

RAF NARRATIVE

THE AIR DEFENCE OF GREAT BRITAIN

VOLUME III

NIGHT AIR DEFENCE. JUNE, 1940 - DECEMBER, 1941

AIR HISTORICAL BRANCH (1)
AIR MINISTRY

CONTENTS

Page

CHAPTER 1. BACKGROUND TO THE BATTLE

Attack as the Best Form of Defence.

Problem of continuous and accurate location of the enemy –
Problems of early detection, inland tracking and height finding -
Problem of engagement in darkness – Gunner equipment made
to fire at 'seen' targets – Fixed Azimuth system – the Radar
system – Other weaknesses in the night defences – Development
of specialised night defences.

The Character of our Defences.

Inadequacy of searchlights – Investigations to improve the night
Defences – Plans for the provision of defences.

The German Minelaying Campaign by Night.

(Winter 1939 to Spring 1940)

Problems of intercepting minelaying aircraft – Early attempts at
Interception using AI – Failure of the AI experiment.

CHAPTER 2. BACKGROUND TO THE BATTLE

The Functioning of the Defences.

Raid Intelligence – The Observer Corps – Air raid warnings –
Plotting – The machinery of interception – Co-operation
between Fighter Command and AA Command –

The Role of the German Air Force before the Night Battle.

The German Night Flying Organisation.

Enemy Blind Bombing and Navigational Aids.

Organisation of Counter-Measures.

CHAPTER 3. THE EXPLORATORY PHASE: 6th JUNE to 7th SEPTEMBER, 1940

Consequences of the German Victory in Europe.

Operations Between 6th June and 30th June, 1940.

Distribution of attack – New policy of air-raid warnings –
The Fighter Command re-action to enemy operations.

Policy for the Expansion of the Air Defences.

Operations Between 1st July and 10th August, 1940.

Claims by Fighter and Gun defences – Summary of enemy
intentions.

Operations Between 10th August and 7th September, 1940.

Commencement of major attacks – Our failure to appreciate
enemy intentions – Prolonged warnings through nuisance
raids – Increasing scale of attack.

CHAPTER 4. THE FIRST MAIN PHASE: 7/8th SEPTEMBER to 13/14th NOVEMBER 1940

The attack on London Opens.

The Night Battle is Joined. 7/8th September, 1940.

Enquiry into Failure of Defences by Salmond Committee.

The Kenley Experiment.

Summary of the First Main Phase.

Analysis of a Typical German Air Force Night Raid of the Period.
German Plan of attack – Units Participating – Tonnage of bombs dropped – Subsidiary raids – Tonnage of bombs dropped on London – The progress of the attack – Enemy comments on our defences – Defensive activity: analysis of claims – Details of damage caused – Details of subsidiary attacks – Conclusions.

CHAPTER 5. THE SECOND PHASE: 14/15th NOVEMBER, 1940 to 19/20th FEBRUARY, 1941.

War on Industry and Ports.

Analysis of the Raid on Coventry. 14/15th November, 1940

Timing of the raid – Part played by Luftflotte 3 –

Tonnage of bombs dropped – Course of the attack –

Assignment of specific targets – Fighter Command

patrols – AA claims – Consequences of the raid –

Conclusion.

Progress in Fighter Command and in AA Command.

Summary of the Second Phase.

CHAPTER 6. THE THIRD PHASE: 19/20th FEBRUARY to 12th MAY, 1941

War on Ports

Fighter Command Measures to Meet the Attack on Ports.

AA Command Measures to Meet the Attack on Ports.

Attacks on Shipping at Night: The Minelaying Campaign

Air War at sea.

Summary of the Part Played by the Night Defences.

Analytical Summary of the Night Battle.

(7/8th September, 1940 to 11/12th May, 1941)

The Fighter defences – AA Guns and Searchlights –

The enemy.

CHAPTER 7. ACTIVITY FROM 12th MAY to 31st DECEMBER, 1941

Air War at Sea: Reshuffle of German Forces.

The Enemy's New Policy.

Summary of Raids Between 12th May and 31st December, 1941.

General Activity.

Summary of Developments in Fighter Command and AA Command.

APPENDICES

1. Summary of damage to Key Points. (1940 and 1941).
2. Noteworthy Minor Raids in which Key Points were affected. (January to May, 1941).
3. Distribution of Raids in 1941 showing chief areas of damage.
4. Major attacks on British Targets (Compiled from German Records). (August, 1940 to June, 1941).
5. Distribution of German night attack (in terms of Major Raids). (August, 1940 to July, 1941).
6. Notable Raids on Towns in relation to Moon Periods. (1941).
7. Attacks on the British Isles in 1941 (Compiled from German Records).
8. GAF Effort. Casualties claimed by Night.
9. Notes on Minor Raids.
10. German Long Range Bomber Strength in the West.
11. Night Interception.
12. 'Starfish'. Operations in 1941.
13. GCI – Progress in Installation.
14. Intruder Patrols. (December, 1940 to December, 1941).
15. The Attack and Defence of Coastwise Shipping. (November, 1940 to December, 1941).
16. AWAS Estimates. Weight of Bombs dropped on Great Britain by Night (HE and IB).
17. Analysis of an attack on Liverpool. (12/13th March, 1941).
18. Fighter Command – Order of Battle of Night Fighters.
19. Function of Night Operations Staff at Headquarters, Fighter Command.
20. Fighter Command Operational Instructions.

NOTES ON STATISTICAL SOURCES

Figures have been where possible arrived at by a comparison of the various British and enemy sources available.

These especially include:

Luftkrieg gegen England:

Anlage zum Gefechtskalender, a record kept by the Germans Historical and Archives Branch – Abteilung 8.

Führungsabteilung Gruppe Ic which comprise the daily intelligence summaries of Luftlotte 3.

Luftwaffe Führungsstab Ic III/A – a series of maps showing tonnages of bombs dropped on Britain in Major Raids.

Records of Strength kept by the German Historical and Archives Branch – Abteilung 8.

Air Warfare Analysis Section Figures.

Figures in the Fighter Command Records, Appendices etc.

CHAPTER 1

BACKGROUND TO THE BATTLE

Attack as the Best Form of Defence

AHB IIA/1/7 ADGB
file folio 23, also
H A Jones, 'The
War in the Air'

Ibid Vol.2 folios 89,
23

'The War in the Air'
Vol.5 p.159

During the war of 1914-1918, the majority of air raids on this country had been made at night. Sixty-two and a half tons of bombs had been dropped on London killing 670 people and affecting the output of munitions although no factory had been directly hit. To meet these attacks we were forced by military necessity and public agitation to create an expansive and elaborate system of defences, so that when the Armistice was signed in 1918 we had a home defence establishment of 480 guns, 760 searchlights and 16 fighter squadrons. It was, nevertheless, not the casualties inflicted by our anti-aircraft artillery or by fighters co-operating with searchlights that made night raiding a prohibitive form of warfare for the German Air Force. Enemy attacks ceased because Germany was facing a precarious position on the Western Front the restoration of which demanded all her energy.

Indeed, the difficulties and the uneconomic character of anti-aircraft defence so impressed the air historian that he declared: "the only defence in the air likely to be effective in the long run is an offensive more powerfully sustained than that of the enemy".

Home Defence
Committee Paper
No. 220,
9 Feb 1937

AHB ADGB Vol 2
Folio 89

This view still held currency in 1937, for no new developments in night air defence had come about since 1918 either to supersede the system of searchlight aided interception or make it so much more efficient that the chances of direct defence against the night bomber had improved. "Local defences" it was stated by Air Chief Marshal Sir Hugh Dowding, Chairman of the Home Defence Committee, "however numerous and efficient cannot alone provide an adequate measure of security Offensive action will be ultimately more efficacious in reducing the scale of attack on Great Britain than a vast increase in the number of local defence fighters, though these have a vital part to play, particularly in the initial stages before our counter-offensive has had time to make its effects felt". The strength of Fighter Command was accordingly based on the strictest economy of effort relative to the scale of attack it would have to meet¹, and the balance between the offensive and defensive arms of the Metropolitan Air Force was maintained in the proportion of two bombers to one fighter through all the expansion programmes of the rearmament period.

DPR Committee
Paper No 2

The problem of night defence was affected by this standpoint, for though it was recognised that attacks by night² might well be as intense as those by day and that an adequate night defence was imperative, it was held that the preparation of a night defence should not absorb too great a fraction of the whole national effort.

Problem of Continuous and Accurate Location of the Enemy

The problem of air defence is well conceived in three subsidiary but interrelated phases. Simply stated, these are early detection of the enemy, his continuous and accurate location and, finally, engagement and destruction. In broad terms, these are the prerequisites of successful interception both by day and by night, with the important difference that by night the limitations of human vision had somehow to be made good.

Late in 1940, a specialised form of night interception involving both airborne and ground radar equipment³ began to show encouraging results, but until then, searchlights remained the sole means of reducing the limitations of human vision in darkness⁴. It is not a matter of surprise, therefore, that each successive review of the Air Defence of Great Britain emphasised the importance of the searchlights in night defence. In 1935 it was stated that "without searchlights this operation by night of fighter aircraft and anti-aircraft guns would be severely crippled and interception of the enemy bomber would become a matter of chance". In May 1937, the AOC-in-C Fighter Command during the course of a lecture delivered to the Staff College declared that "the disposition of a network of searchlights alone for the time being make night fighting possible save in conditions of exceptional visibility".

Unfortunately enemy aircraft could neither be continuously nor accurately located by the form of acoustic control upon which the searchlights relied to illuminate their targets. Sound waves are affected by temperature lapse rate in the atmosphere and by variations of wind speed and direction at different altitudes. In particular, erroneous calculations were liable to be made owing to the lag in time taken for the sound emitted by an aircraft to reach the sound locator on the ground, a drawback aggravated by the high speeds of modern bombers. But the difficulties did not end there. The effective range of the searchlight beam did not exceed 12,000 feet, so that aircraft operating above this height enjoyed immunity for detection. Indeed, when war came, no beam or combination of beams existed which could secure illuminations above 12,000 feet, so that the successes of searchlights against enemy raiders during June 1940 were short lived. The enemy quickly rectified his tactical mistake and commenced operating at heights at which attempts to destroy him by searchlight assisted interception were frustrated.

In addition, climatic conditions over this country seriously hampered the workings of searchlights, and it was estimated that there was cloud between 400 and 5,000 feet on over 100 nights during a year. On moonlit nights, searchlight beams were hardly visible at all. It was a safe assumption, therefore, that the searchlight would be incapable of illuminating the target on one night in three⁵. Finally, there were tactical difficulties. It was assessed that a target had to be illuminated for 8 minutes to enable a fighter to close and engage, but nothing in the performance of the searchlight could hold out hope of such a high standard of efficiency. Evasive action by the enemy and the inherent weaknesses of acoustic control (which the scientists advised "should be relied on to a decreasing extent") could not both successfully be

DPR Committee
Paper No. 2

HCTD S/212
14 May 1937

AHB/IIH1/18
Air Chief Marshal Sir
Hugh Dowding: 'Battle
of Britain' 234

DPR Committee
Paper 189

AHB/IIH/93 Encl.1A
19 March 1938

CSSAD 9th Meeting

contended with.

Problems of Early Detection, Inland Tracking and Height Finding

CSSAD 23rd, 27th,
33rd Meetings

The Air Defence of Great Britain in the period before September 1939, short of equipment and personnel, and manifestly lacking in quality, demanded complete overhaul. Late in 1934 the Committee of Imperial Defence therefore formed an Air Defence research Sub-Committee and the Air Ministry established a Committee for the Scientific Survey of Air Defence to undertake this task. Their work reflects the complex and difficult problem of night defence and shows the numerous directions in which solution was sought. Searchlights in aircraft, illumination by towed flares, by flares dropping out of bursting anti-aircraft shells, aerial minefields in the enemy's path, infra-red detection – these were some of the forms of night defence exhaustively debated and carefully tried. Attention was even paid to an inventor's claims for his death ray. Of these possibilities only two were ultimately exploited operationally – the laying of aerial minefields and the airborne searchlight – neither with any marked success.

AHB/IIH1/18
Air Chief Marshal
Sir Hugh Dowding
'Battle of Britain'
215

The main weakness of our defences⁶ was the absence of any satisfactory means of early detection. Happily the principle of radar had been discovered and its practicability conclusively proved at a demonstration at Orfordness early in 1935 and, by March of that year, a Treasury Grant had been obtained for its development. As a result, our radar stations were in a position by the time war came in September 1939 to detect enemy aircraft at some distance⁷, thus giving sufficient warning for both active and passive defence measures to be set in motion before attack developed. Early warning certainly did much to save Fighter Command from having to resort to the uneconomic tactic of maintaining standing patrols, and in general fighters remained on the ground until required to make an interception.

CSSAD 26 Nov,
1937

Early detection was, however, only the initial function of the machinery of defence. Continuous and accurate location of raiders was also a requirement. This was possible to seawards by means of the chain of radar stations which covered many of the air approaches to this country from Germany. Aided by these radar facilities, a system of fighter interception was evolved, carried out by ground controllers in contact with the fighters by radio telephony, the course of our own aircraft being determined by wireless direction finding (D/F) methods. The system had been far enough developed by November 1937 for Sir Henry Tizard, Chairman of the Committee for the Scientific Survey of Air Defence to say that "interception had now been developed so that in daytime or on clear nights there was a high chance of success at the coast".

AHB/11H/148
Encl.36
3 July 1939

Inland tracking however was carried on by the Observer Corps who depended on a view of the target for accurate location. In cloudy weather and at night, therefore, enemy aircraft had to be located by sound alone, so that the information furnished by the Observer Corps became too inexact for controlled interceptions to take place. As Mr. Winston Churchill who had served on the Air Defence Research Sub-Committee

wrote to the Secretary of State for Air: "A weak point in the wonderful development (of radar) is of course that when a raid crosses the coast it leaves radar and we become dependent on the Observer Corps. This would seem a transition from the middle of the twentieth century to the early stone age."

In addition to the inaccuracies of overland tracking by night and in cloudy weather, inaccuracies in reading the heights at which enemy aircraft were flying presented a further problem. Neither the coastal radar stations nor the Observer Corps were able to provide exact heights, and though errors could be compensated for in daytime, it was impossible to compensate for them by night, when interceptions represented as perfectly effected on Operations Room tables were in reality made totally abortive by the great difference in height between the fighter and its target.

Problem of Engagement in Darkness

Inaccurate inland tracking and inaccurate readings of enemy heights were thus the two cardinal defects in our night defence system until the GCI method began to be used early in 1941, and all effort was directed towards overcoming them. "It was borne in upon me with special force" wrote the AOC-in-C Fighter Command in November 1940, "how hopeless it is to attempt night interceptions against high flying aircraft on the basis of Observer Corps sound plots alone". A month later, the AOC-in-C was writing: "I am convinced that the main obstacle to night interceptions is the lack of accurate tracking inland from the coast, and most important of all, lack of accurate information with regard to the height of the enemy bomber".

Neither of these defects was eliminated from the night defence system until the early part of 1941, when the application of the radar principle to the special demands of night interception began successfully to be pursued.

Closely linked with the problem of continuous and accurate location was the third problem of interception – engagement and destruction of the enemy. The best of aircraft and guns would be valueless unless they could be placed within range of the enemy. We had the Hurricane and the Spitfire, both 8-gun single-seater fighters, but the failure of daytime interception methods at night – owing to the uncertainty of searchlights in illuminating their targets – largely denied to us the use in darkness of the fire power of these aircraft⁸. Indeed the potentialities that seemed to exist in the use of airborne radar equipment for night interception led to the choice of the slower, lesser-armed twin-engined Blenheim as a night fighter, until it was gradually replaced towards the end of 1940 by the faster, more powerfully-armed Beaufighter. Thus, contrary to original intentions and policy, the development of specialised night fighter formations was proceeding. "I think" wrote the AOC-in-C Fighter Command in December 1939 "that a division between day and night fighters will soon be forced on us". By December 1940 the AOC-in-C Fighter Command was asking for "at least twenty specialised fighter

AHB/IIH/240/4/121
FC/S.21197
3 Nov. 1940 Encl.2019
and FC/S.22104
3 Dec. 1940

"The Battle of
Britain" 33 etc

AHB/IIA/240/4/126(A)
FC/S.16806 2 Dec.
1939 Encl.19A.

FC/S.22104

squadrons" to make a success of night interception.

Gunnery Equipment made to Fire at 'Seen' Targets

The AOC-in-C
Fighter Command
AA Command's
Despatch Section III
Para. 44 et seq.

Anti-aircraft gunnery at night presented a similar paradox, guns being robbed of their full effect so long as no means existed of locating enemy aircraft continuously and accurately. Practically all gunnery and equipment was designed for visual shooting at 'seen' targets both by day and by nights, and some locators were used with guns, a target being tracked by these sound locators for some time to establish its course and speed. This information was then passed to the guns so that 'future position' could be calculated, the fuses set and aim taken. In all, there was an interval of anything up to a full minute between the pick-up of the target by the sound locators and the arrival of the shell at its destination. During this time, an aircraft might have moved between four and six miles and, in calculating 'future position', it had to be assumed that course and height would remain constant. This was, in fact, far from the case. Moreover, at night, Heavy Anti-Aircraft required the illumination of targets by searchlights so that they could be 'seen'. Searchlights were therefore deployed with heavy guns round important cities and a system of 'gun-defended-areas' (GDA) was accordingly created. In addition to the drawbacks inherent in location by acoustic method and in location by searchlights whose reliability was always in question, predictors were not designed to accept heights over 25,000 feet and their speed of traverse was limited, so that close targets often moved too fast across the sky to be followed.

Fixed Azimuth System

For the defence of London two lines of sound locators, spaced at intervals of two miles, were sited at right angles to the Thames Estuary on the capital's eastern flank. A similar siting of sound locators on its western flank had been carried out. Each sound locator was connected to the London Gun Operations Room. It was expected that the two nearest locators would almost simultaneously be able to report the bearing and angle of sight of an approaching enemy machine, while two sound locators from the inner line would be able to supply its speed and direction. Working on this data, the Gun Operations Room was expected to fix the 'future position' at which the guns were to engage, the guns making the adjustments necessary to their own position. This complex organisation for engaging the enemy was called the Fixed Azimuth System. However when the first big raid on London came (7/8 September), the Fixed Azimuth System broke down completely. The reasons for the breakdown were threefold: the enemy was flying at greater heights than those at which sound locators could make accurate detections; at times more than one machine was operating between two locators, making it uncertain that both were tracking the same aircraft; and lastly, the assumption that the enemy's main approach would be up the Thames Estuary was not always fulfilled, many of the raiders passing outside the flanks of the sound locator layout. Faults in the communications-system did not help to smooth the difficulties, and few of the guns on that day received data on which to engage. It was therefore

decided that guns unable to fire on the Fixed Azimuth System should have a free hand to use any method of control they liked. A large volume of fire resulted, hailed by the Press as a 'barrage', but described by the GOC Anti-Aircraft Command as "largely wild and uncontrolled shooting". Results from this were that the public felt better' upon hearing a big volume of sound, and that any timid German aircrews might have been deterred from pressing home their attacks upon viewing large areas of the sky dotted with shell-bursts.

Ibid 58

The Radar System

The application of the radar principle to anti-aircraft gunnery, and the evolution of GL (Gun Laying), first used in October 1940 after many struggles in the testing stages to obtain a measure of accuracy in reading heights, slowly relieved the problems of gunnery and, most important, no longer made it necessary for the target to be 'seen'. An entirely new system of "unseen barrages" was developed with a view to increasing the volume of fire from many guns at once, thus widening the area of the lethal burst. Guns were re-sited in groups, with a master-site using GL to plot the target and pass information to its satellites each firing independently as the hostile machine entered the barrage belt.

This system was continued until January, 1941, when a change was made, the GL data from that moment being passed back to the Gun Operations Room where predictions were worked out and fire orders issued.

Other Weaknesses in the Night Defences

AOC-in-C Fighter
Command Night
Interception Report FC
S22104 8 Dec. 1940

Air Chief Marshal Sir
Hugh Dowding 'The
Battle of Britain' p.46
AHB/IIH1/18

Ibid

Although inaccurate tracking and height finding were the cardinal defects in our night defences, other factors contributed towards their comparative failure until the spring of 1941, including a lack of first-class aerodromes, equipped with night-flying facilities; a lack of specialist training in night interception work and difficulties in the maintenance of aircraft and the poorly engineered radar and R/T equipment they carried. As the AOC-in-C Fighter Command put it: "in nine cases out of ten something would go wrong with the AI set or with the R/T direction finding system or with the communication system before an interception could be made". The lack of a suitable aircraft for night interception work was also felt, for though the Beaufighter began to come into service in the Autumn of 1940, it suffered from a great many teething troubles and furthermore, the supply of this type of aircraft was slow.

Indeed, it was not until early in 1941, when some German night raiding had been going on for three or four months, that this type of machine began to operate in anything like effective numbers.

Development of Specialised Night Defences

By the time we had established the GCI system to ensure the accurate measurement of heights and the accurate tracking inland and to seaward of both enemy bomber and intercepting fighter, and by the time

other drawbacks had been surmounted, the Germans had begun to withdraw the bulk of their bomber forces eastward for participation in the impending attack on Russia⁹. Thus although we were fast evolving a specialised machinery for night defence, raiding on any serious scale had ceased before it could be tested at its fullest efficiency in 1941¹⁰.

FIU Report No. 80

FC Operational
Instruction No. 90

Improvements in our night defences continued throughout 1941. By November the principle of radar had successfully been applied to the control of searchlights and an apparatus called SLC (Searchlight Control or, more popularly, 'Elsie') was coming into use. It had been well demonstrated that efficient troops could expose their beam directly on an aircraft and maintain illumination even if avoiding action was taken. A comprehensive drill had therefore been worked out for co-operation between the searchlights and single engined fighters.

The arrival of SLC raised an important issue. The trend in night fighting had been towards the employment of twin-engined aircraft equipped with AI and operating under GCI control, and the small number of specialised Beaufighter (and earlier Blenheim) squadrons had hitherto constituted the main defence against night raiding. The GCI system however possessed a limitation in that a controller could direct only one fighter (at most two) at a time towards an interception; a limitation that would most seriously be felt when dealing with the mass attack.¹¹ The possibilities of frequent and accurate searchlight illumination of targets by SLC controlled searchlights suggested that the main force of Fighter Command's single engined fighters could now be brought to bear against large scale raids as had been envisaged at the outbreak of war.

The cessation of important German attacks in the Spring of 1941 however prevented this issue being put to any practical test and both searchlights and the GCI system, therefore, continued to be regarded as essential parts of our night defences.

The Character of Our Defences

Inadequacy of Searchlights

With the exception of the searchlight companies, there was no part of the air defence system that functioned solely by night during the early months of the war.

Throughout the 24 hours, coastal radar stations detected the enemy's approach, gave instant and early warning to active and passive defences, and tracked his course until he had made landfall. The Observer Corps, likewise working day and night, continued tracking him over land. The Air Raid Warning procedure remained practically unchanged by day and by night and a single system of communications was in use at all times. Similarly, until radar methods came to be applied to night defence, no distinction between day and night weapons existed, the daytime technique in interception and gunnery having to suffice at night. "We relied" said Sir Hugh Dowding, the then AOC-in-C of Fighter Command "upon daytime interception methods, and on searchlights to illuminate

and hold the bombers".

FC/S.15329
28 April 1939

FC/S.16638
10 July 1939

IVA/16
18 Sept. 1940

But the inadequacies of searchlights had long been in the minds of those responsible for our defences. In the spring of 1939, the AOC-in-C Fighter Command decided to modernise night flying tactics, taking into consideration the serious shortcomings of searchlights which he ordered to be tried out in a variety of ways. But the passage of time only served to diminish confidence in the searchlight method and in July 1939 the AOC-in-C Fighter Command was receiving most discouraging reports about the ability of searchlights to pick up and hold high speed targets painted matt black at heights of ten thousand feet and over. "This gives additional urgency" he said "to the need for pressing on with the new method of night interception".¹² Meanwhile the Air Fighting Development Unit, after two months of experiment could only add to the prevailing scepticism about searchlight assisted interception and, on a later occasion, a representative of Anti-Aircraft Command committed himself to the statement that "modern methods of camouflaging night machines were such that it required about nine times as much light to effect illumination visible from the ground as was the case in the last war". In addition, difficulties in training aggravated this unpromising situation.

