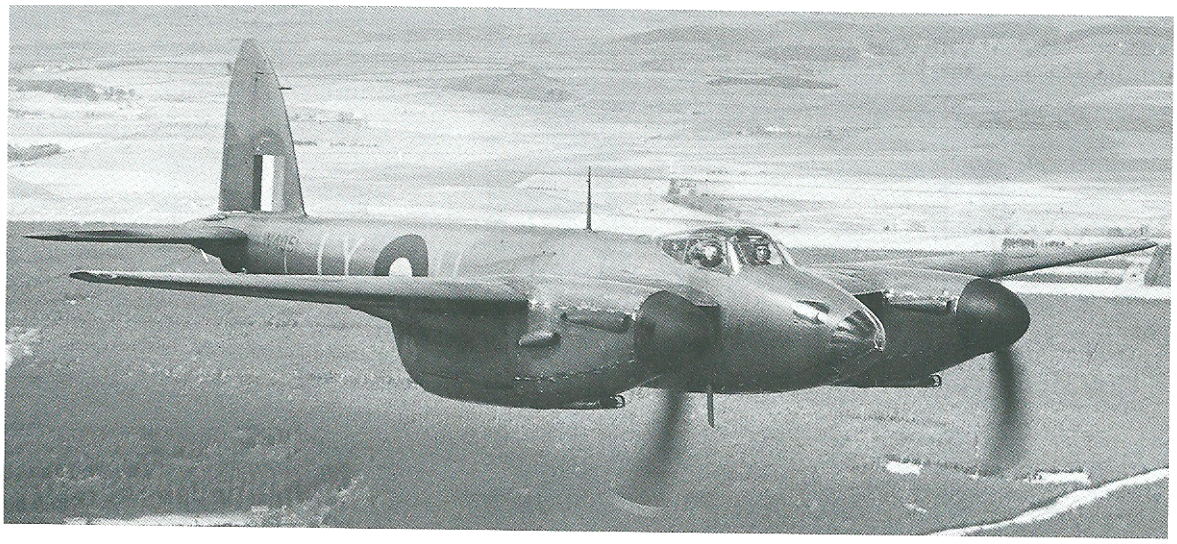
The fighter units and flak batteries defending Brest soon realised that the RAF was mounting regular flights to photograph the harbour, and prepared accordingly. Gordon Green recounted:

'During the early [photographic reconnaissance] missions to cover Brest we lost about five pilots fairly quickly. After the first couple had failed to return the Flight Commander, Flight Lieutenant Keith Arnold, asked Benson to send some reserve pilots. They duly arrived. Both took off for Brest that evening and neither came back. That was a very sobering incident.

'The important thing with any photographic mission was to take the photos if one could, and get them back to base. As the "boss" of PRU, Wing Commander Geoffrey Tuttle, often used to say "I want you to get home safely not just because I like your faces, but because if you don't the whole sortie will be a waste of time!" So it was no use trying to play hide and seek with the Luftwaffe. If one had lost surprise during the approach to a heavily defended target, the best thing was to abandon the mission. One could go back another time when things might be better.

'Looking back at my time with the PRU, I get a lot of satisfaction from the knowledge that although I played my part in the war, I never had to fire a shot in anger. In one sense we in the reconnaissance business had things easy. All the time it was impressed on us: bring back the photographs or, if you can't, bring back the aeroplane. An infantryman taking part in the Battle of Alamein could not suddenly decide "This is ridiculous, I'm going home!" He just had to go on. But if we thought we had lost the element of surprise we were not only permitted to turn back, we were expected to do so.

'On the other hand, there were times when I knew real fear. When one was 15 minutes out from Brest on a low altitude sortie, one's heart was beating away and as the target got nearer one's mouth got completely dry.



Anyone who was not frightened at the thought of going in to photograph one of the most heavily defended targets in Europe, was not human.

'Whenever it was possible to photograph a target, flak could engage us: if we could see to photograph they could see to open up at us. But throughout my time as a reconnaissance pilot my luck held. I never once saw an enemy fighter, nor was my aircraft ever hit by flak. Indeed only once during the time we were flying those missions over Brest did one of our aircraft come back with any damage, and that was minor. It was all rather like a foxhunt – either the fox got away unscathed or else it was caught and killed. There was rarely anything in between.'

