The Background to the Operations of No. 550 Squadron

550 Squadron was formed on 25 November 1943. It operated as part of the Main Force of Heavy Bombers of Bomber Command. The planning of the provision of airfields, heavy bomber aircraft, aircrew and ground crews, the special equipment and facilities required began 2½ years before. So it is necessary to go back to 1941 in order understand the development of Bomber Command operations.

This examination will be restricted to night operations. Bomber Command did carry out attacks by day; first with Blenheims and later with Bostons, Venturas and Mosquitos. However the daylight raids were a small part of the Command's effort and target selection was governed by a different set of rules.

In 1941, the Wellingtons, Whitleys and Hampdens were first sent on night attacks against 17 synthetic oil plants. In March, target priorities were switched to the ports and shipyards which operated or built U-boats or capital ships (particularly the Scharnhorst and Gneisenau at Brest) and the factories and airfields supporting the Focke Wolfe Condors which carried out reconnaissance over the Atlantic.

In July 1941 The Chiefs of Staff declared *'We must first destroy the foundations upon which the German war machine runs - the economy which feeds it, the morale which sustains it, the supplies which nourish it and the hopes of victory which inspire it. Only then shall we be able to return to the continent and occupy and control portions of his territory and impose our will on the enemy . . . . it is on bombing on a scale undreamed of in the last war, that we find the new weapon on which we must principally depend for the destruction of economic life and morale'.* This recognised that Bomber Command was the only part of Britain's Armed Forces which could hit Germany in the West and bring support to the Russians fighting so fiercely on the Eastern Front.

In the middle of 1941, doubts were being expressed in high places about the ability of Bomber Command to hit small precision targets such as factories, refineries, etc.. The Prime Minister, through Lord Cherwell, his scientific adviser, ordered Mr DM Butt, a civil servant working in the War Cabinet Secretariat, to examine 4,065 individual aircraft photographs taken by bombers on 100 night raids in June and July 11 1941. At this stage of the war, only the best crews were given cameras. The 'Butt Report' came up with the following findings:-

1. One third of crews dispatched did not claim to have reached the target even in summer conditions.
2. One in four crews claiming to have bombed a target in Germany were within 5 miles of the target. In the full moon period, one crew in three got within 5 miles of German targets; in the non-moon period, one crew in twenty got within 5 Miles of German targets. For the Ruhr targets, where smoke and haze were a big problem, the ratios were smaller.

In the period 7/8 July - 10 November 1941, Bomber Command lost 414 night Bomber (3.5%) and 112 day bombers (7.1%) over enemy territory, in the sea or shot down over UK by German intruders. This was the equivalent to the loss of the entire front line in 4 months. It was clear that the achievements of Bomber Command could not justify the casualties it was suffering.

With these losses and the Butt report Bomber Command was at a cross-roads. When 21 aircraft were lost out of 169 sent to Berlin on 7/8 November, a loss 12.4%, Sir Richard Peirse, the Air Officer Commanding in Chief of Bomber Command was summoned to Chequers and, after his discussion 'with the Prime Minister, the War Cabinet ordered on 13 November that Bomber

Command carry out limited operations for three months while the future of the Command was debated. Sir Richard Peirse was moved to India on 8 January 1942.
At the end of 1941; the Air Ministry produced a plan calling for 43 of the leading German cities, all of industrial character to be subjected to continuous air attack. If 4,000 bombers were provided and new navigational aids and target finding devices introduced, it was anticipated that Germany would collapse within six months. Prime Minister Churchill backed the future of Bomber Command but could not commit the country to a total of 4,000 bombers.
On 14 February 1942 an 'Area Bombing' directive was sent to Bomber Command saying 'It has been decided that the primary objective of your operations should be focussed on the morale of the enemy civil population and in particular the industrial workers'. The Chief of the Air Staff, Lord Portal minuted Air Marshal Bottomley, who had drafted the directive, 'I suppose it is clear that the Aiming Points are to be the built up areas and not the dockyards or aircraft factories'.