Investigation to Improve the Night Defences

AHB/IIH1/18
Dowding Despatch
"Battle of Britain"
232

S.3867
2 March 1940

It was not only the inadequacies of searchlights, however, which exercised the minds of those responsible for our defences. Other deficiencies existed which had been continuously under the investigation of such bodies as the Committee for the Scientific Survey of Air Defence. Indeed, the shortcomings of night defence caused Sir Hugh Dowding to say that he had "long been apprehensive of the effect of Night attacks, when they should begin, and of the efficiency of our defensive measures". So much was the subject to the forefront that in March 1940, Air Vice-Marshal Richard H Peck, then Assistant Chief of the Air Staff (O & I) addressed a minute to the Chief of the Air Staff asking approval for the formation of a committee "to co-ordinate measures for night defence and link up research and development to the stage of practical trial. There can be no doubt", he said, "of the magnitude and the urgency of the problem of night interception". The Chief of the Air Staff authorised this step and the Committee (called the Night Interception Committee) held its first meeting on 14 March, 1940, under the chairmanship of Air Marshal Peirse, Deputy Chief of the Air Staff, who opened the discussions by stating that "defence against night attack was one of the biggest problems we had to face. Even if the enemy began by raiding in large numbers by day" he went on, "our good defences would force him to adopt night bombing".

The Night Interception Committee energetically explored every means of night air defence available or likely to be available, and the record of their deliberations shows that their efforts were directed especially towards the application of radar devices to the problems of night defence,¹³ a sign perhaps of their distrust of the weapons immediately at our disposal. To wait on the production in quantity of new devices and to neglect available resources would never have been justified, particularly

CID 283rd Meeting
29 Oct. 1936

as the assumption 'that Germany may attempt a knock-out blow from the air and that this blow would be delivered with maximum intensity at the moment of declaration of war' was the one which governed our pre-war policy of air defence. In view of this assumption, therefore, all the equipment to hand, however unsatisfactory had to be deployed in the air defence of the country.¹⁴

COS (40) 320
4 May 1940

This deployment of the country's air defences was carried still further when the threat of a German offensive in the West grew imminent. The Chiefs of Staff expressed the view that if ever the Germans intended to invade us, an air attack on this country would, in the first instance, probably be aimed at the air force and at the aircraft industry, as a prelude to more ambitious operations. While they were reasonably satisfied with prospects if such an attack were made by day, they reported that "our defence against night attack is still far from effective, and while we doubt whether Germany could achieve her aims by night bombardment alone, it must be remembered that our passive defence measures cannot be as effective by night as by day, and morale is more vulnerable during the hours of darkness."

It was thereupon recommended that every means of air defence should be provided as fast as possible, even if this meant that the production of other equipment, equally important in the long run, were to be retarded.

To discuss the reasons for the unsatisfactory nature of our air defence system, even as late as the summer of 1940, would be profitless, touching as they do upon wider political and economic issues, although concerning night defence, it is worth noting that science had not advanced far enough in the early days of the war to offer those delicate and precise instruments, which alone made night defence effective in the times to come. New techniques and revolutionary devices had long promised well,¹⁵ but the practical application of an invention demands time. Unforeseen technical faults and difficulties of production have a habit of cropping up to hinder the progress that in theory seemed so certain. What is more, once new devices are produced, the training of the large numbers of persons required to operate and maintain them is a lengthy process. And the reality of factors of this nature is well substantiated by the slowness in perfecting such apparatus as AI, GL, GCI and SLC, and the poor standards of maintenance and frequent mechanical breakdowns occurring in the AI-equipped Beaufighter squadrons when they first came into the fighting line.

Plans for the Provision of Defences

CID 308.A and
319.A

The successive pre-war reviews of the air defences of Great Britain culminated in the recommendations of the Home Defence Committee of 7th February, and 15th May, 1939. The first of these reviews was accepted at the 346th Meeting of the Committee of Imperial Defence. It provided for 1,584 heavy and 1,622 light anti-aircraft guns, some 4,500 searchlights, 1,284 radar sets for the control of guns and searchlights and 24 stations to form the coastal chain (20 having already been approved).

No additions were made to the approved fighter force which remained at 50 squadrons; nor to the balloon barrages which were to contain a London barrage of 450 balloons, and provincial barrages totalling 2,500 balloons.

CID 308-A Part II

At the same meeting, the Home Defence Committee was directed to examine a War Office outline of probably future requirements in anti-aircraft guns. This envisaged a further increase of 1,144 guns or, alternatively, a similar number of UP projectors, an anti-aircraft weapon under development at that time. Such an increase would ensure that the scale of defence for objectives of the highest importance would be up to a 72-gun density. This conception implied that that number of guns could be brought to bear on any given avenue of approach to a target. Such an increase would also ensure that the scale of defences in less important areas would be strengthened, though not to the same extent. The decision reached, however, was that a 36-gun density was a sufficient defence against the weight of attack then considered possible and an increase of 328 guns was recommended in order to obtain this density over all important areas.

CID 319-A

Altogether the active defences planned at the outbreak of war included 2,232 heavy anti-aircraft guns (including reserves), about 4,700 searchlights, and 50 squadrons of fighter aircraft.

AHB/IIH/148
DHO Folder 'RDF
Stations' also FC Battle
Orders, May 1940 D1

The broad policy governing the disposition of the fighter squadrons indicated that each sector in Fighter Command should deploy 3 squadrons, 2 of single-engine machines chiefly for day operations and one of twin-engined machines for night work. The night fighting squadrons were to co-operate with searchlights spaced at intervals of 6,000 yards in the so-called Aircraft Fighting Zones. Of the Searchlights over 700 were to be of the new 150 cm type distributed among the standard 90 cm projectors in the proportion of 1 - 3. In important areas however, the searchlights were to be spaced at intervals of 3,500 yards and would co-operate with the anti-aircraft artillery.

AHB/IIH1/18
Dowding: Despatch
"The Battle of
Britain" 16

AHB/IIIE/5

These were the plans but they were far from being implemented fully when war broke out. On September 3rd 1939 only 695¹⁶ heavy and 253¹⁷ light anti-aircraft guns were in position, 2700¹⁸ searchlights were manned and 34 fighter squadrons were capable of operating against the enemy. The Aircraft Fighting Zone was incomplete, for there were gaps in the Midlands, and between the Mersey and the Bristol Channel. Nor did the situation improve rapidly. By December 1939, 20 coastal radar stations were working, but only 7 had high-power transmitting sets and none had the agreed standard receiving set. Few GL sets had been provided and none for the control of searchlights. The London balloon barrage was complete but barely 300 balloons were flying in the rest of the country. In view of these facts, the Chiefs of Staff reported to the War Cabinet, in December 1939, that the defences of the country could not be further weakened, even to provide the Expeditionary Force with additional anti-aircraft defences.

There were slightly more encouraging signs in our fighter defences which disposed 53 squadrons on 12th November 1939. Twenty-three of these squadrons were equipped with Blenheim aircraft, but not all of them were available for night fighting. Four were being used for trade defence duties and 16 of them had not yet been trained to operational standards. The intention, nevertheless, was to build up a force of 15 twin-engined squadrons for night defence.

Early in 1940, however, alteration in the dispositions of Fighter Command seriously affected the development of its night fighting resources. Subsequent to a review of fighter strength made by the Air Staff early in January, it was decided to rearm 9 of the existing Blenheim squadrons with single-engined machines, leaving 6 Blenheim squadrons available for night operations, and 4 for trade defence. Two factors appear to have determined this decision; firstly, the need for increasing fighter strength, with an eye to commitments in France; secondly, the relative scarcity of Blenheim aircraft. There were 36 Blenheim squadrons in the service at this date, but the current rate of their production would be insufficient to maintain them at full strength as well as provide the aircraft necessary for training on this type.

Thus by the beginning of April, 1940, only 6 Blenheim squadrons remained in Fighter Command, the four trade defence squadrons having been transferred to Coastal Command in January. And since these 6 Blenheim squadrons¹⁹ were the only ones specialising in night fighting, and assisting in the development of interception with AI, only the single-seater fighters were available in some sectors. These single-seater fighters, many of them Hurricanes, were able, as events proved, to participate successfully in the night battle when the searchlights offered them illuminated targets, but unfortunately, after an initial but transitory victory, their opportunities dwindled. New evasive tactics by the enemy and recourse to the conduct of operations at heights beyond the reach of their beam, frustrated the searchlights. The total number of sorties they made between August 1st and November 1st of 1940 was indeed much smaller in relation to their numbers than the total number of sorties carried out by the Blenheim squadrons. The explanation was that the Commander-in-Chief, Fighter Command, was during that period compelled to keep the exigencies of the day-battles in the forefront of his mind, and that he did not favour the employment of single seater squadrons by night, especially when they had been so severely taxed during daylight.

The German Minelaying Campaign by Night (Winter 1939 to Spring 1940)

Problems of Intercepting Minelaying Aircraft

While our poor night defences were still the subject of research and discussion, the German Air Force began to put to test what forces we could then command, in the opening phase of their operations, which consisted of an attack on our seaborne trade, especially of an extensive minelaying campaign carried on by night. This minelaying campaign was

concentrated mainly along East Coast waters, particularly in the Thames Estuary, off Harwich and in the Estuary of the Humber. There is, however, no record of any success achieved by our night defences against the mine-layer. The shortcomings of radar in detecting low-flying aircraft deprived us of adequate raid intelligence, and without accurate plotting, controlled interception becomes a fortuitous business, promising little more chance of destroying the raider in darkness than a system of free-lance fighter patrols. The difficulties of engaging the enemy either by gun-fire or searchlights when he was at low altitudes over the water made counter-measures hard to devise. Although CHL Radar equipment²⁰ had been sited to provide low cover in areas in which the mine-layer operated, its efficiency at the time was not all that might have been desired and, furthermore, coverage was by no means complete.

ADIK 12/1946

FC ORB Dec. 1939

The German minelaying operations commenced in mid-November of 1939 and three units participated. According to then available intelligence, these included elements of KG4, KG26 and KG30 under the director of Fliegerkorps IX at Jever,²¹ and the Heinkel 115, a seaplane, seemed to be one of the types of aircraft mainly used for this work. The wreckage of a machine discovered off the East coast during December, 1939, which turned out to be a Heinkel 115 provided evidence that they had been adapted for dropping mines probably of the magnetic type, with a parachute attachment to increase accuracy of laying. There had also been frequent reports from various sources that float-planes had been seen to alight on the water, and though it was not possible to confirm many of them, there were indications that aircraft capable of landing on water were engaged. Raids by Fighter Command Blenheims of No. 25 Squadron on the sea-plane base at Borkum at least showed our belief of the time that such attacks might reduce the measure of mine-laying operations by the Germans, while Bomber Command 'security patrols' over Sylt and Borkum during the night were begun with a view to hampering them still further.

Early Attempts at Interception Using AI

FC/S.18378

Our best hope of intercepting the mine-layer seemed to be with the Blenheim fighters which were experimenting with AI, the airborne radar equipment, and were controlled from those radar sites possessing the necessary R/T facilities for passing instructions to pilots. Accordingly Fighter Command despatched a signal on November 22nd to No. 11 Group, to the Radar Flight at Martlesham Heath and to the Radar station at Bawdsey. It read:-

"German aircraft have been active off the East Coast each evening after sunset believed to be minelaying. Intention is to intercept and engage these aircraft to seawards employing AI Blenheim fighters operating under the control of Coastal Radar stations having R/T and controllers."

Two Blenheims from Martlesham Heath were to operate under the control of Bawdsey and two Blenheims of No. 25 Squadron were to operate from Manston so soon as R/T control could be established at the

radar stations at Dover and Dunkirk.

A further signal from Fighter Command of November 27th instructed No. 11 Group to send three AI Blenheims of No. 600 Squadron to Manston, where they would fit themselves for night operations against German mine-layers by intensive daylight exercises.

Soon afterwards these operations commenced and, though they continued for about three months, proved abortive. The defects of early AI equipment and of the ground radar apparatus, the immaturities of a yet undeveloped system of control and of untried night tactics no doubt all contributed towards the failure. Nevertheless, mechanical limitations could mainly be held responsible, for it was only very much later that radar became effective in operation against aircraft at low altitudes.

However, valuable experience was gained not only about workings of AI in practice and in the matter of a technique of control, but in the evolution of a satisfactory procedure for night interception work of this specialised nature.²²

Failure of the AI Experiments

AHB/IIH/240/4/122
FC/S.18353 28A

The German minelaying campaign grew to become a source of anxiety to the War Cabinet. Sinkings through mines which in September had amounted to 26,409 tons and in October 29,388 tons rose alarmingly in November to 99,918 tons, in December to 65,000 tons and in January 1940 to 83,217 tons, following the employment of aircraft to lay mines. It is not possible to assess the number of tons of shipping sunk by air mining alone, since U-boats and E-boats also participated in this work, but it is certainly not possible to doubt the considerable effect of the part played by the German air arm. Owing to the gravity of the situation, the Chief of the Air Staff recommended that a system of standing patrols should be inaugurated as a measure additional to the attempts at interception with AI Blenheim fighters. Accordingly No. 11 Group was made responsible for patrolling the coastal area from Folkestone to the No. 12 Group boundary, No. 12 Group were to safeguard their own coastal front using 8-gun fighters if Blenheims were not available and, similarly, No. 13 Group, using Gladiators, Blenheim or 8-gun fighters as available were to watch their coastal front. These patrols were to be maintained at low altitudes over the most threatened stretches of water.

FC ORB
25 Nov 1939

S.3081

Efforts to intercept the minelayer were continued well into 1940 but no results were achieved and hopes of success were always slight. Addressing the Chief of the Air Staff in December, 1939, Sir Henry Tizard, his Scientific Adviser, wrote: "Director of Communications Development and I have been having a discussion about the interception of low flying aircraft at night, and I think you might like to know our conclusions. We agree that the AI apparatus now being fitted to machines is quite unsuitable for the purpose. It was not designed to meet these conditions and we do not think you ought to rely on it in the least."

AHB/IIIE/68
27 Feb 1940

Summing up the difficulties of CHL interception the AOC-in-C Fighter Command advanced his reasons for the lack of success. They were:

- (a) Lack of trained controllers.
- (b) Limitations in the R/T facilities available.
- (c) Unless the fighter could be manoeuvred from a point immediately over the CHL station, it could not be observed simultaneously with the enemy aircraft.
- (d) There were gaps in the vertical coverage.
- (e) The range of CHL required to be increased.
- (f) Interception at night required an accuracy of 300 yards, hence the importance of AI and the importance of reducing its minimum range to something like this distance.
- (g) Height indications were unreliable.

FC/S.18378

In March of 1940 the three AI aircraft of No. 600 Squadron which had been operating under CHL control from Manston were withdrawn and placed at the disposal of their squadron commander. They had patrolled consistently but abortively, seeking out enemy machines in all sorts of weather in the vicinity of the Thames Estuary; they had practised assiduously by day the method of using AI, but they had failed. In fact, neither effort nor ardour could overcome the technical weaknesses inherent in the primitive airborne radar equipments of those days, nor the drawbacks in the sets used for ground control.

¹ The Home Defence Committee in February, 1937, considered that 35 squadrons (630 aircraft) would be an effective fighter defence against a long range bomber force of 1700 aircraft based in Germany.

² In July 1938 the Assistant Chief of the Air Staff expressed the opinion that we should expect raids by 300-500 aircraft at night either separately or in small formations. (114) 169, 27 July, 1938.

³ Continuous and accurate location of both fighter and target were provided by an apparatus called GCI – Ground Controlled Interception. By this means a controller could place his fighter within 2-3 miles of the bomber. Here the airborne radar equipment (AI – Air Interception) came into play, enabling the AI operator to direct his pilot to within visual range of the enemy.

⁴ Trials appeared to show that a bomber illuminated by a searchlight could be seen by a fighter at a distance of 6-7 miles on a dark night, 2-3 miles in moonlight, provided the fighter was 1,000-2,000 ft. below (AFDU Report No. 13).

⁵ This view was also supported by the Assistant Chief of the Air Staff, Air Vice-Marshal W.S. Douglas (AHB/IIH/169/14 27 July 1938) and by Air Chief Marshal Sir Hugh Dowding who said: "an analysis throughout the year of the occasions on which our aircraft flying at 10,000 ft. could be picked up and held by searchlights would prove alarming from the defenders point of view." (FC/S.15329 28 April 1939).

⁶ At the annual RAF Home Defence Exercises held in August 1938, 5 radar stations were in operation and were reported to have worked satisfactorily. At the outbreak of war in September 1939, 18 radar stations were operating in the Home Chain while two others were completed and awaiting inclusion in the chain.

⁷ Subject to the aircraft being above the height of 2,000 feet (approx).

⁸ Blenheims equipped with airborne radar (AI) were in operation against enemy minelayers during the early stages of the war and the AOC-in-C Fighter Command maintained that they should be used as night fighters, leaving the 8-gun machines exclusively for day use.

⁹ May/June 1941.

¹⁰ The Prime Minister declared in March 1941: "it is clear that our Night Fighters and AA guns are becoming increasingly effective. We now welcome moonlight. Light in all its forms is now our ally." (Night Air Defence

Committee 11/55 24 March, 1941). Moonlight which had been looked upon as of great advantage to the attacking bomber had been turned to the greater advantage of the night fighter equipped with AI and controlled by GCI. The pilot homing on his target with the help of AI could see it in moonlight from great enough a distance to prepare his attack with care. It had also been shown that single engined fighters, operating in moonlight at varying heights over a target area could spot enemy aircraft and destroy them. (Operation 'Fighter Night'). Generally we had begun to increase the measure of our success against the night raider.

¹¹ It is noteworthy that Germans were compelled later in the war to find other means than GCI for dealing with our mass raids against them.

¹² The reference was to the new airborne radar device, AI, which the AOC-in-C expected to see in operational use within one year. His forecast was correct in so far as AI-equipped fighters began to patrol against German night raiders in the summer of 1940. It was not until early in 1941, however, that AI-equipped squadrons began to carry the main burden of night defence.

¹³ The Committee however did not necessarily believe that these new devices would solve every problem of night defence. At its first meeting it was stated that 5000-10000 rounds of anti-aircraft fire would be necessary in order to destroy the unseen target, even when GL was used under the best conditions. Later a War Office spokesman denied that such an extravagant expenditure of ammunition would be required although he admitted the vast difficulties of accurate anti-aircraft gunnery.

¹⁴ For example, it was decided to retain 78 batteries of 3" guns for use as heavy anti-aircraft artillery (CID 308A Feb. 1939).

¹⁵ At a conference held at Fighter Command on 23 Sept. 1939 for instance the AOC-in-C spoke of the remarkable progress made with AI. "A new chapter in night fighting had started" he said. Nevertheless, it was not until early in 1941 that the use of AI began to show real results.

¹⁶ Of an approved total of 2232.

¹⁷ Of an approved total of 1200. Some had been borrowed from the navy and there were only 76 40.m.m. Bofors guns, the best type of LAA weapon.

¹⁸ Of an approved total of 4700.

¹⁹ Nos. 604, 600, 25, 23, 29, 219.

²⁰ Details of these stations are given in Vol. IV Part I of "Signals In The Second World War".

²¹ German sources describe these units as from Fliegerkorps 8, Luftflotte 5 and the Channel Command (Kanalkampfhuber).

²² The orders evolved for the operation of AI-equipped fighters under radar control read:

"Should *RDF plots appear on the Fighter Command plotting table which indicate that a track will enter the Dover or Dunkirk radar area and probably pass within 40 miles of Manston, the Command Controller is to instruct the Filter Officer to order Controller, Radar stations at Dover or Dunkirk to prepare to intercept an approaching track. Single aircraft will be employed at night. Until Dover or Dunkirk plots appear on the table, the Filter Officer is to keep Controller, Radar stations informed of movements of approaching hostile aircraft. On instructions issued by the Command Controller (through the Filter Officer), the Controller, Radar stations will give the executive order for the aircraft to "take off". The Command Controller is to inform No. 11 Group immediately of action taken in accordance with the above procedure. The Command Controller is to ensure that Controller Radar stations is at once warned if the aircraft is recognised as friendly, and also when a X number is allotted to the track". (Note: Raids whose identity was doubtful were designated X raids on Fighter Command plotting tables.)

Thus the responsibility for the allocation of raids to radar control stations rested with the Controller at Fighter Command. Later however with the increase in the number of centres for radar control of night fighters, responsibility for the allocation of raids tended to pass into the hands of Group and Sector Operations rooms.

*Note: The word Radar superseded the term RDF in September 1943, and is mainly used throughout this narrative.

CHAPTER 2

BACKGROUND TO THE BATTLE

The Functioning of the Defences

Raid Intelligence

Before considering an early phase of German night operations against land targets which began in June, 1940, it is essential to examine the functioning of the air defences available to us at the time particularly to examine the means whereby raid intelligence was obtained and distributed to the various parts of the defensive network, for it was against the background of this raid intelligence that a specialised system of night defence later began to take its place.

No. 60 Group ORB
July 1940

Radar was the foundation of our raid intelligence organisation, making both early detection and accurate and continuous location of an enemy possible, at least to seaward. In July, 1940 our coastal radar chain consisted of 30 CH stations and 30 CHL stations, the CH stations being capable of detecting enemy raids at long range and the CHL stations capable of detecting low-flying raids. These stations were disposed round the coast between Scapa Flow and Strumble Head in Pembrokeshire. At the beginning of the war, Fighter Command had not only been in operational control of the radar-chain but had also been responsible for the training of operators, while experimental and research work, as well as equipment and maintenance, had come under the Director of Communications Development at the Air Ministry. Such a division of authority had not proved satisfactory and in February 1940, No. 60 Signals Group had been formed in Fighter Command to take over the technical and administrative control of the radar chain. This Group although placed directly under the Air Ministry for technical supervision came under the operational control of Fighter Command, an arrangement which left the Director of Communications Development free to concentrate on the immense programme of research and development that had been planned. This division of authority continued throughout the whole period of the German air offensive.

AHB/IIE/5

The Observer Corps

The next source of raid intelligence was the Observer Corps. In July 1940 the Corps consisted of a Headquarters located at Fighter Command and five areas, (Southern, Midland, Northern, Scottish and Western), with their headquarters at Uxbridge, Grantham, Catterick, Edinburgh and Gloucester respectively. These contained 33 Observer Groups, each with a Centre, to which the posts, situated for the most part at vantage points in the open country, telephoned plots of enemy aircraft.

The main lack of coverage, like that of the searchlight zones, was in the south-west, and in Wales. The Welsh coastal area was almost entirely unprovided with observer posts and, though this weakness was not felt while the Germans were still based in their own country, it was a

serious gap now that they could approach Liverpool by flying over Wales from bases in Normandy. In the south-west a new Observer Group with its Centre at Exeter had been formed, but it did not commence operations until July.

SD 264

Thus we had as sources of raid intelligence the radar chain, plotting to seaward and the Observer Corps organisation plotting inland. So long as the aircraft was visible, Observer Corps plotting was adequate. When however, they had to rely on plotting by sound, as at night, or under conditions of cloud, the tracks produced were too inaccurate for controlled interception. This weakness, already remarked upon, did not however reduce the value of Observer Corps plotting to another part of the defence organisation, the Air Raid Warning System.

Air Raid Warnings

The issue of raid warnings was the business of an Air Raid Warning Officer¹ who worked in the Command operations Room with a view of the Plotting Table on which tracks of enemy raids were displayed and on which the whole country was shown in outline, divided into 130 'warning areas'. When a raid was judged to be within 20 minutes of warning area, the raid warning officer would send a preliminary warning to the area threatened through one of his 3 telephone operators, connected with the trunk exchanges in London, Liverpool and Glasgow. This warning was immediately retransmitted to the warning area, where it was distributed to the police and to the fire and ARP services. This was known as the 'Air Raid Messages – Yellow'. At night there was also a 'Purple' warning, which was a signal for the dowsing of exposed lights in factories, marshalling yards and docks. The sirens warned the public only when the Air Raid Warning Officer saw clearly that a district was threatened with attack, and this was done upon receipt from him of the 'Air Raid Message – Red'. The 'Air Raid Message – White' signified that the raiders had passed and again the sirens told the public with their long, sustained blast. Fighter Command Headquarters was also in contact with certain broadcasting stations which were warned to cease transmitting so that the enemy would be afforded no navigational assistance.

Ibid

While the Air Raid Warning System employed the raid intelligence provided by Radar and the Observer Corps to keep the passive defences informed of approaching attack, this same intelligence had to be employed by fighters, guns and searchlights through more complicated methods.

Plots of enemy aircraft approaching the coast were passed from radar stations to the Filter Room at Fighter Command, where it was the duty of the officer responsible to evolve a track of the raid. A second function of importance to be performed at Fighter Command was the identification of the raid, and decision had to be taken whether the track being plotted was friendly or hostile. This problem of recognition was always difficult, notably during the early hours of the morning when our own bombers were returning from raids and enemy aircraft were still over the country.