During 1941 there was a rationalisation of the system of designating the reconnaissance Spitfires then in service. The Type D became the PR Mark IV; the Type F became the PR Mark VI and the Type G became the PR Mark VII (by then the earlier reconnaissance Spitfires had been modified into Fs or Gs, or had passed out of service). Also during that year each reconnaissance Spitfire in front line service was fitted or retrofitted with the more powerful Merlin 45 series engine. No change in designation followed this change, however.

Towards the end of 1941 the twin-engined Mosquito entered service in the photographic reconnaissance role, thus opening vast new areas including Eastern Germany, the Baltic ports and much of Northern Norway. The carriage of a navigator in the Mosquito made it much easier to find distant targets, especially on flights involving a long sea crossing.

From the beginning of 1942 the German air defences steadily improved with the deployment of the latest Messerschmitt Bf 109G and FW 190A fighters. As a result, the reconnaissance units suffered mounting losses. The obvious answer was fit the new Rolls Royce Merlin 61 engine, with a two-stage supercharger, into reconnaissance versions of the Spitfire and

Above: In September 1941, the de Havilland Mosquito entered service in the photographic reconnaissance role. With greater range than the Spitfire, it opened to photography most of the rest of eastern Germany, the Baltic ports and northern Norway. The carriage of a navigator made it much easier to find the most distant targets, especially if the flight there involved a long sea crossing.

the Mosquito to improve their performance at high altitude. In the spring of 1943 the new variants entered service as the Spitfire XI and the Mosquito IX, able to photograph targets from 41,000 feet and 36,000 feet respectively. These aircraft enjoyed about a year of near-immunity from fighter interception provided they remained at high altitude. When these planes were lost it was usually after they had descended due to a technical failure, or the need to avoid condensation trails or to fly beneath cloud to take photographs.

Also during 1942 there were important developments in aerial cameras. This work culminated in the superb F.52 camera, fitted with lenses up to 36 inches long, which produced photographs to a scale of about 1:13,000 from 40,000 feet. That was sufficient to allow photo interpreters to observe and analyse, for example, the type of traffic in a railway siding, the state of construction of a U-boat or the layout of a radar installation.

As the war progressed, the RAF reconnaissance force faced increasing demands to provide photographs of targets deep inside occupied Europe. To meet these requirements, No 1 PRU steadily grew larger, so that by May 1942 it possessed six flights of Spitfires and two of Mosquitos with a total of 65 aircraft. That October No 1 PRU was re-organised into No 540 Squadron with Mosquitoes, and Nos 541, 542 and 543 Squadrons with Spitfires.

In August 1943 the US 8th Air Force established its own photographic reconnaissance unit, the 7th Photo Group, at Mount Farm near Benson. From the start there was very close co-operation between them and United States Army Air Force (USAAF) reconnaissance units, with much interchange of equipment and sharing of knowledge. Initially the 7th Photo Group flew F-5 aircraft, the reconnaissance version of the P-38 Lightning fighter. This aircraft was vulnerable to interception during deep penetrations into enemy territory, however, and it had serviceability problems. One squadron in the Group received Spitfire PR XIs, and operated these aircraft for the rest of the conflict.

Below: The Spitfire PR XI, powered by the Merlin 61 engine with two-stage supercharger, entered service at the end of 1942. This type proved highly successful, and it bore the brunt of the Allied photographic reconnaissance effort during the mid-war period. This example belonged to the US 7th Photo Group based at Mount Farm near Oxford.

Also in the latter part of 1943 the Mosquito PR XVI appeared, fitted with a pressurised cabin. It was an important innovation, which allowed its crews to remain alert and reasonably comfortable while flying for long periods at altitudes above 35,000 feet.

During the spring of 1944 the 654th Reconnaissance Squadron, part of the US 801st Reconnaissance Group based at Watton in Norfolk, formed with Mosquito XVIs. This unit flew photographic reconnaissance missions for the remainder of the war.

The period of near-invulnerability to interception for aircraft powered by the Merlin 61 engine lasted until the spring of 1944. It ended when with the appearance of the first German jet fighter types, the rocket-propelled Messerschmitt 163 and the turbojet powered Messerschmitt 262. The reconnaissance Spitfires and Mosquitos, flying alone and unarmed, offered perfect targets for the German jet pilots to carry out practice interceptions. Yet again losses began to rise.

THE MASTER SPY

To provide give a further increase in performance at high altitude, to reduce the threat of interception by the jet fighters, the Supermarine Company produced the definitive long-range unarmed reconnaissance variant of the Spitfire, the PR 19. (In 1943 the RAF had changed from roman to arabic mark numbers for all new aircraft types and new variants.) Driven by a 2,035 horsepower Rolls Royce Griffon engine, the new

Left: Ground crewman loading an F.52 camera with a 36-in lens into the cramped rear fuselage of a Spitfire PR 19. The film magazine, sitting on the trolley, was attached to the top of the camera after the latter was in place.