Front Line Force 1 March 1942			
Night Bombers		**Day Bombers**	
221	Wellingtons		
112	Hampdens		
54	Whitleys		
29	Stirlings		
29	Halifaxes		
20	Manchesters	56	Blenheims
4	Lancasters	22	Bostons
469	**night bombers**	**78**	**day bombers**

Air Chief Marshal Sir Arthur Harris was appointed AOC in C Bomber Command on 22 February 1942 and set about implementing his new directive. During the year, the numerical strength would not increase greatly but the bomb carrying capacity would be much larger as the Whitleys, Hampdens and Manchesters were phased out and replaced by the Lancasters and Halifaxes.
Gee was introduced as a navigation aid giving an instant fix at ranges up to 400 miles from the UK if the aircraft was at 20,000 feet. Close to home, the fixes were very accurate but over the Ruhr, Rhineland and the North German ports the intersection of the lattice lines on the Gee charts was very acute and the accuracy of fixes was 3-5 miles. Gee enabled navigators to keep an accurate track for the first part of a trip and to pick up wind changes early on. This helped to concentrate the bomber stream and helped to find the target although the Germans could and did jam the Gee. Aircraft fitted with Gee went out in the first wave.
Harris immediately concentrated his bombers on one target at one time and made incendiary bombs an important part of the bomb load. The combination of high explosive and incendiary bombs was an effective way of attacking towns or cities if the target could be accurately located and attacks on Lubeck and Rostock achieved considerable damage now expressed, in terms of acres of the town destroyed by fire or the number of buildings damaged.

March / April 1942 figures:-	
1,555	bombers dispatched
1,006	crews reported bombing Essen
64	aircraft lost
212	aircraft brought back photos showing ground detail
22	photos were plotted within 5 miles of Essen

Even with the leading aircraft using Gee, targets in the Ruhr were hard to find as cloud, smoke and haze searchlight and flak defences and decoy sites all made life difficult for the bombers. Eight attacks on Essen, the home of the giant Krupps armament factories.
It was clear that Gee was not accurate enough to improve the target finding or bombing performance of the Command against well defended targets in the German interior.

Harris was keen to try some very large concentrated raids - code name 'Millennium'. By using aircraft from his training units and with occasional help from Coastal Command and some help from Flying Training Command, 1,047 aircraft were sent to Cologne on 30/31 May 1942. A 'bomber stream' was adopted with all flying a common route at briefed speeds, heights and times over target to minimise the collision risk but to put all 1,000 aircraft over the target in 90 minutes. The bomber stream should pass through one night fighter box only and would swamp the defences as each night fighter box could only handle six interceptions per hour. Concentration over the target would swamp the searchlight, flak and night fighter defences. The tactics adopted on the first 1,000 bomber raids would serve Bomber Command well for the next two years. The Cologne raid was a great success and confirmed the future of Bomber Command and established Harris as a public figure. Losses of 41 aircraft worked out at 3.9%.
Two more 1,000 bomber raids followed. On 1/2 June, 996 aircraft were sent to Essen. Only 31 were lost but the raid was not so successful from the bombing point of view. On 25/26 June, 1,067 aircraft were put over Bremen in 65 minutes; 48 bombers were lost but the raid was regarded as a success.
From mid-1942 some changes occurred in the front line. The Mosquito flew its first operational sortie (PRU) on 31 May. The Manchester was withdrawn at the end of June and the Hampden followed it in mid-September.
The 8th USAF now opened their daylight attack on Germany.
Harris, against his own wishes, was ordered to form a target finding force called The Pathfinder Force (PFF) which began work on 17 August with four squadrons under the command of Don Bennett. The first target indicators were tried by adapting the casings of 250 pound and 4,000 pound bombs, the latter being called 'Pink Pansies'. The early raids lead by PFF met with varying success:-

Initial 'PFF' Led Raids		
18/19 August	Flensburg located on an inlet on the Baltic Sea coast and in theory an easy target	The winds were not as forecast, the bombers got well north of track and the bombs went down on an inlet on the Danish coast 25 miles north of Flensburg which received no bombs.
24/25 August	Frankfurt	In very cloudy conditions, most of the bombs fell in open country north and west of the city.
27/28 August	Kassel	In clear weather the target suffered severe damage and three Henschel aircraft factories were hit.
28/29 August	Nuremburg - 159 aircraft	The moon was nearly full and 23 aircraft were lost (14.5%). The PFF claimed to have marked the aiming point but the city records showed that about 50 aircraft bombed the city and that many attacked Erlangen 10 miles to the north
1/2 September	Saarbrucken - 231 aircraft	The PFF marked Saarlouis, a town on a similar bend on the river Saar but 13 miles north west of Saarbrucken which was untouched.
2/3 September	Karlsruhe - 200 aircraft	Accurate marking and heavy damage to the target.
4/5 September	Bremen - 251 aircraft	The PFF adopted new tactics, first dropping flares to illuminate the target, then visually aiming the primary markers which were backed up throughout the raid. The weather was clear and heavy damage was done to the target including hits on the Wesel aircraft factory and the Atlas shipyard