But on the successful designation of raids as hostile or friendly depended the saving of fighter effort and the avoidance of false air raid alarms. The IFF² device helped to minimise errors in identification, but it was not fully efficient at that time, and it was necessary to attach liaison officers from Bomber and Coastal Commands to Fighter Command who in direct contact with their own Operations Rooms, were able to assist identification from up to date information about the movements of their aircraft.

Plotting

SD 264

Radar plots, giving position, height and numbers of approaching formations, having been filtered and the track of a raid as it moved on were passed ('told') by the Filter Room staff to the plotters around the table in the Operations Rooms both at Command and at the Fighter Groups. From the Groups these plots were told by multiphone amplifier to Sector Operations Rooms. Sometimes both radar and coastal Observer Centres might be plotting raids simultaneously until they made landfall, but once out of the orbit of the radar stations, raids would then be plotted by the Observer Corps only.

Observer Centres had direct telephone lines to Fighter Groups and to some sectors but not to Fighter Command Headquarters. The procedure for the transfer of plotting from Radar stations to the Observer Corps was that a 'sea teller' in the Group Operations Room passed to Observer Corps Centres details of aircraft detected by radar and likely to enter their area. The Centres then warned individual posts of the approach of such aircraft and the posts, picking them up would send back to the Centres their identity, position and course. Frequently identity had already been established by the time the Observer Corps had taken over plotting. Observer Centres 'told' all hostile or doubtful raids to the appropriate fighter groups and sectors and the group re-transmitted these plots to the Command Operations Room. The aim of the system was, therefore, to ensure that all possible information about enemy movements would simultaneously be displayed in Sector and Group Operations Rooms and on the Command plotting table.

The Machinery of Interception

AHB/IIH1/18
Dowding: Despatch
para. 75 etc

SD 264

The assembly, analysis and transmission of raid intelligence fell heavily upon the Filter Room and Operations Room staffs both at Command and at the Groups. To have sub-divided tactical control after the same fashion would have been to overstrain their resources. In the words of Air Chief Marshal Lord Dowding: "It appeared to me quite impossible to centralise control at Command Headquarters, and even Group Commanders would be too busy during heavy fighting to concern themselves with details of interception. The system was that the Command should be responsible for the identification of approaching formations and for the allotment of enemy raids to Groups where any doubt existed. Group Commanders decided which sectors should meet any specified raid and the strength of the fighter force that should be employed. Sector Commanders detailed the strength of the fighter units

to be employed and operated the machinery of interception.”

The functions of the Sector Operations Room and the Sector Controller were therefore particularly important in the defences, for not only would the Sector Controller be directing fighters towards their targets (or vectoring them as it was commonly called), he would have to watch their movements closely in relation to those of the enemy in order to make the changes of course necessary to effect an interception. He would also have to keep fighters away from Gun Defended Areas or make sure that the batteries were aware of the presence of friendly aircraft. At night, in addition to the raid intelligence made available to him through the normal channels, he would receive information from the searchlight liaison officer in his Operations Room concerning the position of enemy aircraft.

By night, the Sector Controller laboured under many serious difficulties, the most serious of which was that the plots laid on his table were often as much as four minutes old, and often older, making the accuracy which controlled interception at night demanded impossible to achieve. By day when a pilot could see his target up to distances of 20 miles, depending upon visibility, such inaccuracies could be allowed for and result in successful interceptions. At night however, without searchlight illumination of the raider, the fighter had to be brought to within 300 yards of the enemy before he could see it, so that the technical of controlled interception used successfully by day proved ineffective.

Another of the Sector Controller's difficulties was the limitation placed upon him by the D/F 'fixing' method of tracking fighters. By day when formations were operating, their position could be fixed by a signal automatically transmitted by one aircraft in the formation for 13 seconds in each minute, which was picked up by two or three D/F stations set up in the sector for the purpose. These D/F stations would pass their readings by telephone to the 'triangulating' room at the Sector, and the resulting 'cut' would indicate the position of the formation. In this manner large formations of aircraft could be tracked. At night however when formation flying was not possible (at least in any numbers), the D/F fixing method only permitted the Sector Controller to keep track of individual machines.³ Thus by night the simultaneous control of only a small number of night fighters was possible in any one period.

Apart from the method of control by the D/F fixing system, fighters at night were placed on patrol lines marked out either by ground flares or by searchlight marker beacons, in the hope that they would be able to intercept approaching raiders by general indications of enemy positions transmitted to them by the Sector Controller.⁴

Co-operation between Fighter Command and AA Command

These were thus the limitations under which our night defences laboured in the summer of 1940 and although measures were in hand to overcome them, the process of doing so was slow. Limitations similarly existed with the guns and searchlights and new equipment was also

being developed for increasing the efficiency of Anti-Aircraft Command whose problems were not unlike those confronting Fighter Command. Both depended on accurate data of the enemy's movements for the effective operations of their own defensive machinery, and as has been emphasised, the degree of accuracy demanded for night interception and for the operation of guns and searchlights by night was extremely high. Faced with largely identical problems, the joint working of Anti-Aircraft Command and of Fighter Command became imperative, particularly if the difficulties inherent in the night defence problem were successfully to be met. The fact that the headquarters of both Commands stood in the grounds of the same country house⁵ perhaps best symbolises the close relationship existing between them.

Pile: Despatch I
paras 5 et seq.

At the beginning of war there were 7 AA divisions:

- 1st – The Metropolitan area of London
- 2nd – Northern East Anglia, East Midlands, Humber
- 3rd – Solway Firth, Scotland, Northern Ireland
- 4th – N.W. England, West Midlands, North Wales
- 5th – South Wales, S.W. and Southern England
- 6th – S.E. England and Southern East Anglia
- 7th – N.E. England

At the end of 1940, the General Officer Commanding felt the necessity for much reorganisation in order to relieve the burdens on the existing Command and Divisions, and also to achieve a closer co-ordination of boundaries with Fighter Command. Five new Divisions were therefore created:

- 8th – covering the south coast as far as Bournemouth
- 9th – South Wales
- 10th – the West Midlands and Central Wales
- 12th – Clyde, Solway Firth and Northern Ireland

In addition, to ease the supervision of this organisation, three AA Corps were created:

- 1. AA Corps in the south (Nos. 1, 5, 6, 8, 9 Divisions)
- 2. AA Corps in the Midlands (Nos. 2, 4, 10, and 11 Divisions)
- 3. AA Corps in the North (Nos. 3, 7, and 12 Divisions)

Ibid 5, 7

Thus No 1 AA Corps Area corresponded with that of Nos. 10 and 11 (Fighter) Groups, No. 2 AA Corps area corresponded with that of Nos. 9 and 12 (Fighter) Groups, and No. 3 AA Corps area corresponded with that of Nos. 13 and 14 (Fighter) Groups.

Within these broad, co-operative arrangements was a further disposition of particular importance for night defence, by which each fighter sector was allotted a number of searchlight companies, usually forming a brigade, which worked in conjunction with the night fighters operating in the sector.

Heavy guns⁶ and searchlights were controlled from Gun and Sector Operations rooms. The same raid intelligence was available at a gun operations room as at sector operations rooms, through the anti-aircraft liaison staffs that were stationed at all operations rooms throughout Fighter Command. There was also a counterwise flow of raid intelligence from gun and searchlight detachments to their respective operations rooms, which, in turn, 'told' to group and sector operations rooms.

Each gun operations room controlled a gun area, providing individual sites, to which it was connected by direct telephone lines, with information about all aircraft in the vicinity. In addition, it actually controlled fire against unseen targets, and acted as an exchange for transmitting gunnery data from gun site to gun site.

Searchlights, at this date, were controlled by searchlight control officers stationed at sector operations rooms. There were direct telephone communications between sectors and searchlight company headquarters; thence, intelligence was passed to searchlight sections, and to individual detachments.

Such then were the methods adopted by Anti-Aircraft Command for the control of its operations at the time when night bombing of land targets by the German Air Force first commenced.

The Role of the German Air Force before the Night Battle

A feature of the German air offensives in Poland, in Norway and in the West was the concentration upon battlefield operations. While the battles in the West were in progress, even long range bomber units stationed in Southern Norway and North-west Germany, away from the fighting areas, were not directed against targets in England. Such night attacks as were executed were aimed, firstly, at protecting the right flank of the advancing armies by means of an extensive minelaying campaign along the coasts of Holland, Belgium and North-eastern France and, secondly, by a similar campaign in the Southern Flanders Bight and in the Straits of Dover, aimed at impeding the movement of Allied shipping, especially during the evacuation of Dunkirk. In the early days of June, this type of activity was continued, minelaying aircraft frequently visiting the Coasts of south-east and southern England and dropping mines near the many small harbours between Ramsgate and Portsmouth. Here again the aim was to hinder the passage of shipping, weaken communications between England and France, and thus indirectly assist the armies assailing the line of the Somme.

During the first week in June, however, small bombing and reconnaissance raids against England by night commenced. At first the majority of these sorties were confined to the coastal counties in the East and South East, but as more units were brought into operation and as the Germans took over more airfields along the French seaboard, these sorties were extended towards the West of England and as early as the end of June, methodical reconnaissance of the route from the Bristol Channel to Merseyside was begun, while the industrial Midlands also

became the subject of attention.

This preliminary phase of armed reconnaissance came to an end about the middle of August and there began a series of night attacks of mounting intensity. The restricted operations undertaken by the German Air Force during June and July can be explained by the necessity for a period for redeployment and re-equipment following the battles in France when many losses had been incurred and many aircraft had been worn out by continuous flying. This strategic redeployment was completed by the end of July about six weeks after the fighting in France had ceased and in the disposition of forces, Luftflotte 2 under Generalfeldmarshal Kesselring covered Holland, Belgium and Northern France, while Luftflotte 3 under Generalfeldmarshal Sperrle covered Western and Southern France. Luftflotte 5 under General Oberst Stumpf covered Norway and Denmark. The plan was for Luftflotten 2 and 3 to secure air superiority over Southern England while Luftflotte 5 was to engage our defences in the North.

The German Air Force was in fact for the first time to be called upon to act, not in concert with the Army, but by itself. Alone it had the responsibility of creating those conditions which could enable the Army to undertake the invasion of these islands. This primary aim, as is known, had to be modified owing to the Luftwaffe's failure to achieve air superiority over Southern England. New and modified aims were therefore set forth, said to be "economic war from the air, subjection of civilian morale to heavy strain and lastly, reprisals⁷ for British raids on German towns", and these new aims were to be achieved by mass bombardment at night.⁸

Note: Some material for this section has been derived from German sources, especially a lecture by a Hauptmann Bechtle on 'The Air Offensive against Britain', delivered in Berlin in April, 1944. Hauptmann Bechtle's sources of information are given as:

GAF General Staff/8th Abteilung (Historical Archives)
GAF General Staff/6th Abteilung (Quarter Master General's Dept)
GAF Operations Staff/1c – Intelligence, HQ Luftflotte 3

While preparations for large scale attacks were proceeding, the enemy no doubt felt that his bomber pilots should familiarise themselves with the conditions of night flying over England, while to test the strength of the defences, specific targets were occasionally attacked with fair accuracy. Furthermore, such attacks, though of a minor character, served as good propaganda material for consumption at home and around them, colourful stories of blows upon the last enemy, England, could be built. But it is conceivable, also, that the chief purpose of these night flights was to test out several radio aids to navigation and blind-bombing devices that the enemy was suspected of developing.⁹

The German Night Flying Organisation

By contrast with our own night flying airfields¹⁰ the German Air Force had many magnificent bases from which to operate both in Germany itself and later in the occupied territories. In Germany, the expropriation of land for the Air Force involved compensation to private owners or the sacrifice of farmland and forest valuable to the State. Such restraints as applied to the acquisition of land in their own country however did not apply in the countries the Germans had come to dominate. Moreover, a vast reserve of labour was available in prisoners of war, demobilised soldiers and unemployed civilians, and the Germans did not fail to make the utmost use of the resources they had acquired. The number of acres lost to cultivation, though colossal, did not matter and German airfields began to sprawl across western Europe in numbers sufficient for an Air force of considerably greater first line strength than that of the Luftwaffe.

In Germany, Denmark and Holland, airfields which did not possess grass surfaces usually had a capital layout of runways, special servicing tarmacs and three or four dispersal areas adjacent to the landing-ground, with aircraft shelters close together. Special branch railway lines serviced the airfield. In France and Belgium, airfields covered much wider areas, dispersal being at some great distance from the landing-ground. A single runway was originally provided at most of them but the construction of a second and even a third runway was generally put in hand without delay. Up to the autumn of 1940, these runways, with concrete surfaces, measured 1500 yards in length and 40 yards in width.

Night flying airfields possessed an elaborate and varied system of aids. Non-visual aids consisted mainly of radio beacons giving out particular signals at intervals, thus enabling the aircraft to take bearings and even cross bearings so as to 'fix' its position. The characteristic emitted by these beacons and their respective positions would be known to crews before taking off so that the problems of navigating by night were considerably simplified. In addition, the German Air Force possessed a well-developed system of Regional Control for the assistance of machines making lengthy flights. Provided with a list of the wireless call signs employed by the controls for the various areas over which a flight was being made, an aircraft was in small danger of losing itself and could at any time call for information or help. The Regional Control system existed also at airfields, so that an aircraft could always call an airfield on the medium frequency band (300-600 kc/s)¹¹ and ask for homing or for such help as a damaged machine might require in landing. The Lorenz blind-landing equipment was a common installation at German airfields and was always available to aircraft coming down in doubtful weather, while the so-called ZZ procedure for landing under the strict instructions of an airfield controller who directed the operation from frequent wireless D/F fixes and bearings obtained from transmissions by the aircraft was also used.

Numerous visual aids to night navigation and landing also existed including a system of 'visual Lorenz' for use in conditions of low cloud or ground mist. This consisted of a long line of lights leading up to the

boundaries of the airfield intersected at right angles by two or three shorter lines of lights. These points of intersection told the pilot his exact distance from the main runway, thus enabling him to regulate his height as he came in to land. Flashing beacons (Blinkfeuer), usually white, signalled two letter characteristics denoting the airfield in whose vicinity they were situated. Thus the characteristics B/X might have stood for Bordeaux while the characteristics O/B might have stood for Orleans-Bricy. Rotating Light Beacons (Leichtes Leuchtfeuer) were in different colours, each colour representing the region or sector in which they were located. Searchlights (Flugsicherungs-scheinwerfer) also played their part in ensuring the safety of German aircraft by night and one light of almost every battery was detailed to act as pointer towards the aerodrome. The other aids to night flying included a well laid on flare path, boundary lights and the usual obstruction lights.

Captured documents and observations by RAF crews suggested also that a complex of about 75 Visual Navigational Beacons existed in North-west Germany, the Low Countries and France, usually on the same sites as the high powered Radio Beacons. These Visual Navigational Beacons, showing certain recognition signals, were used by German crews on night operations for ascertaining their positions either when setting out or returning from operations.

It will thus be seen that in addition to a system of blind bombing and radio navigational aids, the German Air Force had begun to establish a highly efficient night flying organisation as soon as they took possession of airfields in the occupied countries, an organisation which was working well by the time they had decided to undertake full-scale night attacks against this country in the summer of 1940.

Note: Information for the compilation of this section about GAF night flying organisation comes from AP1928 (October, 1941).

Enemy Blind Bombing and Navigational Aids

S.3984 Night
Interception Committee
7th Meeting 16 June
1940

Evidence concerning the use of radio navigational aids by the German Air Force had been accumulating slowly during the spring of 1940 and it appeared that during March a document salvaged from an aircraft of KG26 made mention of 'a Knickebein beacon' operating at 315° from darkness until 0600hrs. One or two other such beacons were also mentioned. At that stage little could be done and further developments had to be awaited. Later, a diary was picked up from another aircraft of KG26 in which it was stated that the author had taken ranges on Knickebein in collapsible boats. Prisoners had been interrogated but had attempted to be misleading in their replies. Nevertheless it began to be clear that a beam was sent on short waves and that it was almost a kilometre wide. Intelligence sources were then suddenly able to add to this slight and laboriously garnered information by providing the phrase 'Knickebein Kleves is at 53/24 N 1° West', which indicated the neighbourhood of Nottingham. It seemed possible, therefore, that an aeroplane flying over the Nottingham area had found a 'cut' or intersection of beams at that point.

On 15th June, however, interrogation of a prisoner had produced the story that they had set up a very high powered beacon and that they flew in a beam, but that they had so far not been able to use it against targets in this country as they had not been able to obtain a sufficient divergence of base to get a good 'cut'. A high degree of navigational accuracy was apparently possible by this means, alleged to be within about 4 square kilometres. Investigation on our side had led to the discovery of two such high powered beacons, but their exact use had not then been determined.

At an emergency meeting to discuss the implications of this situation, the Night Interception Committee recommended among other steps to be taken:

- (1) That a flight of aircraft fitted with Lorenz equipment should be formed to obtain further information about German beams.
- (2) That a jamming system should be evolved.

HCTD/S.321 Air
Scientific Intelligence
Report No.6, 28 June
1940,
AHB/IIIE/77/6

Our Air Scientific Intelligence subsequently discovered that the German blind bombing technique had been developed 'almost beyond what we had thought possible.' It was considered that the German Air Force, using a revolutionary method, could 'place an aircraft within 400 yards over a point in this country'. So serious was the threat that a meeting was immediately convened at No.10 Downing Street, with the Prime Minister himself presiding, to discuss the situation and the possible counter measures.

Organisation of Counter Measures

No. 80 Wing ORB

Meanwhile an organisation had been set up on 18th June 1940 under the Deputy Director of Signals 'Y' to investigate German beam type transmissions on 31.5 mc/s, these signals having been detected by our Wireless Intelligence service, and the last days of June were passed in carrying out investigations with a mobile van fitted with the necessary wireless equipment. Investigation flights in an Anson aircraft were also carried out and, during the second of these, it was established that a German beam crossed the English coast at the mouth of the Humber on a bearing which indicated that its source was near Cleve.

It soon became evident that a specific organisation would be required to meet any extensive use by the enemy of radio bombing devices, especially as the useful range of Knickebein beams would inevitably be increased when stations were built in Northern France. A special Radio Counter Measures (RCM) section was accordingly formed¹² within the Signals Directorate at the Air Ministry, operating upon information received from the Wireless Intelligence Service ('Y'), its aim being to deny the enemy effective use of any of his radio aids.

The character of the Very High Frequency directional Beams (known as Knickebein) had gradually been established, and they were found to be 400 yards in width, with a range of approximately 300 miles. The

standard Lorenz blind approach equipment in German long range bombers indicated the position of the aircraft in the beam and a 'kicker' on the instrument panel in the machine showed when it was off course. Properly used, such an aid would have enabled any German bomber force to find its way to a target even in very bad weather, for the normal navigational methods became superfluous when a flight was being made along the beam, while the system of Medium Frequency Beacons in the Low Countries and France had considerably simplified the task of the bomber in locating its exact position by taking bearings and 'cuts' on the signals emitted by these beacons.

No. 80 Wing ORB

Counter measures were taken in the light of the information yielded by our intensive investigations into the nature of German radio aids to navigation to deal with Knickebein, a special section was formed at No. 80 Wing, and a number of Watcher stations were set up around our coasts to report signals on the ground, from which the direction of the German beam could be deduced. In addition flights were made by aircraft of the Blind Approach Training Unit at Boscombe Down during which it was hoped to detect the beams in the air and judge the effect of our jamming, which had by this time received the name of 'Aspirin'.

Steps to deal with German medium frequency navigational beacons had also been taken, and it had been decided to erect a number of re-radiating transmitters rather than employ any crude method of jamming. The object was to pick up the German signals and re-radiate them so as to mask the enemy system and confuse his aircrews with an embarrassing choice of transmissions by which to navigate. This was called Meaconing.

The first attempt to jam the Knickebein beams using a number of modified diathermy sets, borrowed from hospitals, and installed in Police stations round the coast had proved abortive, and a more successful jamming method using Lorenz Blind Landing transmitters was therefore introduced. The plan was to fill the air with signals of the same kind as the Knickebein signals, yet possessing no directional properties and thus largely depriving the Germans of the use of the Knickebein installations.

Action had quickly followed the discovery of the German intention to use radio bombing aids against us and no time had been lost in the establishment of an organisation for taking counter measures. We were therefore not unprepared when large scale German attacks using the new technique commenced, but the lapse of time required in preparing to meet every new variation tried out by the enemy naturally afforded him certain opportunities. However, our RCM experts were in time able to claim that 'meaconing' largely prevented the German Air Force from taking full advantage of their system of MF navigational beacons, and prisoner of war reports supported this view.

AHB/IIE28/1

Pre-war training of the German airman had equipped him for a navigation by beam methods and by use of MF beacons in conjunction with aircraft DF loops. Thus he based his navigation to the United Kingdom in bad visibility conditions on 'Knickebein' employing DR and

pinpointing as a check. This very reliance on radio aids him all the more vulnerable to RCM. It was true that the more experienced navigators could work their aids to navigation through interference in certain circumstances, but navigators of this competency were not available in large numbers.

Our investigating aircraft were able to provide evidence of the growing value of our counter-measures, and though they could not entirely nullify the German use of radio aids to bombing, they were able to give strength in no small measure to our weak night defences in 1940 and early in 1941.

¹ The final responsibility for the issue of raid warnings rested with the Duty Air Commodore at Fighter Command under whose supervision this officer worked.

² IFF: Identification Friend and Foe. This device, fitted first of all in Bomber Command's aircraft and later fitted to most operational types, by producing a characteristic 'echo' helped the Coastal radar stations to distinguish our own from hostile machines.

³ With the use of the 13 second signal 'pip squeak', a maximum of 4 such aircraft could be positioned by the sector D/F station operating on the sector fixer frequency.

⁴ This was indeed the accepted method of operating night fighters and the Fighter Command Battle Orders of May, 1940 stipulated that "fighters will normally operate on patrol lines in co-operation with searchlights. Sector Front and Back patrol lines are to be decided upon by Sector Commanders in consultation with the local anti-aircraft Searchlight Commander, and these patrol lines are to be notified to Group. In order to avoid undue interference with sound locators at the front of the searchlight area, patrol lines are to be at least five miles behind the front line of searchlights. The normal tactical unit for Fighters by night is the single aircraft or a section of 3. Attacks are to be delivered by single fighters".

⁵ Bentley Priory, Stanmore

⁶ Light guns, such as the Bofors 40mm and the Vickers 2-pdr, were not included in these methods of control. Normally, these guns only went into action against aircraft visibly recognised as hostile.

⁷ "We are now giving our reply night after night. If the British declare that they will attack our cities heavily, then we will wipe out their cities" – Hitler in a speech, 4th September, 1940.

⁸ London (as the centre of British economic and social life) was attacked every night save 7 from 7th September to 7th November 1940 with an average of 166 aircraft a night (statement by Hauptmann Bechtle in his lecture).

⁹ On the morning of 6th June, 1940, a meeting was held at No. 10 Downing Street with the Prime Minister presiding to discuss this topic and to take measures to deal with those devices. (HCTD 5/321).

¹⁰ As the German attack was intensified, it became increasingly clear that enemy aircraft could fly in weather conditions under which our own fighters remained grounded, and while differences in the weather conditions prevailing over the Continent and over the British Isles could account for some of these occasions, the fact was that the German Air Force had made greater headway in the provision of night flying aids both in their aircraft and on the ground. This was the gist of the C-in-C Fighter Command's comments in his Progress Report rendered in October, 1940. He emphasised how the lack of proper night-flying facilities was hampering our night fighter defences.

¹¹ Flugsicherungsfrequenz – The standard wireless apparatus carried by German long range bombers was the Funkgerät 10 which had two frequency ranges: M/F-3 – 600 kc/s. H/F-3 – 6000 kc/s.

¹² Formed in July 1940, it was known as No. 80 Wing and was then commanded by W/Cdr E B Addison OBE.

CHAPTER 3

THE EXPLORATORY PHASE – 6 JUNE TO 7 SEPTEMBER 1940

Consequences of the German Victory in Europe

By the middle of June it had become apparent that the situation in Europe was undergoing a violent change. Soon Germany's Air Force possessed with the fall of France, Holland and Belgium bases which made every industrial centre in the British Isles vulnerable to attack by night if not by day. It was impossible to overrate the gravity of this situation. Even the Western and North Western parts of England, hitherto regarded as relatively immune from attack had now become threatened. Our Western ports to which shipping had more and more been diverted, the Estuaries of the Severn, the Mersey and the Clyde could be subjected to bombardment by night, a contingency that the Air Staff had not failed to envisage in their deliberations concerning the likely situations we might be called upon to face¹. Furthermore, the whole of southern England could now become a field of operations for the German bomber arm under strong fighter escort directed towards establishing the conditions required for launching an invading army across the Channel.