Right: The definitive reconnaissance version of the Spitfire, the PR 19 powered by the 2,035 horsepower Rolls Royce Griffon engine, entered service in the late spring of 1944. Fitted with a pressurised cabin, this formidable aircraft was able to photograph targets from altitudes above 48,000 feet.

Spitfire had integral wing tanks similar to those fitted to the PR IV and the PR XI. The first Mark 19s entered service in May 1944 and gave a huge advance in performance over their predecessors. After the first small batch, these aircraft were fitted with pressurised cabins which enabled pilots to operate for long periods at altitudes above 45,000 feet.

Provided the pilot of a Spitfire PR 19 saw an approaching enemy jet fighter in time, he had little difficulty in outmanoeuvring it. Squadron Leader Alfred Ball, commander of No 542 Squadron, recalled:

'I encountered Messerschmitt 262s on a couple of occasions. Unless your eyes were shut when they jumped you, you could usually get away from them. They had a long climb to reach us, and they could not stay with us for very long. I would wait until the 262 pilot was about to open fire, then pull into a tight turn. You had to judge the turn correctly – if you turned too soon it was not difficult for him to pull enough deflection and you were a sitting duck. Provided you handled your aircraft properly, it was very difficult for them to shoot you down.'

For low altitude reconnaissance a fighter-reconnaissance version of the Spitfire XIV fighter appeared. Also powered by a Griffon engine, it carried an oblique camera in the rear fuselage and was designated the FR XIV. This aircraft retained the fighter's armament of two 20-mm cannon and four machine guns, making a formidable opponent if engaged by enemy fighters.

Another high-performance reconnaissance type introduced near the end of the war was the F-6, the reconnaissance version of the famous P-51 Mustang fighter. In January 1945 a few of these aircraft were delivered to the US 7th Photo Group, which used the type for low altitude missions.

Throughout the war, there had also been many improvements in camera design. As aircraft speeds increased, blurring often appeared on

close-up oblique photographs. To overcome this problem, some F.24 and F.52 cameras were modified into moving film strip cameras. In these, the film was arranged to pass over a narrow slit positioned near the focal plane, at a speed that cancelled out the movement of the aircraft. The resultant negative took the form of a continuous strip.

American reconnaissance cameras also made their appearance in USAAF and RAF planes, notably the K.17 with a 6-inch lens and the K.8 AB with a 12-inch lens, both for aerial survey and mapping. Another import innovation was the K.19 camera specially designed for night photography.

Above: Scale mattered. The village at Bullingen in Belgium (centre right of the picture, nearly halfway up), photographed by 'Shorty' Longbottom during his initial mission on 18 November 1939. Taken from 33,000 feet using an F.24 camera with a 5-in lens, the scale is about 1:79,000. Little ground detail is visible and individual vehicles or troop positions could not be picked out.

The night reconnaissance operation deserves mention at this stage. By 1944 the degree of the Allied air superiority over northwest Europe was such that whenever possible the German army made most of its troop movements at night. Two squadrons, Nos 69 and 140 equipped respectively with Wellington and Mosquito aircraft, provided the RAF 2nd Tactical Air Force with its night photographic capability.

The procedure for night photography, using a pair of K.19 cameras, was as follows. The aircraft approached the target at altitudes of around 10,000 feet, with the cameras' shutters locked in the 'open' position. As it neared the target, the plane released a line of M 46 photoflash bombs at about 10-second intervals. When the first flash bomb ignited at about 4,000 feet above the ground, it produced a brilliant flash of brief duration which lit up the ground and produced an image on the film. That flash triggered a photoelectric cell fitted to the cameras, which closed the shutters, wound on the film and then re-opened the shutters ready for the next picture. As each succeeding photo flash bomb ignited, the process was repeated.

AT THE WAR'S END

At the end of World War II in Europe the Royal Air Force and USAAF reconnaissance units were well-equipped and highly efficient collectors of intelligence. Their aircraft had the range to photograph targets anywhere in enemy held Europe, and the speed and the altitude performance to execute that task with minimal losses. Photographic reconnaissance had indeed made giant strides during the five years of conflict, and in the pages to follow the reader will see the fruits of those endeavours.