In the second half of 1942, Bomber Command was settling to a system of tours for aircrew which would last for the rest of the war. The pattern was a first tour of 30 operational sorties, then a rest as an instructor in the training machine ,then a second tour of 20 operations. No-one could be forced to undertake a third tour although many volunteered. The chances of surviving 50 operations depended on the casualty rate and could be assessed from the following graph:-
It was generally believed that any loss rate above 4% over a period would lead to the decline of the front line with insufficient crews surviving to provide the experience and leadership required on squadrons and in the training organisation. The casualty rates in 1942 were:-

- 30/31 May - 17 August (the 1,000 bomber raids) 4.3%
- The next period - involving PFF leadership 4.6%
- The Halifax squadrons from March to August 1942 suffered a loss rate of 6.2% and the Halifax Force had to be rested for one month to restore morale.

The end of 1942 saw a series of breakthroughs for Bomber Command:-

1. 'Oboe' - a blind bombing device fitted into aircraft but controlled by ground stations in England. Two stations transmitted pulses which were picked up by the aircraft and retransmitted to the ground. The aircraft could use the pulses to fly on a track which took it over the target; the ground stations could calculate the exact position of the aircraft and send a signal to indicate bomb release. If all went well, an average bombing error of 300 yards could be achieved However the system had three limitations:-
    1. It was a line of sight device which could not be bent to follow the curvature of the earth. Therefore range depended on the height at which the aircraft could fly. The Mosquito could fly at 30,000 ft and was the obvious aircraft to use.
    2. Each UK ground station could only handle six aircraft an hour. With a maximum of three stations, the limit was 18 aircraft per hour.
    3. The aircraft making the bomb run had to fly straight and level for several minutes which made it vulnerable to flak and fighters.
    The first Oboe equipped Mosquito was ready for operations on 20 December 1942 and a number of trial attacks were carried out in the following weeks. After the inevitable teething troubles, Oboe proved a tremendous asset to the Command and it was remarkable that the Germans never managed to jam it.
2. The end of 1942 saw the first delivery of H2S ground scanning sets for the aircraft of Bomber Command. The early sets gave a flickering indeterminate picture but coastlines and wide water features could usually be picked up and city outlines sometimes. The sets were ready for use by the PFF in January 1943.
3. Radio counter measures (RCM) to jam German radar and radio started in December 1942 with:-
    1. Mandrel, a ground based device for jamming German radar stations.
    2. Tinsel, a device in the bombers which drowned any frequencies used by German night fighter pilots (it was the task of the wireless operator to detect these frequencies) by broadcasting noise from a microphone in an engine nacelle.

Bomber Command was beginning to expand in early 1943. Four-engined bombers were now arriving in strength and a new No. 6 Group Royal Canadian Air Force started operating on 1 January 1943. On 8 January the PFF was upgraded to Group status and became No. 8 Group. The Command was no longer required to 'lend' squadrons to Coastal Command or the Middle East which had held back its expansion previously. The PFF received delivery of purpose built 250 pound marker bombs packed with pyrotechnic candles which could be ejected at varying heights by a barometric fuse and cascade slowly to the ground. These proved difficult for the Germans to copy throughout the war.