COS(40) 475
June 19, 1940

To redispense and strengthen the country's defences was a matter of paramount importance. The Fighter Command organisation was extended with the intention of protecting the west and south-west of England, and the number of squadrons in the Command was to be increased as quickly as aircraft, pilots and ground facilities became available. Greater efforts were made to hurry the moment when No. 14 Group in the north of Scotland could assume an operational role, the area of No. 10 Group was extended as quickly as possible to include Cornwall and No. 9 Group was formed to cover the west. But the organisation necessary for the exploitation of fighter defences takes time to prepare, and it was not until October, 1940, that an aircraft in No. 14 Group made an operational flight, while No. 9 Group assumed operational control on 1st December 1940. Meanwhile all defensive operations were carried on by the four Fighter Groups already established.²

FC ORB July, 1940,
Appendix G

The problems of the Command could be summarised without difficulty. The North Channel and St. George's Channel had both become vulnerable to attack, and this factor had in turn brought about certain changes in our main trade lines. To meet this situation certain re-arrangements within these established Groups was desirable. The Commander-in-Chief therefore summoned a conference of his Group Commanders to communicate to them the decisions adopted with regard to these re-arrangements. No. 13 Group was to include Turnhouse, Usworth, Catterick, Church Fenton, Squires Gate and Aldergrove (Northern Ireland), No. 12 Group was to be split down the middle and assume the important function of defending a long narrow strip facing east, while No. 11 Group was to keep Tangmere and Middle Wallop under its jurisdiction. No. 10 Group was to include Ringway, Ternhill, Castle Bromwich, St. Eval, Barnstaple, Filton, Pembrey and Anglesey. In due course, No. 14 Group was to include within its boundaries Aberdeen,

Evanton and Wick. The workings of No. 10 Group were brought under special survey, and various suggestions for increasing its efficient operation were to be put into effect as rapidly as possible in view of intensified German raiding of the south-western parts of the country. It was also hoped that the Navy's new routings of shipping to make the enemy's tasks of reconnaissance more difficult would be of benefit to Fighter Command.

DCOS (AA) 116

The campaign in France had made deep inroads into the resources of the Command, for the expenditure of fighter aircraft had been heavy, and the Commander-in-Chief, with the assent of the Chiefs of Staff, appealed successfully to the War Cabinet against the despatch of any more squadrons to the Continent, and against any further weakening of the country's air defence. On June 1st, a recommendation was made that certain anti-aircraft units comprising one regiment of heavy guns and several companies of searchlights should not be sent to France for the defence of base ports but should be retained for home defence. This was agreed, and these units were then assigned to give added protection to the aircraft industry. The Deputy Chiefs of Staff further recommended that all the new production of anti-aircraft equipment should be allocated to Home Defence, but this was not approved since many overseas centres were so weakly guarded. Finally about 50% of production was set aside for the Air Defence of Great Britain.

COS (40) 475
June 19, 1940

No changes in the basic deployment of searchlights³ was contemplated, for the searchlight zones were still incomplete by the standards laid down prior to the war, and there were unilluminated areas in the midlands and to the south of Liverpool. The first task of the searchlight organisation was thus to fill these gaps. Where the gun defences were concerned, however, it was decided to undertake considerable re-deployment. The Chiefs of Staff were particularly concerned about the further protection of the aircraft industry (a matter of prime importance), and felt that this additional protection could best be afforded by the provision of a higher concentration of weapons. Accordingly 116 heavy guns and 40 light guns were allotted to the defence of localities where the manufacture of aircraft and aero-engines was going on. The light guns had been brought back from Narvik, but the heavy guns could only be provided at the expense of other areas. Forty were supplied from London and from the East coast ports, by 11th July, over 300 heavy guns were emplaced for the protection of Derby, Birmingham, Coventry, Brockworth, Bristol, Southampton, Slough and Brooklands, the districts chiefly occupied by factories engaged in aircraft production.

COS (40) 547
July 13, 1940

AHB/11E/6 Encl.2
Feb. 27, 1940

As for the raid intelligence system, action was directed towards reinforcement of the west. No new plans were made, for it had been decided earlier in the year that radar cover should be provided off the coasts of Lancashire and of Wales. By the middle of July the radar chain stretched from Scapa to Strumble Head in Pembrokeshire, although the stations in the west, being of recent construction, were not working at their highest efficiency. A gap in Cardigan Bay, however, remained to be covered even as late as October. The Observer Corps had new groups

FC ORB July, 1940

Appendix A6

watching in Cornwall, South Wales and Scotland; but the groups in Cornwall and South Wales at first only reported aircraft movements off the coast and passed their information to the fighter stations at Pembrey and St. Eval; a group in North Wales was linked directly to the centre at Wrexham, and though all these groups had partly commenced their reporting activities by the beginning of August, communications were nothing like complete until some months later. Meantime Scotland was to have three new groups with centres at Ayr, Oban and Inverness, which could eventually cover the western half of Scotland between the Caledonian Canal and Ayr.

Ibid
Appendix G

Finally the balloon barrage was in the process of being thickened, and trials were proceeding to test the possibilities of producing a smoke screen haze during moonlight periods to shield vital production centres from well directed attack without embarrassing our own defences. Smoke screens, in fact, later took their place among our recognised method of night defence. But perhaps the most encouraging news which had been received by Fighter Command was that two fully equipped and armed Beaufighter aircraft were ready for their trials at Filton. There seemed ground for the hope that new night fighter squadrons consisting of these fast machines, superior in every respect to the Blenheim, would be coming into the line at an early date.

AHB/IIH/18
Dowding Despatch
234 et seq.

Apart from the inadequacies of the Blenheim as a night fighter, it would not be inappropriate to summarise again the chief difficulties to be overcome before Fighter Command could effectively meet the threat of German night attack. By the end of June it had become clear that the success enjoyed by the searchlights had been short-lived. By flying at greater heights and by employing tactics of evasion, enemy aircraft had managed to avoid illumination. The fitting of AI to Blenheims, however, held promise that an alternative system of operation against unilluminated targets could be developed, but the conditions to be satisfied before such interceptions could take place were formidable. The fighter had to be placed within several hundred yards of the enemy and on the same course, instead of the four or five miles which were sufficient against the illuminated target.

Many factors at this juncture stood to militate against success. In the first place the 'sound plot' track transmitted by the Observer Corps with a variable and unpredictable lag was too inaccurate for the purposes of controlled interception, nor were the height indications given by the Observer Corps little more than guess-work. Their raid intelligence was thus of small value to the controller endeavouring to position his fighter within AI range of the enemy.⁴ Earlier it had been found that even the tracks obtained by the coastal radar stations and the heights provided by them were not precise enough to effect successful AI interceptions to seaward. In truth we had not yet begun to solve the problem of continuous and accurate location, especially inland, and until this had been solved by means of GCI, we were unable to exploit our night fighters with any degree of success. In June, with the initial success enjoyed by the searchlights, our fighters claimed the destruction of sixteen enemy machines, but in July the monthly figure fell to four and did

not show any substantial increase until March, 1941, when GCI began to be effective in conjunction with AI-equipped fighters.

Operations between 6th June and 30th June, 1940

The weather over England was generally fair during the whole of this period. The first ten days were fine and clear, and conditions remained good until the night of the 21st. During the rest of the month the weather was cloudy, in the Eastern half of the country, but neither our own night fighters nor the German bombers were affected by this. German operations took place on one night only during this period, the 29th/30th, when the defending fighters were grounded, and they were on a small scale. On the other hand, the state of the moon appears to have conditioned this series of enemy attacks in June. After vigorous raids on the moonless nights of the 5th and 6th, there was a lull during the good weather of the next two weeks, the offensive only being resumed with deteriorating weather conditions, but when the moon was full. If the Germans hoped that the brightness of the full moon period (18th-25th) coupled with haze and low cloud would frustrate searchlight interception, they were wrong. The most striking feature of this phase of operations from our point of view was the success of the searchlight method of interception.⁵

AHB/IIG/1

AM Weekly
Intelligence
Summary Vol. 3
1940

A considerable number of German units participated in these actions although on no occasion were more than 70 aircraft employed. Our intelligence identified them as from KG 1, 4, 26, 27, 30 and 55. It seemed probable, therefore, that German policy was to form a nucleus of aircraft crews in each bomber unit experienced in night flying over England. And the possibility that some of these were trying out their techniques of blind-bombing and navigation must not be lost sight of. A great deal of the work, however, was carried out by KG4 which was thought to be operating partly from Stavanger, partly from Wittmundhaven and partly from Merville near Lille. These three airfields as well as the airfields at Schipol near Amsterdam and Evreux near Rouen were the chief bases used by the GAF in their operations against England.

Each enemy raider flew unaccompanied, but a number of aircraft frequently made landfall within a few minutes of each other and there were clear signs that operations on a number of nights, particularly the 25th and 29th, were carefully phased in time and direction, activity only commencing in one area after it had finished in another. On the 25th, aircraft of KG26, based at Stavanger, were over Clydeside and Southern Scotland before midnight; an hour later, activity was mainly over East Anglia; later still aircraft of KG1, probably from Evreux were flying over Dorset, Bristol and South Wales.

The points at which the raiders crossed our coast were notable for certain prominent topographical features being within sight of the great estuaries of the Forth, the Humber and the Blackwater. Their average flying height was 10,000 feet. Out of a total of 22 combats between night fighters and enemy raiders during the period, only 3 took place at

altitudes over 12,000 feet and 5 were at altitudes between 6,000 and 9,000 feet. German tactics, however, soon changed and operations in the future were conducted at much greater heights.

Distribution of Attack

During this period 13 airfields, 16 industrial plants and 14 port areas were bombed and it is of interest that the airfields were raided during the early part of the month, after which interest shifted to centres of industry and distribution. The steel works at Scunthorpe and Middlesborough and the Billingham works of the Imperial Chemical Industries were accurately bombed, but so small were the concentrations of bombs that it is difficult to infer that the Germans hoped for more than a slight dislocation of work both among the plants and ports singled out for attack. Numbers of bombs fell ineffectively in rural areas, giving rise to the view that German crews were not well trained for night bombing operations. The Ministry of Home Security suggested also that the Germans might be pursuing ends connected with the timing of invasion plans and that bombs were being dropped in open country⁶ where parachute landings would later take place. There is no evidence to support this view, but it does seem as if the German purpose was two-fold, firstly to intensify the training of their airmen in night tactics by giving them set operational tasks including experience in the use of blind bombing methods and navigational aids, and secondly to strike at morale and the general economy of the country by forcing the sounding of air raid warnings in more areas than the threat of attack fully warranted. If they were able at the same time to damage industrial plants and ports, so much the better.

From the 19th to the 25th, for example, they caused warnings to be extensively sounded, affecting areas not really threatened by attack. On the 24th/25th all districts south of a line between Hull and Liverpool were under 'red' warning although Bristol was the only area where the precaution was truly required. On the night following, sirens were sounded in practically all industrial districts save Lancashire, but in no area except the Potteries did public safety demand this. Some support for the theory that the enemy's intention lay in striking at morale and industrial efficiency by compelling civilians and workers to take shelter finds some support in our own plans at the time. Bomber Command's purpose was also to dislocate German economy by keeping her industrial districts under warning throughout most of the night, thus affecting the health and stamina of workers and civil population. The plan included an attack on one objective in fair strength each night, so that the German public could never be certain whether the sirens signified mere threat or attack. The British plan was to effect maximum dislocation at minimum cost and it is not impossible that the German planners were attracted by the same prospect, especially as at this early stage, the greater part of the GAF was re-equipping and reorganising after their arduous campaign in the West and only small numbers of aircraft and few crew were at their disposal for operations.

Ministry of Home
Security Daily
Appreciation
July 25

Plan WA8
AHB/11A1/9

New Policy of Air Raid Warnings

A new policy governing the sounding of sirens was therefore required, unless a small force of aircraft were to keep most of the country awake night after night with a corresponding decrease in the efficiency of workers, and a reorganisation of the air raid warning system was quickly effected. No fundamental changes were necessary, the new policy being based only upon the exercise of greater restraint in the despatch of 'red' warnings and a more frequent use of the cautionary 'Air raid warning yellow' message. The results were immediately noticeable. On the night of the 26th, Middlesbrough, Norwich, Ipswich and Portsmouth were the only areas under warning, yet enemy aircraft covered as much of the country as they had done on previous nights. The risk of bombs falling on places not under warning existed and Cardiff was bombed on the 26th/27th without the sirens having been sounded. Nevertheless, it was a counter to any German intention of sapping the efficiency of the population by keeping them in shelters throughout the night.

The Fighter Command Re-action to Enemy Operations

FC ORB
Appendices June,
1940

On one night only, June 29th/30th, were the enemy unhindered by fighter patrols, and the searchlight detachments, especially in the Eastern part of the country, had every cause for satisfaction. An average of 40 fighter sorties was flown on each night that the Germans raided in strength, these being equally divided between the 6 twin engined squadrons⁷ and 30 of the 49 Spitfire and Hurricane squadrons. All the combats that resulted were due to illumination of the raiders by searchlights, and only one pilot complained that he was hampered in his efforts by being himself illuminated instead of the enemy, although he flashed the agreed recognition signal. All other pilots who intercepted German aircraft praised the good work of the searchlights.

AWAS statistics

Six Blenheims, 3 Hurricanes and one Spitfire were lost during the month's night operations by the Command and 5 pilots and 5 air-gunners were killed. The enemy's losses for the month were claimed at 16⁸ aircraft destroyed, but only 8 of these could definitely be authenticated, prisoners having been taken from 4 aircraft of KG4 destroyed on the night of the 18th, among them the Gruppenkommandeur of 11/KG4; 2 aircraft of KG26 were shot down in the Forth area and one of KG4 in the Humber area on the 25th/26th, while another of KG4 was brought down off the Tees the following night. Only one of the raiders was destroyed by anti-aircraft fire, Blenheims destroyed four, and Hurricanes and Spitfires three. Fourteen other raiders were attacked, but it is not possible to say more than that some of them may well have failed to reach their bases.

These results were encouraging. Searchlight interceptions had worked well, our own aircraft with a single exception had not been illuminated as feared, and interceptions had been achieved in weather conditions that give little help to the lights, since it happened to be the full-moon period. The performance of the fighters also gave cause for encouragement. But as we have observed, the searchlights were immediately afterwards reduced to impotence by the increased heights at

which the enemy began to fly, and by his tactics of evasion. And although the Commander-in-Chief, Fighter Command, in close consultation with the General Officer Commanding Anti-Aircraft Command tried out every conceivable means of operation to make searchlight-assisted interception efficient, no success was achieved.

Policy for the Expansion of the Air Defences

Preliminary to The Battle of Britain pp 11, 12

Throughout July and the early part of August, while the German night attack was developing from sporadic raiding into a settled policy of attrition, the air defences of the country were being strengthened and reorganised in the light of plans drawn up in June, but nevertheless there were many gaps in the ADGB system and the Chiefs of Staff decided to assess the scale of air defence that the new situation demanded, obvious though it must have been that at existing rates of production even the old scale, much less a new and larger one, could hardly be completed for many months. The review they compiled was circulated on 16th August, and became the basis for the expansion of our air defences.

COS(40)632

It was considered inadvisable to attempt to estimate the full number of squadrons required to meet the heaviest scale of attack that the Germans could mount, until we had had some experience of the effect of intensive air attack upon our defences and upon the national economy. Nor was such estimation necessary. Fighter Command was expanding with great speed and, at that time, had the equivalent of 71 squadrons, though many of these were not yet fit for operations. However, anticipating the formation of new squadrons, plans for the extension of the ground organisation could be prepared. Accordingly, new sectors were recommended for north-east Scotland, Ayrshire, and most of the coastal counties of the West and South West and work on these sectors and the requisite communications had begun.

COS(40) 269TH
Meeting 17 August

The question of the ratio of long range and short range fighters had had to be decided. Since the collapse of France every squadron added to Fighter Command had consisted of single-engine fighters and there remained only six twin-engined squadrons in the line. The Chiefs of Staff confirmed this policy, saying that "whereas for the present phase it suited us best to have a preponderance of short range fighters, we might need a larger proportion of long range fighters in the future. There would be little difficulty" they went on, "in increasing the number of long range fighters if the present proportion proved insufficient". The wisdom of such a decision could not be questioned since only in a sustained day offensive could the enemy bring our fighters to battle and defeat them. Moreover, to have maintained a higher ratio between single and twin-engined fighters would have meant increasing the quantity of Blenheims available, an aircraft not very satisfactory as a night fighter and of no value in day combat if opposed by the single-engined machine. Unfortunately when the night attacks on towns and cities commenced and the need for twin-engined fighters became pressing, their provision was extremely slow, chiefly because the aircraft industry had concentrated on the manufacture of a great force of single seater fighters.

Ibid

The improvement of gun and searchlight defences rested on two principles, firstly that searchlights should be provided for all parts of the country over which the raider could fly to reach important objectives, provided their deployment was practicable; secondly that gun defences were to be allotted to all communities of any size engaged in industrial work of national importance.

It was calculated that 150 extra searchlight batteries, consisting of nearly 4,000 projectors would be essential. Of these, 87 batteries were required to complete the Aircraft Fighting Zone, and their provision was to receive priority over the provision of the 12 batteries that were to constitute a mobile reserve, and the 60 needed to increase the density of searchlights in gun defended areas. It was hoped, however, that the use of GL Mark II,⁹ the radar equipment for the control of gunfire against unseen targets would make it possible to omit this last requirement.

Extra guns were needed on an equally large scale. 856 heavy guns were wanted to strengthen the defences of places open to heavier attack than when their defences had first been planned, while 672 guns were wanted for hitherto undefended districts. The chief places in this category were the Lancashire towns and the smaller towns in the Midlands such as Leicester, Peterborough and Northampton. In addition, 425 vulnerable points were added to the list of small targets requiring defence by light guns, and 2,550 guns of 40 mm calibre were therefore demanded.

Such additions made the total authorised anti-aircraft defences of the country 3,744 heavy and 4,410 light guns. But this was not all. Eight thousand UP projectors¹⁰ were ordered, their object being defence against low-flying attack. It was hoped also that a multi-barrelled projector would be designed and produced for increasing the density of fire over large targets.

Finally it was decided to increase the strength of the balloon barrages. New barrages were planned, chiefly for the protection of ports, harbours and anchorages against mine-laying aircraft. Six hundred balloons would be needed, making the operational strength of Balloon Command 2,600 balloons, with a similar number in immediate reserve.

This vast programme would certainly require an increase in the number of higher formations, especially in Anti-Aircraft Command, which would probably require five more divisions to absorb the additional weapons which it was to receive. The Chiefs of Staff, therefore, thought it proper to emphasise the principles which had governed the growth of the ADGB system

These were:

- (i) that the AOC-in-C Fighter Command must have a single anti-aircraft commander to deal with
- (ii) that the location and boundaries of anti-aircraft corps and divisions must largely be dictated by the necessity for close co-

operation with Royal Air Force Groups.

At existing production rates, it would have demanded years to execute these plans, especially for heavy anti-aircraft guns.¹¹ But the historical importance of the recommendations by the Chiefs of Staff lies in their definition of the maximum insurance for the air defence of the country in the serious situation which faced it following the fall of Europe into German hands, having in mind the power of the enemy gradually weakened. And finally they show to what an alarming degree our industry would have been absorbed in the manufacture of weapons of a mainly defensive character, not forgetting the employment of numbers of men in the armed forces on mainly defensive functions.¹²

Operations between 1st July and 10th August, 1940

AHB/IIG/1
AMWIS No. 44
1940

Towards the end of June, certain German units had been identified as operating against this country by night. On 25/26th KG1 had flown from a base in the Amiens area, while KG26 had flown from a Norwegian base. The night following KG26 was again known to be taking part in the raiding, flying probably from Stavanger while KG26 also participated, using a base in the Lille area. On the night of the 29/30th, KG4, KG26 and KG55 were active. Before 27/28th June, German interest had centred around the Eastern Counties and against South-east England, with aerodromes as a special objective, possibly in the hope that this would interfere with our night offensive against Germany, possibly in the hope of discovering the location and character of our night flying aerodromes.

Ministry of Home
Security Daily and
Weekly
Appreciations
July 1940

In early July, however, the enemy turned his attention to the reconnaissance of docks and industrial regions, mainly in the area of the Bristol Channel, including the neighbourhood of Cardiff and Bristol, bearing out a forecast made by our Intelligence who declared that aircraft movements towards Central and Northern France and the course of enemy aircraft on night raids indicated a probable line of attack towards the Western harbours and the Midlands. The enemy was using a route over Dorset and Somerset, aided perhaps by such excellent landmarks as Portland Bill, by four lighted buoys in the Bristol Channel and the glare from the works of the Guest Keen & Nettlefold works near the docks at Cardiff. The route may also have been chosen to keep their forces clear of our main defences in the South and South East. In any event it was the most direct approach to the West Country for aircraft operating from Normandy.

There was no attempt to achieve any concentration of effort, aircraft operating singly and in twos and threes and if the Germans had an aim, it seemed to be an intensive reconnaissance by night, bombs being dropped as a secondary aim at widespread points, sometimes on specific targets, sometimes apparently haphazard. Crews were no doubt familiarising themselves with the operational area during the progress of these raids and night defences were being tested, while public demand for an attack on the 'final enemy', England, was at the same time being satisfied, during a period when the main force was being built up and

AHB/IIG/1
AMWIS No. 44 1940

1940

consolidated on newly captured airfields in occupied territory. It was well known that transport activity at this time was intense, the chief aerodromes being supplied by air with fuel, crews being moved in transport aircraft to forward bases in order to overcome delays that movements by road would meet owing to the destruction of highways, railways and bridges during the recent land battles. The hindrance of production by causing prolonged periods of alert and the added alarm that bombs dropped from time to time would occasion were also doubtless objectives in these night attacks and morale was thus being put to test.

Ministry of Home
Security Daily and
Weekly
Appreciations
July, 1940

Apart from docks and industrial districts, communications also attracted the attention of the night bomber. The road bridge over the GWR's line at Newton St. Looe was accurately bombed on the night of 2nd July, while on the night following bombs fell in the vicinity of railways between Cardiff and Penarth, Newport and Gloucester, near Filton an important junction, between Bath and Radstock, near Nailsea, Shepton Mallet, Dawlish, Wimborne, Salisbury, Micheldean, close to Winchester, and between Newcastle and Thatcham, while the Tyne Bridge at Newbury escaped by the narrowest of margins. These railways round about Bristol, Bath and Radstock were extremely sensitive points in the West Country system of communications, carrying heavy dock traffic to the East and South and coal to the Western ports. The enemy's intentions at this stage seemed to be represented by his careful reconnaissance of railways. He may well have had it in mind, if invasion were undertaken later, to immobilise these railways by determined attack, virtually cutting off Southern and Eastern England. On the night of 4/5th July, incendiary bombs fell in the North Kent marshes which seemed to have been meant for the marshalling yards at Faversham.

Experience of these raids had already shown that in the interests of public morale the rapid standard of repair achieved by local authorities should be maintained. People 'felt better' about streets cleared of rubble and debris. It was shown also that the presence of good defences helped to keep up spirit, based largely upon the idea that they were 'hitting back'. One other lesson learned was the vulnerability of gas, water and electricity mains. During the period between 7th and 14th July, 960 high explosive and 534 incendiary bombs were reported to have fallen while 3 people were killed and 61 injured.

Home Security
Weekly
Appreciation 7-14
July & FC ORB,
July, 1940

Between 4th July and 13 July poor weather conditions with low cloud and little moonlight seemed to frustrate the enemy. No serious attacks took place. Day reconnaissance seemed to be for the purpose of assessing damage done by night. Intelligence sources reported GAF bomber units to be concentrating between Paris and Brussels, while two long range Goswader remained in Norway and Denmark. On the night of the 13th, Aberdeen was raided between 0119 and 0125 hours, Russell's shipyards were hit, 29 persons were killed and 103 persons were injured. Unfortunately no red warning was in operation at the time of the raid or the casualties might well have been lower. On the night following, Avonmouth was attacked, resulting in damage to railways which was quickly repaired. Both areas thus continued to be a major attraction for

the enemy night flyer, perhaps because waterside targets were easier to locate than inland ones where effective blackout would make accurate target finding difficult.