Just as these new systems and equipment seemed to be setting up the Command for a new offensive against Germany, Bomber Command received a new directive on 14 January 1943 which was to pull it away from German targets. Because of the U-boat menace priority of attack was to be given to the U-boat bases in Western France (Lorient, St.Nazaire, Brest and La Pallice) and the U-boat construction yards in German ports. Attacks on Italian cities were also urged to help force Italy out of the war. By this time the U-boat pens at the French ports had been protected by huge concrete roofs which made attack by the normal bombs rather ineffective. Although a Bombing Directive gave priorities, German targets would continue to be attacked in order to keep the German Air Defence Controller guessing. If he knew or could deduce that Bomber Command was going for ports, he could redeploy his night fighter and flak defences accordingly. Therefore it was important to go to targets inside Germany from time to time.
In early January 1943, the PFF had started to mark targets with Oboe Mosquitos dropping sky markers but, by the very nature of sky marking, it was difficult to mount an accurate and concentrated attack. On 27/28 January, Oboe Mosquitos marked Dusseldorf with ground markers and despite a thin layer of cloud, the attack was very accurate. On 11/12 February 177 bombers went to Wilhelmshaven and, despite complete cloud cover, sky marking by H2S PFF lead to another very accurate attack during which a naval ammunition dump was blown up and 120 acres were devastated. This was the first blind bombing success for those PFF aircraft equipped with H2S.
In March 1943, Bomber Command started the Battle of the Ruhr which was to last 4 months. The Ruhr targets were within Oboe range and could be attacked in the shortening nights. At the start of the Battle, the front line strength was 600 bombers; by the end of May 800 bombers flew to Dortmund and four fifths of these were four engined. The aircraft factories and the aircrew training organisation were producing the resources for fast expansion.
In the 4 month period of the Battle of the Ruhr, Bomber Command carried out 43 major raids; two thirds of these were against Ruhr targets but the remainder ranged from Stettin to Munich to Turin to Pilsen. The Oboe marking system was very accurate on Ruhr targets but the Oboe Mosquitos could only provide primary marking. In April 1943 the PFF was reinforced by two new squadrons and 1409 Met. Flight who provided daily weather checks over the continent for Bomber Command and the 8th US Air Force.
The Battle of the Ruhr opened on the night of 5/6 March 1943 when 442 aircraft went to Essen. In spite of a thick ground haze which made ground identification impossible and the early return of three out of the eight Oboe Mosquitos marking the target, the remaining 5 Mosquitos marked the centre of Essen perfectly. The PFF backers-up continued the good marking and a very accurate attack took place. 160 acres were destroyed and the Krupps Arms Works hit 53 times. The other Ruhr cities were subjected to similar heavy attacks often under 'blind' conditions and it was clear that Oboe had given Bomber Command an ability to bomb accurately under all weather conditions on targets within Oboe range. Outside Oboe range, the Command was still finding it difficult to find targets in the non-moon periods.
In May 1943 the day bombers of No. 2 Group left Bomber Command to join first Fighter Command and later 2nd Tactical Air Force. However two Mosquito squadrons were transferred to No. 8 (PFF) Group - 105 Squadron becoming the second Oboe marking squadron and 139 squadron became the first element of the Light Night Striking Force which eventually grew to a strength of eight Mosquito squadrons and carried out many harassing attacks on German cities and diversionary raids.
There were two special raids in this period. No. 617 Squadron carried out the Dams raids with the bouncing bomb on 16/17 May. On 20/21 June 60 Lancasters flew to Friedrichshaven on the shores of Lake Constance to bomb the Zeppelin works where the Wurzburg radar sets were made. A Master Bomber was used for the first time and in bright moonlight much damage was

done to the factory. To fool the night fighters waiting for them on the return flight, the bombers flew on to bases in North Africa, another first.
On 3/4 July on a raid on Cologne, the first use of Wild Boar single engined night fighters was noticed over the target. These fighters made use of any illumination available, searchlights, flares, fires, target indicators.
The Bomber Command statistics for the period 5/6 March - 24 July were:-
23,401 night sorties flown 1,000 aircraft lost (4.3%)
The next big battle was the Battle of Hamburg (the second largest city in Germany with a population of 1¾ million). It took place between 24/25 July and 3 August 1943. Hamburg was beyond the range of Oboe but with a well shaped coastline 60 miles away providing a good landfall and the wide River Elbe and dock basins, it was reckoned to be a good target for attack by H2S. The city was subjected to four major attacks in 10 nights by forces varying from 740 to 791 bombers. The 8th US Air Force was supposed to join in by day but pulled out after their first small attack was severely handicapped by smoke from the fires started by the night attacks.
Window had been ready since April 1942 but was first used over Hamburg. Window consisted of strips of coarse black paper 27 cm. long and 2 cm. wide with aluminium foil on one side. When dropped in large quantities at set intervals, it could protect the bombers below and behind the dropping aircraft by swamping with false returns the Wurzburg radar sets which controlled night fighter interceptions and radar predicted flak and the airborne Lichtenstein interception sets in the night fighters. Thus, from a radar point of view the defences were blinded as could be deduced from the monitored German radio traffic.
The second night raid was the 'firestorm' night. An accurate attack made with the usual mixture of one third high explosive bombs and two thirds incendiary bombs was amplified by special circumstances into something horrific. Ground temperatures were very high, 30ºC at 18:00 hours and conditions were very dry, most of the fire fighting vehicles were on the other side of the city dealing with fires from the first raid; the fires started by the new incendiaries suddenly joined to either and created a firestorm which lasted three hours; people died from lack of oxygen. Approximately 40,000 people died; 16,000 residential buildings destroyed. 1.2 million people fled the city.
The statistics covering all night operations in the period 24/25 July to 3 August were:-
4,307 night sorties 130 aircraft lost (3.0%)
Window had given the bombers a tremendous advantage over the defences and Bomber Command would be expected to drive this home with concentrated raids on German targets before the defences could reorganise. However other considerations came into play. There was a chance that Italy could be forced out of the war and attacks on their cities would hasten this process. Between 7/8 August and 16/17 August 1943 Bomber Command attacked, Turin and Genoa on 5 different nights. This pressure was effective and Italy surrendered on 8 September 1943.
On 17/18 August 1943, 596 aircraft attacked Peenemunde, the German research establishment on the Baltic coast where the V2 rockets were built and tested. This raid had several firsts. It was the first time the whole of Bomber Command had been deployed to attack a precision target at night. For the first time a Master Bomber controlled a full scale raid - he was Group Captain John Searby, of 83 Squadron, No. 8 (PFF) Group. This was the first night on which the Germans used their 'Schrage Musik' upward firing cannon in night fighters and it was some months before the Bomber Command authorities became convinced that the enemy was using this new weapon.
The raid took place in moonlight under clear conditions. A small island just off the coast could be used by the H2S aircraft of PFF for a timed run. Three aiming points were selected for the three waves of the attack which was successful and, it is estimated, put back the V2 programme by two or three months, a delay which proved very important later on. The raid also forced the

Germans to move production of the V-weapons into safer locations often underground in caves or tunnels. 85% of the bomb load was high-explosive. A Mosquito diversion attack on Berlin initially drew off the night fighters to the capital but the night fighters did arrive to catch the final wave of bombers and 40 aircraft were lost - 6.7% of the force dispatched. This was considered an acceptable loss for the results achieved.

On 23/24 August 1943, Bomber Command started raids on Berlin which Air Marshall Harris intended to be the next big battle. The full-moon period in the third week of August had given the Command a break and 727 aircraft were launched on this first raid. PFF Mosquitos were used to drop route markers along the outbound track to help concentrate the Main Force. Those PFF aircraft equipped with H2S had difficulty in identifying the centre of the city and the markers were dropped in the southern suburbs. The Main Force arrived late with many aircraft cutting the final corner so the bombing became rather scattered. Despite this much damage was done and many bombs fell in the industrial area near Tempelhof and in the 'central government quarter'. The defences were formidable and 56 bombers were lost (7.9% of the force dispatched) the biggest loss to date.

622 aircraft were sent to Berlin on 31 Aug. / 1 Sept. Cloud conditions, the disappointing performance of the H2S sets and fierce defences caused the markers to be dropped well south of the aiming point and the Main Force bombing became even more scattered. The Germans used fighter flares to mark the bombers track outbound and inbound and 47 aircraft were lost (7.6% of the force). The next attack on Berlin on ¾ September was by Lancasters and Mosquitos only as the Stirlings and Halifaxes had suffered proportionately high casualties in the previous raids. Although Mosquitos dropped 'spoof' flares away from the bombers track to draw off the night fighters, the Lancaster losses were 22 (7% of the force dispatched). The marking and bombing were not all that accurate.

The losses on these three Berlin raids (an average of 7.5%) and the disappointing results achieved with the bombing persuaded Air Marshall Harris to give up Berlin as a target, for a few months. The German defences had clearly recovered from the Window setback a new mark of H2S was due to reach PFF in a few weeks and a new navigational aid, the Air Position Indicator, was expected shortly. Bomber Command would wait for the longer nights and the new equipment before resuming the offensive against the German capital city.