Ibid

As a counter-measure to attacks on South Wales port installations, a new balloon barrage was flown to protect Barry docks. Until 21st July, nevertheless, comparatively few bombs were dropped, and Home Security sources estimated them to be 140 high explosive and 100 incendiaries. Apart from Avonmouth Docks, the British Oxygen Company's works near Plymouth received serious damage. Water, gas and electricity mains again proved most vulnerable. An interesting feature of activities was the glaring error in a German communiqué of the 12/13th showing confusion between the Tay Estuary and the Firth of Forth. Similar confusion had earlier been shown between Hartlepool and Billingham, and Newport and Cardiff.

On the night of the 21st, in propitious weather conditions, a factory at West Hartlepool was demolished by high explosive, Swansea Docks and Falmouth Docks were attacked, and railways again suffered. The night following railways were once more affected when the Derby L.M.S. shunting lines were hit. During the last days of July further damage was sustained by railways between Neath and Port Talbot and in the neighbourhood of Merthyr Tydfil. Barry Docks and Swansea Docks were again bombed without great consequence.

FC ORB June 1940
also Appendices to
ORB June 1940

Nothing fresh could be said of German tactics although some of their aircraft were stated to have approached targets in a glide from 12-15000 feet with engines off. This may have been to confuse ground observers who plotted by sound at night or to trick the searchlights which followed targets with sound locators. On the night of the 27th, 6 enemy raiders flew from bases in Belgium to Cherbourg before setting out to attack the Western Counties but this could well have been a normal reinforcing measure or an attempt to give units operating against other parts of the country an opportunity of familiarising themselves with a new area. About this time also intensive transport activity in the Paris area was noted, enemy aircraft moving in from North West Germany. Counter-measures on our side to this activity were slight, a balloon barrage being flown at Liverpool on the 23rd, supplemented by a waterborne barrage. Belfast and the Belfast Lough areas were now declared night artillery zones, and the Air Ministry notified Fighter Command that the defence of the Bristol Channel Ports had been strengthened as far as possible, but that little more could be done until the UP weapon became available.

Claims by Fighter and Gun Defences

During July Fighter Command had flown an average of 23 sorties a night for 13 nights of the month, a total of 278 sorties being made on these 13 nights. It was not until the 21st November, that any success came. A Blenheim of No. 25 Squadron claimed to have shot down an enemy seaplane, probably engaged on minelaying off Harwich. On the 22nd, a notable enough event occurred when the first enemy aircraft was claimed to have been destroyed with the help of AI by a Blenheim of the

Appendices to FC
ORB July, 1940

Fighter Interception Unit at Tangmere. The Blenheim, vectored by Tangmere Sector Operations Room on data supplied by the radar station at Poling contacted an aircraft on its AI equipment and altered course for an interception. After four minor alterations of course had been made on the instructions of the AI operator, the aircraft was spotted by the observer and identified as a DO17. An attack was made and many hits were observed before the Blenheim broke off the engagement. The two other successes of the month went to single-engined fighters. On July 24th a Spitfire of No. 602 Squadron on patrol from Turnhouse destroyed a Heinkel 111, three survivors of the enemy crew being found, and on July 26th a Hurricane of No. 87 Squadron destroyed another Heinkel 111 over the Bristol Channel.

Anti-Aircraft Command claims for the month were equally modest. On the night of the 19/20th the guns destroyed a Heinkel 111 in the Tyne area, the crew of which were rescued by a ship the following morning. On the night of the 20th a German aircraft of unknown type it was claimed fell to the guns a mile off-shore from Harwich. Four nights later the Mersey guns claimed a Dornier 17 and on the night of the 27th the Tyne guns claimed a further success.

Ironically enough almost as many enemy machines as either fighters or guns could claim to have destroyed became casualties for undetermined reasons. On the night of the 1st, a Heinkel 115 came down into the sea off Whitby because of engine failure, the crew later being brought into Grimsby.

Summary of Enemy Intentions

AHB/IIG/1
AMWIS No.44 1940
and FC ORB and
Appendices

Summing up, it seemed as if German night operations over land during the month were in the nature of tactical experiments to determine future policy. The consistency of the mine laying effort, however, was noteworthy, Belfast was mined on the 18th and Liverpool Port was badly affected, while the Thames Estuary, the Humber, Harwich and Western Waters also continued to figure among areas to be mined. Of the units participating, Coastal Unit 106 and Gruppe 126 were identified, and it was thought that Gruppen 506 and 806 also played their part. I KG40, equipped with the four engined Focke Wulf Kurier, was discovered to be operating from Marx in North West Germany and with another formation were suspected of participating in mine laying activities.

By the beginning of August it became clear that the enemy had certain recognised tracks for his night bombers, by Devon to the Bristol Channel and up the Welsh border to Chester and Liverpool. There were also the approaches inland from the Humber and Tyne, and a new tendency to fly over the industrial Midlands. Air transport activity from North West Germany to the Paris area had decreased, but there was an increase of traffic towards North Western France and Belgium, indicating that the preparation of main supply bases had given way to the preparation of operational bases from which attacks on this country would be launched.

FC ORB, July &
August, 1940

Meanwhile, interesting light was cast on enemy activity until this point by Göring in an interview with an American correspondent, when he declared that operations up to the beginning of August were merely armed reconnaissances, but that these would soon end and air warfare against England would start to play its prime role. General Zander, the AOC of the German Coastal Command added an instructive comment, saying that the policy from now on would be blockade with air attack, and he may well have had in mind the recent addition of a new unit, KG4, to his already sizeable mine-laying force, bent no doubt on throttling sea communications. Dr. Ley finally added his voice to those of Göring and Zander, declaring on 4/5th August that an aerial Blitzkrieg against England was about to commence. There were unquestionable signs, outside these straws in the wind, that the GAF was indeed about to deliver its greatly publicised attack upon us.

Until 9th August, though air activity at night showed an increase, few bombs were dropped. On the 4th 71 areas were under purple warning while on the 8th, 66 areas were under purple warning. Many leaflets were showered in various districts giving extracts from Hitler's Reichstag speech and imploring our surrender. On 8th August the Port of Liverpool had to be closed owing to heavy mining but this was probably the most important result achieved by German night activity during the period. Home Security sources estimated that 731 night explosive and 771 incendiary bombs fell on the country between 28th July and 7th August and that 583 purple and 135 red warnings had been given. 10% of the high explosives were stated not to have exploded while many incendiaries were also ineffective.

Activity continued to increase and on August 9th Birmingham was bombed, the raiders coming in over Devon and North Wales, over Liverpool and Leeds, causing many purple warnings to be issued. The damage to industry in Birmingham was not serious, but there was considerable damage to private property. On the night following, activity again showed an increase and Wallasey was bombed.

From June until 10th August may therefore well be regarded as a period of preparation for the GAF, the scale of night attack gradually mounting, and with evidence accumulating from early in August that the expected onslaught was about to commence. By 8th August the main battle by day had been joined, with the night attacks for the time being playing a subsidiary role.

Operations between 10th August and 7th September, 1940

The feature of enemy night operations during the early part of this period was the wide range of targets selected for attack. The bomb tonnage dropped in relation to the number of aircraft estimated to be operating was small and, with few exceptions, raids retained the character of armed reconnaissances¹³ covering most of the country south of a line between the Mersey and the Humber, including South Wales – frequently visited – and the North East coast, Scotland being almost unaffected. Yet a small measure of concentration on certain regions was

Min. of Home
Security Daily and
Weekly
Appreciations June-
September 1940
Key Points
Intelligence
Summary, 1940

discernible. Up to 17th August Cardiff, Swansea, Portsmouth and East Kent received the greater weight of bombs, between 17th August and 24th August most bombs were put down in Cardiff, Swansea, East Kent, South London, Essex and Norfolk. From 25th August, however, operations were concentrated against certain precise target areas and until 7th September (when the attack on London commenced), a few cities suffered the chief attack.¹⁴ In addition there were two further zones which seemed to have been earmarked for attention, the first from the north to the south coast of Cornwall, the second from the southern side of the Bristol Channel to the coast between Portsmouth and Portland. Between 24th and 31st August, for example, the highest density of bombs fell on London, Liverpool and Plymouth and on an L-shaped strip, the base of which was the coast between Portsmouth and Portland, and the vertical stem a strip of the country running through Bristol, Birmingham, Derby and Sheffield. Kent and Sussex were also much under bombardment. Between 31st August and 7th September, Liverpool was strongly attacked, but London, the south coast of Wales, Essex, Kent and Surrey also suffered.

It is evident from this survey that the Southern Railway's system had been most severely tested by the bombing during the period, and that the Great Western Railway's system had not escaped. In fact, fewer goods had been transported over the two systems since the raids on London and the southern counties had begun, and some part of this decline could unquestionably be attributed to the effect of disturbance and damage by enemy bombs. But it was in no sense a dangerous decline, the quantities of goods safely carried being well in excess of the safety margin.¹⁵

Harbours which had been raided equally showed no dangerous decline in the inward and outward clearances of goods,¹⁶ though such a decline was noticeable in the case of the Welsh ports which had been consistently bombed. This was, however, well accounted for by the restriction of imports and the rapid fall in exports, especially as more entering cargoes had been cleared at Welsh ports during the months of bombardment than had been cleared when they enjoyed freedom from attack.¹⁷

These were heartening pointers, for though bombardment might have lowered the turnover at some harbours, it seemed unlikely that the flow of essential cargoes would be interfered with to stopping point unless enemy attack was intensified to a far greater degree than could then be anticipated. The same applied to railways. But our worst fears were never realised, and the rapidity with which damage to railways could be repaired was surprising.¹⁸ Similarly enemy attack had so far produced no serious effect upon the production of our essentials of life. Food and textiles were being produced normally, while variations in the output of coal, iron, steel and machinery showed no marked difference from the variations to be expected under more settled conditions.¹⁹

If, therefore, the enemy's plan of night operation resembled our own, and if they were hoping to affect our industry and our economic life by

subjecting working people to unendurably long hours of alert and alarming them by widespread bombing that grew in concentration, the assumption had to be that they had thus far been unsuccessful. If the enemy's further objective was to prepare for invasion by dislocating our systems of distribution and supply, the assumption once again had to be that he had so far failed. The attack on airfields²⁰ might have been pursued with the object of minimising our own bomber offensive or it might in some way have been connected with the German policy of day attack which was to destroy the airfields covering London preparatory to invasion.

Commencement of Major Attacks

Up to 25th August, no urban area had suffered attack by night from more than twenty aircraft, but from that date what may be well described as major attacks commenced. These were made against Merseyside towards the end of that month, and on each occasion over one hundred tons of H.E. bombs were dropped.²¹ About 100 aircraft took part in the first of the raids, while 137, 109 and 107 aircraft were believed by the Germans to have bombed their targets on the three subsequent occasions. In fact, many of their crews completely failed to locate their objectives. Until 7th September when a major bombardment of London was made, concentrated nightly attacks were carried out by between 30 and 60 aircraft each dropping approximately a ton of bombs.

Our Failure to Appreciate Enemy Intentions

It is clear, however, that we did not then fully appreciate this turn in German policy towards major attack of a concentrated variety, even if there was an awareness that a heavier weight of bombardment was being brought to bear on industrial and commercial targets. It was hardly appreciated that Merseyside had been the objective in four successive major attacks and the Ministry of Home Security summarised the activities on these nights as follows:

- 1st attack – "... the Midlands being the main objective"
- 2nd " - "... areas mainly attacked were the Tyne and Hartlepool, South Wales, Liverpool and Manchester. No serious damage was done."
- 3rd " - "...Considerable bombing occurred in London and the Midlands, Manchester, Wrexham, Derby and Nottingham being mainly affected."

Fighter Command and AA Command tracks showed that the main direction of German aircraft had been towards the North West, but they had been unable to gauge that the enemy's intention was to concentrate more than half his force against Liverpool. The confused nature of overland tracking, made even more confused by the widespread character of the German operations (apart from the attempt to move on the Liverpool area), would easily account for this lack of precise knowledge of the enemy's intentions, while his failure to achieve the concentration he had planned helped involuntarily to baffle our raid

Home Security
Daily Appreciations
August 1940

intelligence, for, as remarked, a large proportion of his crews did not find their targets during the Merseyside attacks, even if these were taken to be in an area within a ten mile radius of Liverpool. On the 29th bombs fell to the east of Liverpool, in Widnes, St. Helens and Wigan, and to the south in the rural districts of Cheshire. In Merseyside proper there was desultory bombing, consisting chiefly of incendiaries which fell near the Rootes aircraft factory at Speke, in Halewood and Netherton, at Ellesmere Port and Stanlow, where four oil tanks were hit. In all barely 50 tons of bombs were dropped compared with the 130 tons the Germans believed they had dropped. It seems safe to say that the small numbers of high explosives which fell at Wrexham, Stoke-on-Trent, Bridgnorth and Ledbury were unloaded by crews under the impression that they were on their primary target, Liverpool.

Prolonged Warnings Through Nuisance Raids

The effect upon the Air Raid Warning system of German nuisance raids (Störangriffe) is worth observing. Industrial districts, though only lightly attacked – if at all – were kept under red warning for long periods. On the night of 31st August, when the scale of enemy activity was low and when activity was chiefly directed against Merseyside, and the West Riding, the following ports and industrial towns were under public warning:

| | <u>Duration of Warning</u> | | <u>Duration of Warning</u> |
|----------------|--------------------------------|----------------|--------------------------------|
| Liverpool | 6 hours | Coventry | 5 hours |
| Manchester | 4 “ | Leicester | 2 “ |
| South Wales | 4 “ | Derby | 2 “ |
| Portsmouth | 5 “ | Humber | 5 “ |
| Central London | 6 “ | West Riding | 2 “ |
| Norwich | 5 “ | Middlesborough | 4 “ |
| Birmingham | 5 “ | Newcastle | 2½ “ |

Min. of Home
Security Daily and
Weekly
Appreciations
August, 1940

Towards the end of the period under review, the enemy tried a new way of imposing a sustained strain on communications and upon industrial and social life, by the use of delayed action bombs on an ever increasing scale, sometimes with an interval of up to 80 hours before explosion took place. Bomb disposal squads were quickly organised, but their numbers were not great enough to deal with the quantity of bombs dropped. Great inconvenience and hardship were caused by the compulsory evacuation of persons from the threatened areas, and by the diversions of road and rail traffic. The tempo of life and work was slowed down by this new German move which was much in keeping with the policy of “nuisance” raids and the attempt to dislocate production.

We have seen how the night bombardment had changed its character towards the end of August when a greater attempt was made to concentrate attack and damage definite areas, especially urban areas in which industry was centred. An exploratory phase was, in fact, coming to

AHB/IIG/1
AMWIS No. 50
August, 1940

an end, and the Luftwaffe was beginning to undertake a great night assault. Nevertheless it is worthwhile making an assessment of what this exploratory period accomplished for the enemy. Preparatory to intensive operations it was obviously desirable to let aircrews acquaint themselves with the area in which they were going to operate, and to let them gain a first-hand knowledge of the weather conditions over this country.

Secondly, weaknesses in the defences could be sought out and carefully noted and, lastly, aircrews could learn the proper use of the navigational and blind-bombing aids provided for them. Indeed, prisoners of war had upon interrogation revealed that they were made most carefully to study the country they were to fly over, observing particularly such landmarks as lakes, rivers, estuaries and arterial roads. They were also instructed by their more experienced colleagues who imparted the lessons they had learned. The need for strict wireless discipline was emphasised in order to afford our Wireless Intelligence Service as few opportunities as possible.

AHB/IIE/28/1
Encl. 3

Certainly the initial successes achieved with the aid of radio navigational devices were striking²² enough to make the Commander-in-Chief, Fighter Command declare that "the enemy can traverse this country unimpeded at night, and can find his way to the immediate vicinity of his objectives by means of radio navigational facilities. He is not at the moment²³ doing us serious damage because he cannot see his objectives when he reaches them. There is no reason to suppose that this state of affairs will continue, and yesterday for the first time I saw a report that he had begun to use flares to illuminate his objectives". He considered that insufficient measures were being taken to jam enemy beacons of which there were at least 80, and suggested that 5 or 6 BBC broadcasting stations should be taken over and fitted with jamming gear. The Commander-in-Chief's tone suggests that the poor performance of our night defences and the small prospects of any immediate improvement were not far from his thoughts. The menace was a very real one. However, our counter measures which were being quickly organised were gaining ground and by 18th August, nine Beacons were in action and sufficient information about German beams had been acquired to determine that their sources were at Bredstedt, Cleve, Dieppe and Cherbourg, and from about this date also radio counter measures were regularly employed and began to show signs of inconveniencing the enemy. As for his flares, immediate orders were given to battery commanders that they should as quickly as possible be shot out of the sky. Meanwhile uncertainty about the advantages of using searchlights at all was greater than ever, since their presence alone indicated a well defended area and their illumination might disclose to the enemy the targets he was seeking. By way of compromise it was decided that searchlights would be better dowsed in cloudy conditions when the possibility of their successfully exposing on an enemy machine was not great.

80 Wing ORB
August, 1940

FC/S.20305 Ops 2
August, 1940

Increasing Scale of Attack

German aircraft as usual operated in ones, twos or at most threes, but the number used during a single night's operations was always on the

increase, until as many as 200-300 raids were being plotted on the Fighter Command table through the hours of darkness. The enemy seemed to favour certain routes, including the line Portland – Bristol Channel – Wales – Liverpool and the line Alnmouth – Lancashire districts and when he made landfall about 13000 feet seemed to be his customary height.

In addition to the attacks on land targets, mine-laying and anti-shipping operations were pursued with unabated vigour. Gruppen 126 and 106 and KG4, continued to mine the Estuaries of the Thames, the Humber, the Bristol Channel and the Mersey, and on the night of 27th August torpedo-carrying aircraft of KG30 attacked two merchant vessels totalling 11,700 tons in an outward bound convoy off the Moray Firth, one of 10,000 tons being set on fire and beached near Kirkwall. To this kind of operation, Fighter Command had no answer. It had been agreed that fighter protection of convoys by night was a waste of effort since pilots were not likely to see the hostile machine quickly enough, if at all, to engage. Thus ships had to rely on anti-aircraft fire and any other lethal devices they carried for their protection, as well as upon the armament of their escorts.

During August Fighter Command saw small return for their attempts against the night raider. 828 sorties were flown on 26 nights of the month, an average of about 31 sorties a night, and there were claims to the destruction of 4 enemy aircraft, only 3 of which were allowed. On the 18th, a Blenheim of No. 29 Squadron²⁴ claimed the destruction of a Heinkel III off Spurn Head, and this squadron again claimed the destruction of a further Heinkel III in the Humber area on 25th August. The two remaining successes of the month went to single-engined machines, a Hurricane of No. 615 Squadron claiming the destruction of a Ju 88 near Godalming and a Hurricane of No. 87 Squadron claiming the destruction of a Heinkel III which crashed at Wimborne in Dorset from which five prisoners were taken. Sixteen hostile machines were claimed as destroyed by the AA guns and 4 other German aircraft it was claimed fell to other causes, making a total loss of 23 machines to the enemy for the whole month.

¹ See AHB/11/H144 – Appreciation of the Situation at 15th April 1940.

² Nos 10, 11, 12 and 13.

³ 4,000 searchlights were available on June 1st.

⁴ Equal to the height at which the fighter was flying but subject to a maximum of two miles on the Mark III AI equipment then in use.

⁵ Air Chief-Marshal Sir Hugh Dowding's Despatch on the Battle of Britain (232-234): "We relied on daytime interception methods, and on the searchlights to illuminate and hold the bombers. If they were capable of doing this all would be well, since the distance at which an illuminated bomber can be seen by night is comparable with the range of visibility by daylight. The first night attack worthy of the name was made in June and the results were encouraging. Aircraft were well picked up and held by searchlights and 6 were shot down. The attack was, however, made at comparatively low altitudes (8000-12000 ft.) and the Germans, profiting by this lesson, resorted thereafter to greater heights at which the searchlights were practically ineffective. In close consultation with myself General Pile (GOC-in-C AA Command) tried every conceivable method of operation but without material success".

⁶ Decoy aerodromes for the RAF stations at Cottesmore and Dishforth were attacked during June.

⁷ Two Blenheim squadrons, Nos. 600 and 604, operating from Manston in No. 11 Group carried out offensive patrols over enemy aerodromes near Lille and St. Omer, used by the Germans for night operations. They were therefore the first units of Fighter Command to be employed on what became known as "Intruder" Operations.

⁸ AWAS statistics accept this figure.

⁹ GLII was deployed round London in March, 1941 (GOC in CAA Command's Despatch)

¹⁰ At this stage of development of the UP weapon there was no means of ensuring fragmentation of the projectile casing. Consequently its use for the protection of inland targets endangered the population (COS 40 800 4th Oct.). Until this difficulty was overcome, UP weapons were only deployed for barrage fire to seaward of coastal targets. And even in this role they were not available until 1941.

¹¹ The average monthly additions to Anti-Aircraft Command between 30th June, 1940, and 28th February, 1941, were 44 heavy guns.

¹² By the end of 1939, 850 heavy guns, 510 light guns and 3361 searchlights were deployed. By July 1940, 1200 heavy guns, 549 light guns and 3932 searchlights were deployed. By May 1941, 1691 heavy guns, 940 light guns and 4532 searchlights were deployed although man-power shortage caused a reduction in the number of equipments in action before May, 1941. In July 1940 for example there were 157,319 persons employed in AA Command but by May 1941 this figure had risen to about 300,000. (General Sir Frederick Piles Despatch).

¹³ The Germans described their raids designed to interfere with sleep and production as Störangriff – dislocation and nuisance raids.

| | | |
|----------------------|-----------------|----------------------------------|
| ¹⁴ August | 25/26 | Birmingham, Coventry |
| | 26/27 | Birmingham, Coventry, Plymouth |
| | 27/28 | Birmingham, Coventry, Portsmouth |
| | 28/29 | Merseyside |
| | 29/30 | Merseyside |
| | 30/31 | Merseyside |
| | 31/Sep 1 | Merseyside, West Riding |
| | September 01/02 | Swansea, Bristol |
| | 03/04 | Merseyside |
| | 04/05 | Merseyside, Bristol |
| | 05/06 | Merseyside |
| | 06/07 | London |

Note: The raids on Birmingham were carried out by crews (including some of KGr 100) who had earlier been briefed to attack the Castle Bromwich district and in particular the Nuffield Aircraft Works, which had been fairly badly damaged, one large shop being put out of action for a week.

¹⁵ (Merchandise carried by thousands of tons)

| Figures for four weeks ending: | <u>GWR</u> | <u>SR</u> |
|--------------------------------|------------|-----------|
| 13 th July | 1011 | 178 |
| 10 th August | 936 | 179 |
| 7 th September | 952 | 163 |

¹⁶ Arrivals and departures of shipping with cargoes (thousands of tons)

| | <u>Liverpool/Manchester</u> | <u>Swansea, Cardiff</u> <u>Newport</u> | <u>Bristol</u> |
|--------|-----------------------------|---|----------------|
| May | 1616 | 772 | 213 |
| June | 1553 | 762 | 221 |
| July | 1688 | 478 | 190 |
| August | 1540 | 485 | 229 |

¹⁷ In March, April and May, when free of bombing, 550,000 tons of cargo arrived at Swansea, Cardiff and Newport. In July and August, when these ports were under attack, 394,000 tons of shipping with cargo arrived.

¹⁸ In his book "Bomber Offensive", Marshal of the Royal Air Force Sir Arthur Harris draws attention to this point.

Table showing coaching mileage of the four main Companies. The drop on the Southern Railway occurred after 7th September, and not during the period under review.

| Four weeks ending | Coaching Traffic by Thousands of Miles | | | |
|---------------------------|--|------|-----|-----|
| | LMS | LNER | GWR | SR |
| 13 th July | 1347 | 996 | 632 | 867 |
| 10 th August | 1351 | 981 | 613 | 863 |
| 7 th September | 1349 | 977 | 614 | 847 |
| 5 th October | 1298 | 937 | 619 | 677 |

¹⁹ The Ministry of Home Security, Key Points Intelligence Surveys for 1940 and 1941 are reproduced in Appendix I. They deal fully with the effect of enemy bombing on our vital industries.

²⁰ The Air Ministry Department responsible for camouflage and deception reported that 29 decoy airfields were attacked by night during August. On the night of 26th August, for instance, the enemy attempted to bomb 6 of our

bases including Worthy Down, Boscombe Down, Witney, Brize Norton, Filton and St. Eval. St. Eval escaped, but its decoy airfield was set on fire by an aircraft of KGr.806 and bombed by other machines of this unit which were following up. Six craters were counted the next morning.

²¹ German records show that any attack in which 100 tons of HE bombs was dropped was regarded by them as a major effort. Other German documents show that 103 tons of HE bombs and 6800 incendiaries were launched at the Liverpool area on the night of the 28th. On the two succeeding nights 130 tons of HE and 11,200 incendiary and 127 tons of HE and 8100 incendiaries were dropped. The units participating were drawn from Luftflotte 3 only. The second attack was shown to have been made by all Gruppen of KG27 51, 55 and Lehr 1, KGr100, 606 and 806 also being involved. 1 KG40 supplied three of its FW200's although this unit was trained principally for mine-laying and anti-shipping work. Exactly the same units (less one Gruppe on the 31st) took part in the raiding on the two subsequent nights. KGr100 (the 'fire raisers') did NOT lead the attacks of the 29th or 30th both of which were opened by KGr606 and 806. The forces employed in all these attacks probably represented the maximum effort that Luftflotte 3 could make by night at this time without resorting to special measures, and it is significant that its daylight activities of the period were on a reduced scale.

²² On 26th August, Birmingham was bombed for the fourth time in nine nights, causing considerable destruction of property. Sixty fires were started in the city. A number of key factories were slightly damaged. This attack took place despite considerable low cloud indicating that the enemy had probably relied on radio aids to locate his target.

²³ In early August.

²⁴ The Blenheim squadrons had a large proportion of their aircraft fitted with AI Mark III, but on 13th and 14th August, the Fighter Interception Unit carried out tests with AI Mark IV, as a result of which this much more efficient type was recommended for future use. (FIU Report No. 31).

CHAPTER 4

THE FIRST MAIN PHASE: 7/8 SEPTEMBER to 13/14 NOVEMBER, 1940

The attack on London Opens

COS(40)
300th Meeting

All that had gone before was a prelude to the great night bombardment of London which commenced on 7/8th September and continued until 12/13th November, when German policy entered another phase. The reasons for the decision to subject London to attack must be examined, and among them its evident importance as a centre of communications and of production springs immediately to mind. It was, indeed, the core of the economy and the symbol of the way of life which the enemy wished to destroy. But that the attack was also connected with a plan for invasion was suggested at the time in a report which the Director of Military Intelligence made to the Chief of Staff's Committee. It appeared that the reduction of London by aerial bombardment was considered an essential preliminary to the landing of troops at various points along our coast, nor can it be denied that with communications severed, with the city isolated and the population demoralised, any defence of our southern regions would have been gravely embarrassed. However, it must also be remembered that the German High Command quickly changed from day to night assault because the Luftwaffe was beginning to recoil from the serious losses inflicted upon it in the day battles by the RAF. According to General Leutnant Galland, an important figure among the leaders of the German fighter force, and according to General Feldmarschall Milch,¹ the problem of successfully escorting bombers with Me.109 fighters could not be solved, with the result that night attack was decided upon in order to save the bomber arm from irreparable losses.

Against this we must set the preparations the Luftwaffe had indulged in during the exploratory phase of night attack which began in June, 1940. Crews had been given experience and training in night bombing, a night flying organisation had been established, airfields had been prepared and a complex of navigational beacons and blind bombing aids installed before the daylight battle was joined. These were, indeed, the advantages with which the Luftwaffe confidently undertook their night bombardment of London. On the other hand, it must be added that the German Air Force was not in the first place built for night bombing tasks. It consisted of medium bombers with considerable advantages of speed, by which it was hoped that fighter defences would be eluded when daylight operations such as those conducted in France were being carried out. All the same, this particular disadvantage was in some degree discounted by the preparations for night bombing already mentioned. And numerically it was a large bomber force which embarked upon the reduction of London, consisting of an establishment of 1504 long range bombers,² and a strength of 1241 machines.

Throughout the period under review (and indeed afterwards), the enemy's chief tactical plan was to guide his bombers to their targets by

FC/S.21197

the use of radio aids, and as the night battle progressed he demonstrated his ability to fly in adverse weather conditions. "The enemy's navigational aids are so effective" wrote the Commander-in-Chief Fighter Command in October, "that he will be able to bomb this country with sufficient accuracy for his purposes without even emerging from clouds. The most depressing fact which has emerged from the past weeks" he continued "is that the Germans can fly and bomb with considerable accuracy in weather in which our fighters cannot leave the ground. Their navigation is doubtless due to the excellence of their radio aids, but one cannot assume that the weather is always fit for flying in France when it is impossible by our standards in England."

FC ORB
October 1940

Indeed on eleven nights in October, for example, when the weather was indifferent and we could reasonably have expected a respite from the bombing, the German Air Force was carrying out raids on a large scale. On the night of 6th October when weather conditions were tempestuous, the enemy made a precise attack on a powder factory at Waltham Abbey, and Hatfield aerodrome had a narrow escape. It was a striking example of accurate bombing from a high level in circumstances which were unpropitious.

AI1(K) Report
No. 341 1941

One particular German unit specialised in the use of blind bombing aids and frequently led attacks against various targets in this country. Its principal function was to act as "pathfinder", and to raise fires³ so that the force following up could bomb into them. The unit in question was Kampf Gruppe 100. At the outbreak of war it consisted of two Staffeln,⁴ and even at that early date was equipped with the necessary apparatus for blind-bombing. During the Polish campaign its aircraft flying along beams had successfully destroyed bridges in Warsaw. At the conclusion of the war against Poland KGr100 had moved to Rothenburg where it was formed into a Gruppe. It next took part in attacks on shipping off Narvik, afterwards going to Vannes where it was based when the night bombardment commenced in September, and from where it began to lead attacks against targets in London and elsewhere.

No. 80 Wing ORB
October, 1940

Fortunately the discovery in June that the Germans were developing a technique of blind bombing had enabled us to set up an organisation to conduct the necessary counter measures. By October, No. 80 Wing which had been formed for this purpose, had made good headway. A number of engineers from the BBC were commissioned to fill technical appointments, and fifteen Lorenz type 'Aspirins'⁵ had been installed to interfere with Knickebein beams, while monitoring of German signals from mobile vans in order to render jamming more effective had commenced. A prisoner of war from KGr100 who fell into our hands during the attacks on London testified to the increasing efficacy of our jamming, although in his view an experienced operator could none the less successfully make use of the beams. Two other prisoners of war, however, when interrogated said that though they were members of KGr100, they did not believe in beam systems and preferred bombing visually. This attitude was probably engendered by the belief current among Luftwaffe crews that we concentrated both fighters and AA guns along the path of the beams.

AI1(K) Report
No. 341

It is hardly necessary to reiterate the grave difficulties faced by Fighter Command when it met this highly organised German challenge. The searchlight method of interception was a failure, and the problem of making interceptions against unilluminated targets remained unsolved, even though AI was being fitted into our night fighters. The fast, well-armed Beaufighter was not available to make any significant contribution to the defences during the attacks on London, and we were handicapped by the lack of proper night-flying organisation. When the critical test came in September, we disposed eight night squadrons while aircraft of the Fighter Interception Unit were also available for operations.⁶ There were six Blenheim squadrons⁷ at Northolt, Hornchurch, Catterick, Martlesham, Warmwell and Middle Wallop, all of them pre-war squadrons with experienced crews, and they had suffered few casualties. The two other squadrons consisted of Defiants⁸ which had recently been turned over to night fighting. In addition there were the 8-gun single-engined squadrons which were generally available for night work, but not all the pilots had had experience of night flying, while their machines were not very suitable for night fighting owing to poor visibility from the cockpit and limited endurance. Moreover, in utilising these squadrons for night work, the Commander-in-Chief had always to keep in mind the exigencies of the day battles then in full swing. Especially he had to consider that his pilots were too fatigued after participating in the strenuous fighting by day to fight at night as well.

FC ORB
Appendices
October, 1940

During October, however, he had to choose three single seater squadrons equipped with Hurricanes to take their place among the night fighters. The decision to employ these day squadrons uniquely by night had involved considerable deliberation and some controversy. In October the situation wore a sombre and even desperate character, for the night attacks were gathering great momentum, and there seemed little we could do to check them. As has already been pointed out, there was no hope that the Beaufighter fitted with AI could begin to carry weight in the battle until early in 1941, and the question therefore was whether the negligible fighter defences could be improved, if in a slight degree, or whether in reality the harsh fact was that no means of improvement lay at hand.

Minute DCAS-CAS
August 28, 1940 (DHO
Branch Folder)

The then Deputy Chief of the Air Staff had towards the end of August obtained the assent of the Commander-in-Chief to a suggestion that two existing squadrons of Defiants⁹ and a third squadron of Defiants then forming should specialise in night interception.¹⁰ He considered, further, that in addition one squadron of Hurricanes should also be reserved for night duty, and that such measures as standing patrols over threatened areas should be borne in mind. The Commander-in-Chief held other views. He believed that night interceptions could best be achieved by fighters equipped with AI and controlled with the help of radar devices on the ground. He believed also that fighters without AI could not be expected to produce results until the searchlights were directed by radar methods. As for standing patrols, it was the Commander-in-Chief's emphatic opinion that "if the whole Air Force were relegated to night duty on these lines, the number of interceptions would not suffice to check the

S.5566 Encl. 19A Notes
of Conference October
18, 1940 (DHO Branch
Folder)

Dowding Letter to Prime
Minister October 17

1940 also S.5566
Encl. 19A

night bombing menace." He felt that to relegate any single-seater aircraft wholly to night duty was "dangerous and unsound".

The merits and demerits of either side of this argument cannot be settled with any degree of finality. Early in 1941 single seater squadrons operated against the German night bomber with some degree of success under conditions of bright moonlight. But in 1941 the circumstances had altered. We were no longer so close to the savage and sustained day-battles on which our future depended. Nor would it be possible to say whether the intervention of large numbers of single-seater fighters could have checked the German bomber. Indeed, future events tended to point to the contrary, for the night fighter force ultimately comprised practically nothing but twin-engine squadrons equipped with AI.

AHB/IIH/240/4/123
FC/S 21340
Encl.30A

However, in October 1940 the protagonists of the idea that the single-seater squadron could with advantage be used for night interceptions prevailed. The Chief of the Air Staff having discussed matters with the Prime Minister instructed the Commander-in-Chief to delegate no less than 3 Hurricane squadrons to night duty. "With the greatest reluctance"¹¹ the Commander-in-Chief chose Nos. 73, 151 and 85¹² for this purpose. Thus with the existing Blenheim and Beaufighter and Defiant squadrons the specialist night fighter force was increased to a strength of eleven squadrons, with a further Defiant squadron (No. 307) in the process of formation.

It may be said that at this juncture both the Air Ministry and Fighter Command recognised the need for a separate day and night fighter force. In truth, a specialist night fighter force with its own methods and even its own traditions was now an accomplished fact. During the winter of 1940-1941 3 more single engined squadrons were set apart for night duty (Nos. 255 and 256 (Defiant) and No. 96 (Hurricane)), and by 15th April the night fighter force comprised 15 squadrons.¹³

Irrespective of controversy, there was nothing for it but to do all in our power to alleviate the unpromising situation of the night defences. Various methods of operating night fighters were open to us and they were:

Ibid

- (a) The operation of AI fighters on a fixed patrol line, a crude method that had already been tried with rather moderate success.¹⁴
- (b) Controlled interception overland, a poor technique owing to the time lag between plotting by the Observer Corps and the receipt of the information by Fighter Command, and owing to the inaccuracy of the plotting and the estimated height of hostile aircraft.
- (c) Controlled interception to seaward using radar. This had been extensively practised with only mild success, for though the time lag in plotting the enemy position was obviated, estimation of heights was poor and there were gaps in the radar coverage in which hostile aircraft were often 'lost'. Furthermore, the Blenheim was not suitable for work over the sea.
- (d) Interception on the coast at focal points where enemy aircraft made landfall. The enemy's use of radio navigational and

bombing aids tended to confine him to certain well defined tracks. Interceptions at the point where these tracks crossed the coast placed fighters in the most fruitful area of search and enabled fighter pilots to make the best use of up-to-the-minute radar information of enemy movements.

- (e) AI fighters with radio directed searchlights. The intersection of radio directed searchlights would provide reasonably accurate indications to fighters of the position and height of enemy machines.
- (f) Lorenz Receiving equipment in fighters. With this apparatus fighters could 'hunt'¹⁵ the enemy up and down the beams he projected over this country for navigational purposes. This type of night fighting would naturally be limited to those occasions on which the Germans were making use of their beams.

S.3983
Paper IC23
August 31st 1940

Pile Despatch
Part 1 60

The searchlight density in the eastern half of the country and round about key centres elsewhere was one every 3,000 yards, and the searchlight carpet was being extended to cover the whole country. Sector Searchlight Commanders were responsible for collaboration with RAF Fighter Commanders, the RAF Group controlling the operation of the lights in its own area. Scepticism about the usefulness of searchlights had grown since it had been discovered that enemy aircraft flying at heights of over 10,000 feet could not easily be engaged. It was even suggested that there was very often safety in complete black-out rather than in revealing defended areas by illumination. Furthermore, pilots were nervous of being exposed to enemy gun-fire owing to the tendency with sound locators to over-estimate the speed of sound and assume the target to be behind its actual position. But it was hoped that the advent of GL2 for the control of 'unseen' fire and the development of barrage methods, using the existing GL1 equipment, would make searchlight co-operation with the guns no longer necessary, thus leaving them free to work with fighters alone. Nevertheless, searchlights had their place in the night defences, for the enemy knowing himself susceptible to illumination at heights below 1,000 feet was compelled to operate at altitudes from which the accurate delivery of bombs became more difficult.

London was protected by 92 heavy AA guns¹⁶ when the night attack of September took place and, in addition, we possessed a now experienced body of Civil Defence workers including the Fire Service, the ARP Wardens and the Rescue Parties, backed by the necessary medical services.

The Night Battle is Joined 7/8 September, 1940

The German attack of 7/8th September was no swift improvisation, and the rapidity with which the night raids followed the raids of the late evening pointed to a clearly organised plan, and to the integration of the day and night effort.

Ministry of Home
Security Daily and

These evening raids had been of the utmost severity and many conflagrations had resulted, most of them in the area of the London

Weekly
Appreciations
September, 1940

docks at the mouth of the Thames. The Surrey Commercial Docks, the East India and the Royal Albert Docks, Woolwich Arsenal, Barking, Shellhaven, Thameshaven and the Anglo-American Company's oil works at Purfleet were alight. Indeed the blaze at these oil works had not been put out by 13th September.

The fire services had toiled desperately to extinguish the great fires that raged before darkness set in, for it was all too keenly realised what excellent guides they would be for any night bombers the enemy might decide to despatch later on. Unhappily their efforts were in vain, and the fires burned brightly to serve as navigational beacons for the German aircraft which undertook the attack that night.

It was not long after the day attacks had subsided before the night raiders began to appear on the screens of our coastal radar stations, who duly passed the warning to our active and passive defences. Raids were developing towards the Le Havre region.

FC ORB
Appendices
September, 1940

The first of these was detected ten to fifteen miles north of Cap d'Antifer between 2008 and 2014 hours, steering for our coasts at a height of some 15,000 feet. There were three separate raids amounting to about 40 machines in all, and they arrived just west of Beachy Head between 2022 and 2034 hours. Proceeding unhindered to London, they dropped bombs in Battersea, Hammersmith and Paddington among other places, turned south-west and returned to their bases by way of Selsey Bill. Judging by the extent of their bombing, however, it seemed likely that earlier estimates of their strength had been too high.

AA Command
Form Y
September 1940

A full explanation for this unhampered progress to their objectives seems hard to find, but it remains a fact that while bombs were falling in London, 2 Hurricanes were patrolling their sector station at Tangmere, though they had received no instructions to intercept the enemy. Even some of the guns did not open fire, for those in the Inner Artillery Zone did not go into action that night until 2100hours, 25 minutes after Battersea had been bombed.

A long procession of raids had now begun, consisting of single aircraft, monotonously crossing the coast at brief intervals between Dungeness and the Isle of Wight, flying to London and then making their egress over East Anglia or south west of Selsey Bill and the Solent. Although no bombing took place in the Solent area, the guns there were firing continuously from 2320-0315 hours.

FIU ORB
September, 1940

Some defensive sorties by fighters were flown, mostly before midnight. Two Blenheims of No. 25 Squadron from Martlesham patrolled North Weald from 2050-2350 hours without sighting a hostile machine, and two AI-equipped aircraft (one a Beaufighter) of the Fighter Interception Unit were up during the night without any success. "Numerous AI contacts were obtained" says the entry in unit records, "but constant interference from undirected AA fire and searchlights prevented success." No doubt the poor visibility and the lack of speed of the Blenheim, as well as the comparative novelty of the Beaufighter

contributed to a blank night. Another patrol after midnight by No. 25 Squadron also yielded no results, and enemy activity came to a close at about 0345 hours.

No. 600 Squadron
ORB
No 11 Gp ORB
September, 1940

The strain of the evening raids, and the necessity for rest and preparation for the day battles of the following day largely prevented our single seater fighters from patrolling, while No. 600 Squadron, the twin-engine squadron kept specially for such an occasion as this, was unable to make a single sortie because of the smoke from the fires in east London which swept over their airfield at Hornchurch and prevented their take-off. Five single seater squadrons in No. 11 Group which had not been seriously engaged by day might have been ordered into the air, but an arrangement with the Group to reserve a section of single-engined fighters for night operations does not appear to have been put into effect, again due no doubt to the Group Commander's anxiety to conserve his resources for the daylight engagements of the next day.

Pile Despatch
Part 1, 52, 53

The anti-aircraft artillery only claim to have destroyed a single enemy machine, for the Fixed Azimuth System broke down completely. The sound locators could not detect aircraft operating at great heights; at other times more than one aircraft was flying between two locators, so that there was no certainty that both equipments were tracking the same machine. Furthermore, the assumption that the main approach to the capital would be up the Estuary was not always fulfilled, and many bombers passed outside the flanks of the sound locator lay-out. Finally, faults developed in the communications system and large sections of the front were put out of action for long periods. Consequently few of the 92¹⁷ guns available received data on which they could fire.

Ibid

It was evident that the introduction of more guns alone would not solve the problem, although within 48 hours the General Officer Commanding AA Command had seen to it that the numbers were increased to 203. A few days later, on September 11th, it was decided that the guns which were unable to fire on the Fixed Aximuth system should be given a free hand to use any method of control they liked. The result was a large volume of fire, described by the GOC as "largely wild and uncontrolled shooting," but its beneficial effects consisted of an improvement in civilian morale and in its deterrent effect on any timid enemy crews. The serious draw-back to this method of fire was the great expenditure of ammunition, and so certain geographical barrages designed to explode over points suspected of being used as landmarks by the enemy were fired on 26/27th September. Though no marked improvement in the number of raiders destroyed came about, expenditure of ammunition was brought under control.

Ministry of Home

The Germans have recorded that they dropped 333 metric tons of bombs and over 13,000 incendiaries on London on the night of 7/8th September. Less than 10% of this weight fell outside an area within ten miles of Charing Cross, which represented a fair degree of accuracy. If, however, the docks were their target, it is not possible to tell what proportion of bombs fell on the dock areas and what proportion fell elsewhere. South London had been under warning for 5 hours and 29

Security Daily and
Weekly Apprecns.
September, 1940

minutes, Central London for 8 hours and 18 minutes and North London for 8 hours and 12 minutes, Battersea Power Station was hit and shut down, West Ham Power Station was shut down, the LNER tracks between Bethnal Green and Hackney, between Stratford and Woolwich, and between Stratford and Fenchurch Street were made unusable. Victoria Station was blocked and only restricted services were operating from there, while all trains into London Bridge were stopped.

Enquiry into Failure of Defences by Salmond Committee

S.6287

The failure of our night fighters to offer any solid resistance to the massive night attacks undertaken by the Germans provoked considerable disquiet, and the Minister of Aircraft Production suggested to the Secretary of State for Air that Marshal of the RAF Sir John Salmond GCB should be called upon to advise him concerning the preparation of night fighters. In turn, the Chief of the Air Staff proposed that Sir John Salmond's enquiry should not only deal with the question of suitable night fighters but should be extended to cover the field of their operation.

Ibid
AC47 (40)

Accordingly a committee¹⁸ under the chairmanship of Sir John Salmond went into sitting, and at the end of their deliberations, communicated their findings to the Air Council who then invited the Commander-in-Chief, Fighter Command to take certain action in keeping with the conclusions they had reached. On 1st October, 1940, the Commander-in-Chief's reply to the Air Council's injunctions was carefully discussed by a Night Air Defence Committee at which the Secretary of State and the Chief of the Air Staff were present. The courses of action they accepted were:

- (i) that subject to the overriding authority of the Group Commander, the normal practice was to be continued and the Sector Commander was to exercise operational control by night.
- (ii) that where possible interceptions were to be controlled from the coastal radar sets including those at Poling, Pevensey, Swanage and others on the East coast.
- (iii) that filter rooms should be established at Groups and the operation of filtering delegated to them when IFF had generally been fitted to aircraft.
- (iv) that some specialised form of night training for night fighting crews was desirable, probably at a night fighter Operational Training Unit.
- (v) that certain officers should be added to the staff at Fighter Command who would occupy themselves solely with the problems of night interception.
- (vi) that in future night fighters would be expected to fly in bad weather conditions with the aid of a standby navigational aid such as a Lorenz Blind Landing apparatus or an AI beacon which would have to be installed at airfields.

(vii) that the FIU was to have a flight of eight Hurricanes in order to study the tactical employment of single-engined fighters at night.

(viii) that optical tests should be introduced at the Senior Flying Training Schools in order to assist in the selection of pilots for the Night Fighter Operational Training Unit.

AHB/IIH/240/4/121
Encl. 11A
FC/S 21197
September 30th
1940

In the main, these recommendations were carried out during the ensuing months. It had long been realised that night fighters could not operate without good airfields and the proper night flying facilities, and the Commander-in-Chief had drawn attention to this fact in his Progress Report of 30th September, suggesting that AI beacons should be installed at night flying stations, and that the sector Controller should be relieved of the responsibility of 'homing' aircraft by the appointment of a separate controller who could carry out this duty. Ultimately a system of airfield control was set up to undertake just this function.

The method of controlling interceptions to seaward using coastal radar stations had been extensively tried without great success. It had already been pointed out that though the time lag in plotting the enemy position was obviated, estimation of heights was poor, and furthermore, hostile aircraft were frequently lost in the gaps which existed in the radar coverage. Finally, the Blenheim was not suitable for work over the sea.

The question of filtering¹⁹ led to some disagreement between the Air Council and the Commander-in-Chief, but his views were rejected and those of the Air Council adopted. The proposal to establish a night fighter OTU was not given effect until 11th November, 1940, when orders for the formation of No. 54 (Night) OTU were issued, and this training centre began its work on 31st December. In due course also, a special night operations staff under Air Commodore A H Orlebar²⁰ took up its duties at Headquarters, Fighter Command.

AHB/II/55
September 1940
Encl. 9.

The importance of technical equipment in the solution of the night interception problem was emphasised during the Salmond Committee's investigations, and it was clear that the operation of night fighters required the evolution of a scientific and specialised technique. In accordance with the committee's findings, the Secretary of State for Air wrote to the Minister of Aircraft Production asking:

(i) that the production of 600 GL Mark I sets should be regarded as of the highest urgency, and that the early production of GL Mark II and of SLC should equally be regarded as most important.

(ii) that an improved view-panel in the Blenheim and the Beaufighter, designed to give the pilot a better upward and forward outlook should be regarded as of great urgency.

(iii) that the production of AI Mark IV²¹ and of the Beaufighter²² should be, as far as possible, accelerated.

(iv) that the trial equipment for inland-looking radar be produced with all speed.

Pile Despatch Part I
58

As we have seen, the application of the radar principle to anti-aircraft gunnery revolutionised the method of firing.²³ Radar-controlled guns went into action on 1st October, 1940, after they had undergone tests which evoked from the GOC AA Command the comment that "the only real success being obtained was with this radar equipment, and that the entire future of anti-aircraft shooting must be associated with it." An entirely new system of unseen barrages was developed at this stage and remained in force until 20th January 1941. Of necessity priority in the provision of radar equipment was given to the guns, but the provision of similar equipment for searchlights was also made, and the first sets of a type similar to those in use with the guns were deployed towards the end of 1940. Shortly afterwards, the type specially designed for searchlight control became available, but it was not until November of 1941 that they were systematically deployed in any numbers for the purposes of searchlight-assisted interceptions.