Bomber Command continued its attacks against other cities. The Wellingtons were withdrawn from the Main Force in October although they were still used on mine laying and diversionary attacks. On 18/19 October, Bomber Command lost its 5,000th aircraft out of 144,500 sorties by night and day - an average loss rate of 3.5%. In four attacks on Hanover in the September / October period Bomber Command lost 110 aircraft out of 2,254 dispatched.

In October 1943 two new radio-countermeasures devices were introduced. 'Corona' involved German-speaking men and women listening to the radio channels being used by the Luftwaffe night fighter controllers and interfering with false instructions. This was done from a ground station in UK. Airborne Cigar (ABC) equipment was fitted to aircraft of 101 Squadron who carried a German speaking crew-member who listened for the night fighter instructions and jammed them.

The main Battle of Berlin started on 18/19 November 1943. In the next 4½ months Bomber Command would mount 32 major raids on Germany; 16 on Berlin and 16 on other large cities which would involve deep penetration of enemy territory as only one target was in range of Oboe.

After one week the Stirlings were withdrawn from the Main Force: they carried a smaller bomb-load and had to fly at a lower altitude than Lancasters and Halifaxes causing them to be more vulnerable to flak and night fighters (Stirling losses had averaged 6.4% over the last 3 months)

.Later in the Battle of Berlin, the Marks II and V of the Halifaxes had to be withdrawn for similar reasons and the Bomber Command front line suffered a double blow.
The use of Window over Hamburg in July 1943 forced the enemy to change his night fighting tactics. The old night fighter interceptions were based on a series of territorial boxes with a pair of Wurzburg radars vectoring a fighter on to a bomber. This had several limitations. The bombers were at risk for a comparatively short period in any one box and there was a strict limit to the number of interceptions the radars could handle. First chance of interception was always given to the best crews who built up very impressive 'scores'. The newer crews on night fighter squadrons were seldom given a chance. Window forced the Germans to adopt many new ideas. New radars less susceptible to Window jamming were developed quickly and the SN2 airborne interception radar being fitted to the night fighters at this time gave a much better performance in terms of range and definition and lead to many kills. The Germans now went for the Bomber Stream as soon as possible, sometimes before it reached the enemy coast. Better long range radar and an improved ground raid reporting organisation were reinforced by specially equipped JU88s and Fw Condors monitoring the position and course of the bomber stream to report to the ground controller and to drop flares to help the night fighters. The night fighters were scrambled en masse at the earliest moment and assembled at beacons from which they could be directed in to the bomber stream. A 'running commentary' was broadcast on the position and course of the bomber stream which was of particular value to the single engined 'Wild Boar' night fighters who did not have an interception radar but relied on visual interception helped by searchlights, flares, fires or any light over the target. Thus all the night fighter pilots were deployed against incoming raids and, with their improved equipment (including the upward firing cannon in twin engined fighters and the better SN2 radar) the period November 1943 to March 1944, saw the night fighter squadrons at their best.
On 19/20 November 1943, FIDO (Fog, Intensive Dispersal Of) was used for the first time on operations at Graveley, a PFF airfield. A FIDO installation involved a line of petrol fed burners down each side of the runway which, when lit and allowed to burn for a short time, would lift the fog, and improve visibility enough to enable a bomber to land.
On 30 November / 1 December 43, the newly formed 100 Group, the radio-counter measures Group of Bomber Command, flew its first operational sorties.
The first three attacks of the main Battle of Berlin were on 18/19, 22/23 and 23/24 November. On all three occasions complete cover of thick cloud over the target forced the use of sky markers aimed by H2S equipped PFF aircraft. The first attack was very scattered. The second attack was probably the most effective raid on Berlin during the war. Very heavy damage was done to the centre of the city including factories and government buildings and 175,000 people were estimated to have been 'bombed out'. On the third raid crews could see the glow through the cloud of the fires started the previous night and more serious damage was done. There was a price to pay. The German controller identified Berlin as the target early on, the single engined night fighters gathered over Berlin before the attack began. The Bomber crews reported that flak was restrained to give the fighters a free hand - 5.2% of the bombers were lost.

550 Squadron took part in the fourth raid on 26/27 November 1943.