Ibid.61

The Secretary of State's plea for acceleration in the production of these scientific devices indicated that the weaknesses in our night defences were fully appreciated at the time when German attacks had become intensified. His request that the production of AI Mark IV be hastened implied the pressing need for a means of operating fighters successfully against targets that were not illuminated by searchlights, while his reference to inland-looking radar implied an equally pressing need for a reliable method of overland tracking to take the place of the unreliable 'sound' tracks provided by the Observer Corps.

AHB/IIH1/18
Dowding Despatch
249

This inland-reading radar apparatus which came to be known as GCI was able to show the position of all aircraft within its range on a fluorescent screen. Its chief advantages were that it possessed a longer range than GL (about 45 miles), and that it was possible to track both bomber and fighter on the same equipment instead of having to obtain the position of the bomber by means of GL or of Observer Corps plots and the position of the fighter by R/T D/F 'fixing', a method whose accuracy was far short of that required for successful interception at night. Unhappily the GCI set was not available for the control of night fighters equipped with AI until the early part of 1941, but it was not until the GCI set was utilised to place the fighter behind the bomber in the position in which AI could detect the bomber that our night fighter force began to offer anything like real resistance to enemy attack.

The Kenley Experiment

AHB/IIH/240/4/121
Encl. 1a
FC/S 21197 September
21st 1940
Dowding Despatch 241
et seq

Although in the long-term sense the foundations of a specialised night defence were being laid, the serious character of the prevailing situation required immediately to be relieved. It was a time for ingenious improvisations. Since inland tracking was so palpable a weakness in the night interception method, and since no radar apparatus capable of inland tracking existed, the Commander-in-Chief, Fighter Command decided to use the GL set for this purpose which could give accurate

position plots within a range of about 40,000 feet, and could, moreover, read height to within plus or minus 1,000 feet at average ranges.

These GL sets – about ten in number – which had been borrowed from the Army were installed at Searchlight Posts in the Kenley Sector, chosen because it lay in the usual path of approach used by raiders making for London. These Searchlight Posts were put into direct communication with the Sector Operations Room at Kenley, where GL plots were shown at intervals of about 30 seconds on a large blackboard. By this means it was hoped to obtain a more accurate and coherent track of the enemy bomber, as well as an exact indication of its height, than had hitherto been possible. The track of the pursuing fighter was determined by the R/T D/F method of ‘fixing’, whereby three D/F stations took bearings on transmissions emanating from the ‘contactor’²⁴ in the aircraft and thereby produced a ‘cut’ which indicated its position.

Ibid

The Sector Controller bore the responsibility of selecting for interception a raid which to his mind offered the greatest chance of success. He then issued orders that every effort be made to intercept the selected raid, and from that moment no searchlight crew was permitted to expose on any other echo seen on their instrument but the one representing the Controller’s choice. Furthermore no light save the GL controlled ‘master’ searchlight was permitted to try and illuminate the enemy machine.

The Sector Controller then passed instructions to the patrolling fighter by means of R/T, concerned mainly with the height, course and speed of the raider, which he obtained from the GL data displayed on the blackboard in the Operations Room, endeavouring to place the fighter pilot in a position to see the single beam of the ‘master’ light. The direction of this beam indicated to the pilot the position of his target, and together with all the other information supplied to him, he could effect an interception.

The experiment promised success for three reasons. Firstly, the enemy’s height would approximately be known; secondly, the fighter pilot would realise whenever he saw a searchlight beam that it was pointing directly at the target and, lastly, the tracking of the bomber by the GL set would be more exact than hitherto.

Indeed, promising results were obtained from the first, and numerous instances occurred where echoes were shown on the AI instruments in the aircraft, but the practical results were disappointing. The reasons for this ill-success were manifold and valuable lessons were learned from failure. The AI set had proved capricious in azimuth, the Blenheim was no match for the faster German bombers which on being pursued were able to draw away, while the Beaufighter was suffering from teething troubles to an unusual degree. Between 21st September and 30th September, not more than one Beaufighter had been in the air on any one night, and such flights as had been made generally terminated prematurely owing to a technical breakdown of some kind. Defective fitting of elevators²⁵ and the faulty attachment of the carburettors to the

engine had kept all Beaufighters out of action until they could be rendered airworthy. The consequence was that the training of pilots to fly this new type of machine was much hampered. The maintenance of an aircraft so recently introduced with only rudimentary facilities presented another awkward problem, and the same difficulty arose to a lesser degree in connection with the maintenance of the delicate AI apparatus and the R/T sets. All this development work might have been carried out by day but for the low rate of aircraft serviceability which precluded both day and night work.

Ibid

Lastly, the weather had not been propitious for an experiment of this kind. Cloud had deprived pilots of a direct view of the searchlight beams, and when conditions were bright and clear, they found they were unable to see the beams at heights above 10,000 feet, indicating once more the drawback with searchlights already experienced. Redhill turned out to be a wet airfield with a tendency towards becoming fog-bound owing to its low-flying nature, so that fighters were all too frequently grounded.

From the point of view of control, incorrect 'contactor' readings²⁶ gave erratic tracks of the fighter, and sometimes the complete failure of the apparatus caused a cessation of these tracks. The controller's task was thus rendered inordinately difficult. Sometimes confusion between the fighter and the bomber took place when the GL set took over the tracking overland from the coastal radar station which had been plotting to seaward. It was clear the IFF Mark II²⁷ would have to be fitted to all Beaufighters at the earliest moment.

Anxiety on the part of the Controller to supply the fighter pilot with a flow of up-to-the-minute instructions concerning the movements of the raider sometimes led him to talk at a time when communication should have been reserved for the pilot and his AI operator. It was therefore decided that the pilot should cry "Tally-ho" immediately an AI contact had been obtained, so that the Controller could then leave the crew to pursue their contact without interference from the ground control.

Unfortunately the Kenley Operations room was a cramped and primitive place, with the result that the conditions in which the Controller worked added to the other handicaps he already faced. The lack of suitably equipped night airfields and the absence of any flying control organisation further placed upon him the unenviable responsibility of seeing that the night fighter reached its base safely after a patrol. When the weather was poor, so much time and attention had to be given to 'homings' that the aircraft next due to take off was frequently delayed, while the interception in hand also had to be interrupted in order to pass instructions to the returning pilot.

AHB/IIH1/18
Dowding Despatch 248
FC/S21197
October 28th 1940
AHB/IIH/240/4/121
Encl. 18A

Profiting by these lessons, AI beacons were installed in the vicinity of Night Flying Airfields for purposes of 'homing', and the need for a flying control organisation clearly emerged. However, even if the Kenley experiment turned out successfully, and if similar facilities for controlled interceptions by night were extended to other sectors in Fighter Command, the expense involved in providing the vast number of GL sets

required made it prohibitive. Nor was it likely that these sets could be produced in sufficient numbers or quickly enough to turn the scale against the German night bombardment.

NAD(40)2
October 21st 1940

It was hoped to surmount these handicaps by the immediate provision of SLC sets in good numbers. Towards the end of October, however, this plan was still far from realisation, for the SLC set had manifested certain defects which still remained to be put right. In the first place, its range was short and it was unable to record slant range, with the result that neither height nor plan position could be determined from a single equipment. It was also unduly sensitive to damp, rain and dew. But its advantages were two-fold. It required no calibration and no intermediate operation between the action of the numbers watching the cathode ray tubes and the actuation of the searchlight, thus eliminating all lag in operation.

Ibid
November 18th
1940

Later results were disappointing. Searchlights with SLC control consistently failed to pick up their targets and were often as much as two miles away from them; the set proved incapable of producing a good track of the enemy bomber and incapable of measuring heights. Nor did it respond to IFF, thereby making it impossible for the operators to distinguish between hostile and friendly machines. Thus hopes of SLC affording a solution to the immediate problem of night interception receded.

AHB/II/55 Encl.17

Meanwhile the Salmond Committee's recommendation that interception to seaward should be more actively attempted had also proved abortive. The standard CH station at Pevensey was used on 69 occasions between mid-September and mid-October. On 10 of these occasions instructions to the aircraft were accurate enough to enable it to bring its AI to bear, but the Blenheim's lack of speed and the overcrowding of the CH station's cathode ray tube generally served to frustrate effective control of interceptions. However, once again lessons were learned from failure, and it was realised that the maintenance and operation of such radar equipment required the attention of skilled persons. Accordingly steps were taken to increase the numbers of qualified technicians working on radar by drawing on the BBC, the GPO and on industry. It was also realised the control of radar interceptions required specialised knowledge on the part of the controllers engaged on this type of work. It was therefore arranged for controllers to be trained at the radar station at Swanage.

All the methods of night interception tried during the first phase of the German night bombardment thus ended in failure, for the results obtained were negligible. Nevertheless, there existed a clear-cut idea of what was essential for the successful exploitation of night fighters. Briefly summarised it was realised:

- (i) that continuous and accurate location of both bomber and fighter must be provided, and that a reasonably accurate system of height-finding was equally necessary.

- (ii) that an efficient type of AI was required.
- (iii) that properly equipped night flying airfields must be built.
- (iv) that some form of flying control as distinct from operational control was necessary.
- (v) that a fast, well-armed night-fighter was an essential.
- (vi) that both air and ground crews required to specialise in their particular duties.

NAD(40)3
November 18th
1940

All these requirements were gradually being met. The installation of AI beacons, the Beaufighter fitted with AI Mark IV and the training of specialist personnel were substantial contributions towards the building of a night fighter organisation. And happily the highly important problem of continuous and accurate location of fighter and bomber was already on the way towards being solved.

Ibid

An experimental inland-looking radar set (GCI) of the mobile type was installed at Shoreham in mid-October, and on the strength of the results it produced, 120 sets of equipment had been ordered with deliveries expected to commence by about Christmas. By November flying trials with aircraft under GCI control commenced, and by the beginning of the next year the apparatus had been introduced in sufficient numbers to show that there was to be no doubt of its success as an aid to night interception.

Summary of the First Main Phase

ADI(K) Report
No. 12, 1946

The broad strategical aims of the German attack on London deserve consideration, and in this connection it is of interest to touch on the statement of General Storp, General der Kampfflieger during the closing months of the war, that "no strategic bombing policy has ever been formulated by the Higher Command, neither has any strategical bombing programme been carried through. The bombing of Britain in 1940/41 consisted neither of a policy nor a programme, although its basis consisted of plans and intentions of both a strategical and tactical nature".

Certainly an overall view of the night bombing between September, 1940 and May, 1941 yields support to the General's thesis. Under the heavy losses incurred in the day battles, a sudden switch was made to a more economical policy of night attack at first directed against London. Between 7/8th September and 12/13th November, 57 major raids²⁸ were launched against the capital and during these a total of 13,351 high explosive bombs were dropped. If the original aim was the progressive and complete annihilation of London, the demoralisation of its civil population and the paralysis of its commercial, civil and technical life, then a little over two months sufficed to show that it was unattainable. By the very magnitude of its extent it defeated such an objective, especially on the scale of the attack the enemy carried out.

However, this must have been patent to him even before he commenced the bombardment. Was it then his belief that the exertion of sufficient pressures on morale together with a sufficient measure of destruction would demonstrate the futility of further resistance and bring offers of submission? Two months showed that this was also unattainable. Realising that they were pursuing these unattainable ends so far as London was concerned, the Germans, with a characteristic change-over, immediately adopted what appeared to be a fresh strategical aim. They concentrated their total effort in the obliteration of a single provincial city during the course of one night. The area of provincial cities was small when compared to the area of London, but they failed to carry through this policy in its entirety and the bombed cities in the provinces were enabled to stagger towards recovery from the great damage they suffered.

Ministry of Home
Security: Key Points
Intelligence Survey
1940

In London the enemy concentrated on two principal objectives: the docks and railway communications. The consequences of the attack on the docks were serious but not crippling. Damage to their structure was on the whole inconsiderable. Generally speaking basins, gates, quays, handling equipment and railway lines survived substantially intact. In fact the ability of the port to handle imports and exports was little interfered with. Warehouses, stores, sheds and yards did suffer damage and their contents were frequently destroyed. Nevertheless, total losses were not as might have been expected because food stock was dispersed 'in buffer' and other depots away from the docks.

Ministry of Home
Security: Daily and
Weekly
Appreciations:
September —
November 1940

The attack on the railways immobilised many lines south of the Thames. Damage North and South of the river to the link lines between northern and southern railways had a serious effect on the transfer of traffic. The Great Northern section of the LNER usually forwarded between 50 and 60 trains to the Southern Company each day, but there was a period when it was possible only to forward four trains to the Southern Company through London. Delayed action bombs caused the greatest hold-ups, and during September 5-6000 wagons were standing idle because of these bombs which had not been dealt with. Between 7th September and 30th September, there were in fact 667 hits on the railways, the majority of these in the London area. Continual attacks on the railways in the region of Liverpool were also carried out, and Crewe also came under bombardment. In consequence goods yards and marshalling yards felt the inevitable repercussions. Dislocation and congestion occurred which was not easy to disperse.

Ibid
October, 1940

While the main weight of the night attack during this period fell on London, the enemy gave his attention to certain provincial cities. Birmingham and Coventry were heavily bombed, over 500 tons²⁹ of bombs falling on these cities in October alone. Liverpool which had been attacked on a diminishing scale during September received barely 200 tons of bombs for the whole of October. Manchester, Hull and Glasgow also suffered, the Metro-Vickers Works at Manchester being the subject of a precision attack. Twelve tons of bombs were aimed at these works, happily without serious consequences.

Thus while London was the main objective, certain provincial centres were regarded as secondary targets, and the usual nuisance raiders kept as much of the country as they could under warning in order to inconvenience people on the largest possible scale.

FC ORB:
Appendices:
Intelligence
Summaries
September, 1940

The comparatively insignificant losses inflicted upon the German raiders meant that the enemy was succeeding in his aim of conserving his forces. During September, following the commencement of the main battle, only on two nights did he fail to send at least 100 bombers against us, while the nightly average was about 200 machines. Our night defences were only able to claim the destruction of 38 raiders. Similarly during October attacks took place on every night of the month but 7, an average number of 190 aircraft participating in each. The claims of our defences against this effort were even more modest than those for the month previous, 31 raiders being counted as destroyed.

Ministry of Home
Security: Weekly
Appreciations
September –
October 1940

Reference has been made to the acute problem presented by the fall of delayed-action and unexploded bombs. Bomb disposal parties were formed to deal with it and they were strengthened to 5 companies, with 55 sections and 10 officers for reconnaissance duties, their numbers gradually increasing as time went on. It was the duty of these reconnaissance parties to survey sites where unexploded bombs were reported, in order to save the disposal parties from being called out on unnecessary errands.³⁰ Special 'bomb cemeteries' were also provided where unexploded bombs could be dealt with. One of the most noteworthy feats of bomb-disposal performed during the attacks on London was the removal of a ton bomb which was endangering St. Paul's Cathedral and all the trunk telephone communications with the north of England. Parachute mines of the most formidable character were also dropped and 100 of these had been reported in the London and Cambridge region between 17th September and 2nd October alone. Naval parties were organised by the Admiralty to dispose of them and a number were rendered safe.

The Ministry of Home Security had only good reports of public morale, although it was an ordeal for Londoners to watch the devastation not only of their homes but of many places of historic significance with which they had been familiar throughout their lives. Somerset House, the Royal Courts of Justice and Buckingham Palace were among such places damaged. Underground shelters were used on a large scale, and on the night of 30th September/1st October, for instance, the police counted 112,925 shelterers in the undergrounds.

Ibid

We have seen how unexploded bombs caused delay on railways and brought about hardship through the necessity for evacuation. The explosion of bombs in a city chiefly struck at communications, electrical installations and public utilities. The repair of damage to public utilities was therefore accorded high priority, and work was carried out with creditable speed, though often hindered by debris which was difficult to clear. The necessity for special attention to these problems was quickly realised, and a Special Commissioner was appointed in the London region to co-ordinate the work of repair to public utilities and roads, and to

ensure the rapid clearance of salvage and debris. At the same time another commissioner was appointed to deal with the problem of housing the homeless and to deal with arrangements for evacuation.

Pile: Despatch
Part I Para. 54

Thus when the period of great and sustained attacks on London came to an end, though Ministry of Home Security observers reported apprehension at the idea of facing a winter of air attack, they noted no serious drop in morale. If the small results achieved by the active defences gave no cause for comfort, the volume of gunfire in London since reinforcement took place was at least known to have produced a beneficial moral effect among its inhabitants, and the Civil Defences carried out their duties with increasing competence as their experience grew.

Analysis of a Typical German Air Force Night Raid of the Period

The pattern of German raids during the period of attack on London did not undergo much variation. The enemy aim remained unaltered. He wished to achieve both precision and concentration in bombing through guiding large forces of bombers to their targets by means of radio aids. Nor was he compelled by our night defences to alter his tactics to any great extent, although it was believed that our radio counter-measures were causing him anxiety³¹. Thus the analysis of a single big raid including the detailed plan of attack embodies the characteristics of most attacks of the period.

The night of 15/16th October was selected for this attack of great dimensions on London, possibly because the weather and the full moon period was distinctly propitious for such a venture. The German meteorological forecasts made 1700 hours on the 15th read:

Channel: 5/10-7/10 cumulus cloud at about 1000 metres.
Visibility: 20 kms.

S.E. England: 7/10-9/10 cumulus cloud

S.W. and Midlands: scattered cloud at medium altitudes
Visibility: 30-50 kms.
Wind: 3-5000 metres about 60 kms per hour

Our own meteorological forecasts for the period were:

S. and E. Coast. 1830-0400 hours

3/10-5/10 cloud with base at 2/3000 ft.
Much medium and high cloud, occasional
showers.
Visibility: 4000 yards – 12 miles

Bristol and Birmingham areas. 1830-2200 hours

4/10-8/10 cloud at 2/3000 ft
8/10-10/10 cloud at 1000 ft, showers.
Visibility: 6-12 miles

2200-0700 hours

Much high and medium cloud at 2/3000 ft base
Visibility: 4-6 miles with local mist patches

Both these forecasts emphasised the excellent visibility prevailing and indicated an obvious opportunity for accurate location of targets.

German Plan of Attack

The German plan of attack was:

Main Attack

| <u>Time</u> | <u>No of A/C</u> | <u>Target</u> | <u>Bombing Height</u> | <u>HE (in metric tons)</u> | <u>Incendiaries (in metric tons)</u> |
|-------------|----------------------|----------------------|---------------------------|--------------------------------|--|
| 2040-0440 | 300 | London ³² | | 394 | 9 |
| 2110-0414 | 22 | Birmingham | | 26 | 2 |
| 0001-0012 | 2 | London | 5000 metres | 2 | |
| | 44 | " | | 8.6 | |
| 0001-0010 | 4 | " | 5000 " | 7.2 | |
| 0030-0045 | 2 | " | 6000 " | 2 | |
| 0038-0120 | 11 | " | 6000 " | 10.25 | |
| 0050 | 1 | Southend | | 1 | |
| 0100-0200 | 1 | Hillingdon | | 1.5 | 0.06 |
| 0417 | 1 | " | | 1.5 | |

Secondary attacks

| | | | | | |
|-----------|---|------------------------|--|------|------|
| 2040-0341 | 2 | London | | 2.4 | |
| 2110 | 1 | Windsor | | 1 | |
| 2235 | 1 | Portsmouth | | 1.25 | |
| 2235 | 1 | Yeovil | | 1.25 | |
| 2235 | 1 | Yeovil | | 1.1 | |
| 2235 | 1 | Southampton | | 1.1 | |
| 2235 | 1 | Bournemouth | | 1.2 | |
| 2349 | 1 | S.W. Filton | | 1.5 | |
| 2252 | 1 | Plymouth | | .5 | 0.06 |
| 2252 | 1 | Tunbridge Wells | | 1.25 | |
| 2110 | 1 | Hastings | | 1.6 | |
| 2130 | 1 | Reigate | | 2 | |
| 0311-0341 | 2 | Eastbourne | | 2 | 0.18 |
| 0630 | 1 | Airfield nr Chester | | 1 | |

Total number of aircraft on London: 365

Units Participating: Luftflotte 3

The records of the Intelligence section of Luftflotte 3 show that this Luftflotte bore the brunt of the attack on London of 15/16th October, 298 aircraft being detailed for it, of which 276 afterwards claimed to have reached their targets. Twenty-five machines of KG26 and 7 machines of KG76 were reported to have made 4 attacks during the night, presumably returning to their bases to refuel, re-arm and take off again. The units of Luftflotte 3 participating were:

| | | | |
|-----------------|----------|-----------|---------------|
| Fliegerkorps V | I/KG51 | 6 Ju.88 | 0105-0130 hrs |
| | II/KG51 | 8 " | 0124-0145 " |
| | III/KG51 | 9 " | 0200-0234 " |
| | I/KG54 | 7 " | 0311-0341 " |
| | II/KG54 | 3 " | 0408-0414 " |
| | KGr 806 | 2 " | 0307-0308 " |
| | St.KG55 | 2 He.111 | 0010-0025 " |
| | I/KG55 | 9 " | 2213-2315 " |
| | II/KG55 | 16 " | 2040-2220 " |
| | III/KG55 | 10 " | 2325-0020 " |
| Fliegerkorps IV | I/LG1 | 16 Ju.88 | 2245-2343 " |
| | II/LG1 | 12 " | 2026-2120 " |
| | III/LG1 | 8 " | 2131-2221 " |
| | I/KG27 | 17 He.111 | 2356-0440 " |
| | II/KG27 | 11 " | 2330-0250 " |
| | III/KG27 | 13 " | 0010-0555 " |
| Fliegerkorps I | KG1 | 26 He.111 | 2035-2200 hrs |
| | KG76 | 28 Do.17 | 2104-0230 " |
| | KG76 | 7 " | 0310-0450 " |
| | KG77 | 8 Ju.88 | 2010-2220 " |
| | KG26 | 34 He.111 | 2041-2205 " |
| | KG26 | 24 He.111 | 0021-0315 " |

Total of aircraft over London 276

Tonnage of bombs Dropped by Luftflotte 3

Tonnage of bombs on London by aircraft of Luftflotte 3:

394 metric tons 9036 incendiaries

Total of all aircraft over London: 356

Subsidiary Raids

Apart from this activity over London, about 15 aircraft of Luftflotte 3 were detailed to subsidiary tasks in the Bristol area at approximately 2000 hours, while 20 aircraft of KGr100 (presumably from Vannes) were detailed to attack the Birmingham area. According to our intelligence reports, shortly after 1900 hours enemy raids from the direction of

Cherbourg and the Channel Islands began to cross the coast at Start Point and St. Alban's Head. About 25 of them flew north to Birmingham and Wolverhampton, another 25 operating in the Plymouth, South Wales and Bristol areas. Allowing for a few other German aircraft, also detailed to tasks in the West country, and a small excess in estimating numbers on our part, it seems clear that all the subsidiary tasks were also mainly carried out by Luftflotte 3, leaving the main force of about 99 aircraft from Luftflotte 2³³ to concentrate on London. Thus it may reasonably be assessed that together with 276 aircraft of Luftflotte 3, 365 aircraft in all participated in the operations over the capital on the night of 15/16 October.

Tonnage of bombs – total on London

Since the total tonnage of bombs to be dropped on London by Luftflotte 3 was 394 metric tons, it can well be supposed that the 130 aircraft of Luftflotte 2 were to drop 144 tons, since the total weight of bombs dropped on the 15/16 October is recorded as 538 metric tons (and 177 metric tons of incendiaries).

The Progress of the Attack

The first raids from Holland crossed the Essex coast at about 1900 hours and were soon followed by other enemy aircraft flying in over the South Coast from France. There can be little doubt that they were all aircraft of Luftflotte 2 making for London, as Luftflotte 3 records show that they did not commence operating until later. A switching of bases occurred among these units of Luftflotte 2, some from Holland returning to France upon completion of their tasks and some from France returning to Holland.

The chief movements and lines of movement were:

(i) from Holland and Belgium in over the Thames Estuary and the coast of Suffolk and Essex, mainly over the Harwich and Blackwater areas.

(ii) Over Fecamp, Le Treport, Berck and other points on the French coast between Le Havre and Boulogne, in for the most part between Beachy Head, Fairlight and Dungeness.

(This was probably the route followed by aircraft of Luftflotte 2).

(iii) Over Cherbourg and Fecamp, in between Bognor and Newhaven, mainly over Shoreham.

(This was probably the route followed by aircraft of Luftflotte 3).

Activity was greatest between 1900-2200 hours and had almost ceased by 0400 hours. Between 1900 and 2200 hours probably all the aircraft of Luftflotte 2 were over their target together with seven units of Luftflotte 3, mostly from Fliegerkorps I. Two units of Luftflotte 3 were

to be over the target soon after 2200 hours, three more after 2300 hours and a further two after midnight. Three were to be over the target within a few minutes of each other after 0300. The highest concentration was, therefore, between 1900 and 2000, with a lesser concentration round about 2330 hours and a final small concentration round about 0300 hours, activity between 2200 and 0400 hours being planned it would appear to extend the state of alarm as far as possible.

Enemy Comments on Our Defences

Two night fighters were reported to have been sighted over London by aircraft of Luftflotte 3, two more about 30 kms south of London, one near Windsor, three east of Brighton, a twin engined fighter between Selsey and Brighton with navigation lights on and a section of single engined fighters between Hastings and Brighton.

Defensive Activity – Analysis of Claims

In fact we flew 40 night interception patrols consisting of 41 aircraft during the night. The only German loss recorded seems to have been a Ju.88 of Lehr I which was flying home in distress and which probably went down near Le Havre, the air/sea rescue organisation having been called out to search for it. Since the AA guns claim an enemy machine hit during the time at which the unit was over the target, it is possible that this German loss occurred through gun fire. A Defiant of No. 264 Squadron claimed to have intercepted and shot down a Ju.88 near North Weald at about 0200 and a Blenheim of No. 23 Squadron claimed to have intercepted and shot down a He.111 in the Tunbridge Wells area at about 2100. It is probably that the second of these casualties was an aircraft from Luftflotte 2, hence its omission from the records of Luftflotte 3, but the first casualty, judging by time, would seem to have been a machine belonging to Luftflotte 3.

Comment on Gun and Searchlight Activity: German aircraft reported anti-aircraft fire over London as varied, strong to the S.E. and S.W. of London with barrage fire at heights between 4000 and 6000 metres. Searchlight activity was reported as intense from the coast to London, probably as a result of the searchlight concentration in the Kenley Sector in connection with the night interception experiment in progress there. Neither of the interceptions by our fighters occurred with searchlight aid, the enemy having become visible in the bright moonlight. German crews reported decoy fires, particularly in Richmond Park.

Attacks on Aerodromes: Numerous fighter airfields were attacked, presumably to embarrass our night fighters. It is not clear by which units these operations were carried out but they probably belonged to Luftflotte 2³⁴. Airfields attacked were Hornchurch, North Weald, Biggin Hill, Kenley, West Malling, Debden, Duxford, Cambridge, Mildenhall and Marham. It is noteworthy that the majority of these airfields lie on the way to London, showing that the 'intruder' tactics were designed to support German bombers making to and from the capital.

Details of Damage Caused

New River Bridge, Edmonton – 24” culvert broken. City and all areas served deprived of forty-six million gallons of water per day. Fifteen million gallons restored within about 24 hours but required much excavation work for which 2000 men of the AMPC were mobilised.

Railways: All services from St. Pancras, Marylebone, Broad Street, Waterloo and Victoria (East and Central) suspended, 70% reduction of service at Euston, Charing Cross, Cannon Street and London Bridge.

District: Charing Cross – Whitechapel closed owing to damage between Aldgate and Mark Lane.

Suspension of services between Acton Town and Northfields, Dagenham and Barking.

At Wimbledon Park near Southfields Station, train derailed blocking one line.

Metropolitan: Baker Street – Moorgate closed. Suspended between Edgware Road and South Kensington.

Bomb through to line between King's Cross and Farringdon. The Fleet Sewer burst, water pouring into the Tunnel.

Piccadilly: Closed between Wood Green and Arnos Grove, Finsbury Park and King's Cross, Acton Town and Northfields, Acton, Acton Town and Alperton. Russell Square closed owing to land mine nearby.

Northern: Closed between Strand and Kennington, Tooting – Clapham Common. Camden Town closed.

Southern:

| | |
|------------|---|
| Battersea | – carriage shop on fire. |
| Waterloo | – train wrecked. Track Circuits affected at Vauxhall. Out of Action. |
| Battersea | – unexploded bomb on railway embankment between Letchmere Junction and Clapham Junction. Goods traffic held up. |
| Woolwich | – damage to track serving Royal Victoria Yard and supply Reserve Depot. |
| Wandsworth | – damaged overhead cables short circuited up and down lines at Permanent Way, Bisley Street. |
| Bermondsey | – Bricklayers Arms' Goods Yards, Loco Sheds and truck damaged. |

LNER: 2 unexploded bombs Goodmayes Marshalling Yard, Ilford: Services suspended Enfield Chase –

Grange Park, Palmers Green – Winchmore Hill.

| | | |
|------|-------------|--|
| LMS: | Willesden | - HE Queens Park Station. Crater on line. Express train fell into crater. Engine on its side and three coaches derailed. Up and down fast line blocked. Down slow lines out of position. |
| | Shoreditch | - Slight damage to track. |
| | Hampstead | - Up and down lines severely damaged. Down N.London line demolished. Up Lines blown out. Camden Yard blocked. All traffic stopped. |
| | Chiswick | - Gunnersbury Station blocked with debris. |
| | Hendon | - Line damaged. |
| | St. Pancras | - Land mine. Station blocked. |
| | Leytonstone | - Lines and buildings damaged by land mine. |
| | Becontree | - All four lines blocked. |
| GWR: | Lambeth | - Large fire at Nine Elms Lane Goods Depot |

Roads and Waterways

Perry Hill, Lewisham, blocked.
High Street south, East Ham, partially closed.
Albert Embankment, Lambeth, blocked.
Oxford Street, closed to traffic.
London Bridge, closed to north going traffic.
Broad Lane, Tottenham, partially blocked.
Fulham Road, completely blocked.
North Shore of River Thames by Bishops Park, wall carried away, danger of flooding.

Public Utilities

Damage to:

S.Metropolitan Gas Co's. Works, East Greenwich.
Central Electricity Board, Woolwich – fire.
London Electric Wire Works, Leyton – fire.
New River Supply, Edmonton.
Leyton Corporation Electricity Sub-station.
Northern Outfall Sewer, Barking Road.
Power Station, Old Street, Shoreditch.
Reservoir, Hornstall Road, Camberwell.
Gas Light and Coke Co's. Works, Fulham – fire.
Unexploded bombs, Caledonian Cattle Market believed to have affected meat distribution in N. London.

Telecommunications

Amhurst Exchange
Palmers Green Exchange and Terminus Exchange,
Grays Inn Road evacuated owing to unexploded
landmines.

Docks

Royal Victoria – damage to warehouses and granary.
Surrey Commercial – damage by high explosive.
Royal Albert – threatened by delayed action bomb.
West India – damage to Blackwall Basin, No. 10
Quay, Quay H collapsed, railway damaged, hydraulic
mains affected.
St. Katherine Docks – land mine at entrance to docks.
Tower Bridge Approach – damage.

Fires

There were 892 fires in the London region, 3 major
and 5 serious. The Royal Victoria Docks and several
factories were involved in a major fire.

Casualties

Several shelters and hospitals were hit causing
casualties.

Total: 213 killed, 915 injured.

Various factories were hit and damaged.

There were 9 incidents caused by land mines and
about 12 land mines were reported as unexploded.

Details of Subsidiary Attacks (Luftflotte 3)

Fliegerkorps V

- | | | |
|---------------|------|---|
| 2 Ju.88 of I | KG54 | on aluminium works at Banbury (Target not found owing to weather) |
| 1 Ju.88 of II | KG54 | on Rootes Aircraft Works at White Waltham. (Target not found owing to weather). |
| 1 Ju.88 of I | KG54 | on Windsor |
| 2 He.111 of I | KG55 | on the Westland Aircraft Works at Yeovil. (Target not found owing to weather, Yeovil town and Portsmouth attacked instead). |

| | |
|----------------------|--|
| 3 He.111 of II KG55 | on Westland Aircraft Works at Yeovil. (Target not found owing to weather. Yeovil town, Southampton, Bournemouth attacked instead). |
| 1 He.111 of III KG55 | on the Bristol Aircraft Works at Filton. |
| 8 Do.17 of KGr606 | on Bristol. One machine attacked Swansea starting fires and one other attacked Plymouth. |
| 1 FW.200 of I KG40 | detailed to attack the Rolls Royce works at Hillingdon, Attacked neighbouring Industrial installations instead. |
| 1 FW.200 | on an alternative target |
| 1 Ju.88 of KG77 | on Tunbridge Wells |
| 5 Ju.88 of KG77 | “ “ “ |
| 1 He.111 of KG26 | on Reigate |
| 2 Ju.88 of KG54 | on Eastbourne |
| 20 He.111 of KGr100 | on Birmingham |

Some aircraft on Glasgow?

Bomb Tonnages on Subsidiary Targets

15.3 metric tons 2016 incendiaries on Birmingham

| | | | | | | |
|------|---|---|-----|---|---|---------|
| 4 | “ | “ | 480 | “ | “ | Bristol |
| 1.5 | “ | “ | 60 | “ | “ | Glasgow |
| 15.8 | “ | “ | 310 | “ | “ | others |

Attack on Birmingham. Of all these subsidiary attacks, that on Birmingham was the most damaging, the LMS railway line at Wylde Green suffered and half a dozen important factories had to suspend production for various periods. 18 people were killed and 110 injured.

Units Identified by our 'Y' Service, traffic being intercepted while homing:

| | | |
|---------------|-----------|--------------------------------------|
| II KG51 | homing on | Orly and Etampes |
| I KG51 | " | Melun |
| III KG51 | " | Le Bourget, Bourges, Tours, Beauvais |
| II KG26 | " | Beauvais |
| I KG76 | " | Beauvais |
| III KG27 | " | Rennes |
| II KG54 | " | Chartres |
| I KG54 | " | Rennes |
| I Lehr 1 | " | Orleans Bricy |
| II KG54 | " | St. Andre |
| III KG55 | " | Villaconblay |
| * I KG3 | " | St. Trond (operating forward base) |
| * III KG2 | " | Cambrai |
| * III KG30 | " | Eindhoven |
| * I KG2 | " | Lille area |
| *I & III KG4 | " | Vendeville (Lille) and Lille Nord |
| *I & II KG126 | " | Les Septanes |
| III KG77 | " | Les Septanes |
| II KG27 | " | Bourges |
| II KG53 | " | Vitry en Artois |

* Units of Luftflotte 2

Thus, of the units participating, the following had not been heard by our 'Y' service:

| | |
|-----------|---|
| KG1 | - 9 a/c to London |
| St.KG55 | - 2 a/c to London |
| II KG55 | - 16 a/c to London |
| KGr806 | - 2 a/c to London |
| II L.G.1 | - 12 a/c to London |
| III L.G.1 | - 8 a/c to London |
| I KG27 | - 17 a/c to London |
| KGr100 | - 22 a/c to Birmingham (20 reached target area) |
| KG40 | - 42 a/c on alternative targets |
| KGr606 | |

We had thus with the above exceptions fairly gauged the units providing the main force used against us and had a reasonably accurate notion as to their basings.

Conclusions: a scrutiny of the damage inflicted upon London on the night of 15/16th October shows how badly communications had suffered. Railways were blocked and roads blocked, although this latter was not so serious owing to the alternative routes generally available. In addition to damage to public utilities, the effect on our trading by damage done to docks must be taken into account. Lastly, there was the vast amount of damage to public property and persons rendered homeless by the destruction of their houses. The cumulative strain on morale was undoubtedly heavy. However, reports give the impression that vital

production was not of itself badly affected. Summing up, it can be said that this German night attack, carried out at small cost to themselves, had partly succeeded in its aim of weakening morale if it had not directly succeeded in its aim of destroying industrial installations, although the dislocation of rail communications must have had its indirect effects on industry.

NOTE: Information for the compilation of this analysis was taken from the British and German documents already named in the note on statistical sources. In addition there was recourse to Ministry of Home Security Daily and Weekly Appreciations for October and the account by the Key Points Intelligence Branch, Ministry of Home Security.

¹ This suggestion was made by them at an interrogation.

² This figure has been computed from reliable German documents. See appendix 10.

³ The unit undertaking this task became known as the 'fire-raisers'.

⁴ The Staffel consisted of about nine machines. The Gruppe normally comprised three Staffeln.

⁵ "Aspirin" was the counter measure to Knickerbein and operated under the general RCM organisation known as "Headache".

⁶ This unit was formed on 10th April, 1940 with an initial establishment of four Mark I Blenheims and an immediate reserve of two aircraft of the same type. Its purpose was to test various aids to night interception as they were developed under operational conditions and also to train ground controllers. The Chief of the Air Staff was most anxious that the unit should start work 'as quickly as possible' and that 'the provision of necessary aircraft and personnel should be on the highest priority, the provision of Blenheims taking equal precedence with the re-equipment of the operational fighter squadrons. By 30th May, the AOC-in-C Fighter Command had ordered that an AI-equipped aircraft of the FIU should be made available for operations against the enemy and on the night of July 22nd, an enemy machine was shot down, the first to be destroyed by an aircraft equipped with AI. (S4211, 30th March, 1941 and FIU ORB).

⁷ Nos. 23, 25, 29, 219, 600 and 604. By 11th September, four of these together with two flights from each of the two Defiant squadrons found themselves disposed in the 11 Group area and the Middle Wallop Sector for the defence of London.

⁸ Nos. 141 and 264. No. 307 (Polish) Defiant squadron was forming. The Defiant was found to be too slow and vulnerable to attack from below to be used with confidence by day.

⁹ Nos. 141 and 264 squadrons.

¹⁰ No. 307 (Polish) squadron.

¹¹ The Commander-in-Chief clearly expressed his convictions about night defence when he said: "an AI sight must eventually be developed, capable of being laid and fixed without seeing the enemy, and every fighter should be capable of leaving and returning to its aerodrome blind. Our task will not be finished until we can locate, pursue and shoot down the enemy in cloud by day and by night, and the AI must become a gun-sight ... nothing less will suffice for the defence of the country. Every night I spend watching attempts at interception confirms me in my belief that haphazard methods will never succeed in producing more than an occasional fortunate encounter." Night Interception Report, FC ORB Appendix D.5.

¹² Early in November No. 73 Squadron was ordered abroad and No. 85 Squadron moved to Gravesend to take its place. Later in the month No. 87 Squadron was turned over exclusively to night fighting in its place.

¹³ There were 8½ single engined squadrons and 6½ twin engined squadrons, No. 85 squadron at that time being in the process of conversion from Hurricanes to Havocs and then consisting of both these types. This figure does not include No.93 (Aerial Mine-Laying) Squadron.

¹⁴ The Commander of No. 219 Squadron had, for example, seen only one hostile machine in 100hrs of night-flying in AI-equipped Blenheims, and his squadron had seen only five hostile machines all told.

¹⁵ Aircraft of No. 219 Squadron were later equipped with the Lorenz receiver to 'hunt in the beam', but they were never successful in intercepting the enemy. For a short time later, No.604 Squadron attempted this type of operation, but efforts were abandoned when better methods of interception like GCI came out.

¹⁶ According to the GOC-in-C AA Command: "... the firing of the dock area on 7th September occurred when the gun defences were numerically at their lowest ebb." (Pile: Despatch Pt.I 40).

¹⁷ Guns in the IAZ were in action from 2105-0300 hours.

¹⁸ The Committee was composed of: Marshal of the Royal Air Force Sir John Salmond (Chairman), Air Chief Marshal Sir Wilfred Freeman, Air Marshal Sir Philip Joubert, Air Vice Marshals A W Tedder and W S Douglas, Air Commodores D F Stevenson and L G Payne, Group Captain Sowrey and Mr F W Smith (Secretary)

¹⁹ This is fully dealt with in RAF Narrative, ADGB Vol. IV, Pt 1, paras 33-48.

²⁰ On 15th October 1940 (FC/S 10163/Air, October 15th 1940)

²¹ AI Marks I and II were largely experimental models and AI Mark III proved to be unsatisfactory. Mark IV was the first successful mark of AI

²² At the second meeting of the Night Air Defence Committee on 21st October, it was revealed that the production of Beaufighters had been stopped following enemy air bombardment, but that it had been re-commenced during the second week in October. At this time, there were altogether about 16 Beaufighters in the Command.

²³ The training of gun crews in the use of radar equipment was undertaken by a team of qualified technical experts and scientists.

²⁴ Fighters were usually equipped with this device (popularly called a 'pip-squeak') which automatically transmitted a high-pitched note of 13 seconds duration in every minute while it was switched on. D/F stations were thus enabled to take regular bearings.

²⁵ Two pilots of No. 600 Squadron were killed in accidents which were probably due to this fault.

²⁶ It soon became clear that contactor readings though adequate for day interceptions were hardly accurate enough for night work.

²⁷ The problem of identification was eased by the fitting of this apparatus which emitted a characteristic echo on the screens of our radar stations, but in practice it was never an easy one. (IFF: Identification friend or foe).

²⁸ Raids in which 100 or more tons of high explosive fell.

Note: Whenever the term "major raid" is used, it means that the Germans had planned to drop 100 or more metric tons of high explosive bombs.

²⁹ Estimate by Ministry of Home Security Sources.

³⁰ Highest priority was given to the removal of bombs from railway lines and railway properties.

³¹ No. 80 Wing reports in September reported that 'meaconing' or 'masking' of enemy beacons by like transmissions from this country were effective enough to make the Germans alter their beacon call-signs and frequencies at irregular intervals in endeavour to outwit us.

³² 300 a/c was an approximate figure.

³³ Units of this Luftflotte identified while 'homing' by our Y service included: 1/KG3, III/KG2, III/KG30, I/KG2, I, III/KG4, 1/, 2/KGr126, II/KG53.

³⁴ Three Staffeln, consisting of Ju.88's were engaged specifically on night intruder operations of this kind. They were described as Fernnachtjäger and were independent of the long range bomber force.

CHAPTER 5

THE SECOND PHASE: 14/15th NOVEMBER 1940 TO 19/20th FEBRUARY, 1941

War on Industry and Ports

The second phase of the night battle opened dramatically and suddenly with the attack on Coventry of 14/15th November, and the reasons for this change in enemy policy have to be considered. The great offensive had been abandoned and the invasion postponed, heavy losses and the necessity for conserving his forces had driven him to launch the night bombardment of London. It was hoped that irreparable damage to the social and economic life of the capital (and through its singular importance of the whole country), might bring us to submission.

By mid-November, however, the most ardent supporters of this thesis must have accumulated sufficient evidence to show that their method possessed considerable limitations when applied to so vast and sprawling a city and applied with the striking force then to hand. London's social and economic life was damaged, but there were no signs that the damage was so decisive that submission was near. German theorists might, therefore, well have argued that the forces operating against London, if concentrated against much smaller areas such as the provincial cities which contained vital production centres, would equally bring us to submission once these were destroyed. This then might have been the motive which caused the Luftwaffe to commence the reduction of provincial industrial cities and of ports.

The dual nature of this policy is noteworthy, for there were attacks on purely manufacturing towns such as Birmingham and Coventry, as well as on ports such as Southampton, Liverpool and Bristol. Of 31 major raids carried out in this period, 9 were on inland industrial cities, 14 on ports and 8 on London.¹ Ports such as Bristol and Liverpool were not without significance as centres of production, but their bombardment served a further three-fold purpose. It formed an attempt to interfere with the speedy discharge of cargoes by damage to facilities, to destroy the cargoes themselves, and, lastly, to destroy the ships which had carried them. Interference with the discharge of cargoes or the destruction of cargoes themselves would have severe repercussions on the industries waiting for the material they required to reach them from the ports, and viewed in this light, it becomes evident that a seemingly dual intention was in fact a well-integrated unity.

One feature of enemy attack during this phase was that practically all the aircraft participating in a night's raiding were directed towards a single target, so that the highest possible concentration was achieved. Thus between 14/15th November and 19/20th February, there were no less than 23 of these 'wholesale' raids against provincial cities and 8 against London. In spite of this figure, it would be misleading to imply that the importance of London as an objective had so diminished that it was given only passing attention. In fact, the capital remained the secondary target,

was consistently under warning and consistently bombed, although on a much reduced scale, for even the enemy's comparatively unimpaired resources did not permit him to mount major attacks on both London and the provincial cities at one and the same time.

One other feature of enemy activity of this period deserves mention. He showed a tendency to bomb a city twice or even three times at brief intervals, presumably with the intention of hampering its recovery to the utmost after the initial raid. Thus Southampton was attacked on 30th November/1st December and again on 1st/2nd December, Liverpool was attacked on 20/21st December and again the night following; Birmingham was attacked three nights running from 19/20th November, while Manchester also received two consecutive attacks on 22nd/23rd December and on 23rd/24th December. All these were major raids when it was intended to drop over 100 tons of high explosive, but many instances occurred of a raid of considerable dimensions followed up by a harassing attack. Coventry was bombed in this fashion, and Sheffield offers yet another example. After 355 metric tons of high explosive bombs had been dropped on the city during the night of 12/13th December, a smaller raid on the night of 15/16th December caused great hardship, over 150 fires being reported, and 48 factories being hit, 15 among them regarded as 'key points'.

Briefly then enemy strategy during the second phase of the night battles consisted of a severe bombardment of provincial cities, with London as the secondary objective. It was his practice to concentrate all his forces against one target on any night, and to follow up the initial raid with further raids of major proportions or with harassing attacks.

When the new phase opened, the establishment of the GAF Bomber Arm stood at 1687 aircraft, and its strength at 1333 aircraft. These figures show that its striking powers numerically was unimpaired, and it is a matter of little surprise, for between June and October our night defences could only claim the destruction of 117 German machines. The picture however was not as bright as it appears on the surface. Interrogation of some of the leaders of the Luftwaffe elicited the information that losses in night operations were in the aggregate almost as high as those sustained by day, and that they were on the increase up to the time that main night assault was discontinued.

The great majority of these losses were said to be due to crashes on landing and taking-off, and during the course of training flights. Furthermore, there was a lack of competent formation leaders,² crews were of a lower standard, and they were finding difficulty in handling the new Ju.88 at night. The approach of winter made operations very trying, for the surfaces of airfields became boggy and the location of targets in cloudy or foggy conditions became an arduous task. The condition of airfields was seriously impaired from December 1940 to February 1941, for during this time the number of major attacks delivered by the enemy showed a striking decline.³

German preoccupation with blind bombing and navigational devices showed that the enemy appreciated the importance of these aids when mounting winter air offensives. Somehow heavy concentrations of aircraft had to be able accurately to locate their targets, and once located, accurately to deliver their bombs, but the planning and timing of mass night attack, (especially in those days when it was comparatively novel) was a complex matter, so that concentration and accuracy were not invariably achieved. By the time this second phase drew to a close, the enemy had several blind-bombing systems, and 'Knickebein'⁴, 'Ruffians'⁵ and 'Benito'⁶ were commonplace cover-names for them among members of the No. 80 Wing organisation set up to disturb them, while German records show that many units⁷ were capable of bombing by instruments.

FC Int.
Summary 217
January 1941

Throughout the period under review the success of a concentrated attack largely depended on the initial marking of the target by the specialist unit KGr100, to which this task was invariably assigned. On the night of 3rd/4th January 1941, when its aircraft were late in taking off from their base at Vannes owing to poor weather, several machines from other formations were compelled to fly about aimlessly without dropping their bombs, since they were waiting the arrival of KGr100 to mark out the target. On the night following when KGr100 were once again late and the fires they started quickly extinguished, the aircraft following up were deceived and did not reach their objective in full numbers.

No. 80 Wing ORB
January 1941

Two points emerged. Any means of nullifying the pathfinding tactics of KGr100 together with efficient fire-fighting could help to influence the course of the raid. The fire services were growing in efficiency and radio counter-measures against the Knickebein beams were gradually driving the enemy to use the complex of MF beacons situated in Occupied Territories for navigational purposes. As however we were 'meaoning' these beacons, his sources of navigational information were seriously curtailed, so that towards the latter part of 1940, many of his crews were heard reporting the failure of their D/F sets.

Ibid

By 19th January the 'Ruffians' system usually employed by KGr100 for accurate bombing was not extensively used, while in February further evidence came to hand of the waning importance of this unit. On two occasions they arrived over the target after the attack commenced, and once they had dropped parachute mines, a weapon demanding no precision of aim. Meanwhile the alternative system of blind-bombing known as 'Benito' began to come into use, and it seemed as if KGr26, the unit capable of exploiting it were about to assume greater importance as 'pathfinders' than KGr100.

The aggregation of encouraging evidence showing the growing effectiveness of our radio counter-measures marked an important contribution towards the night defences, especially the evidence that KGr100 had received certain setbacks. The importance of this formation to the success of German night raiding had been repeatedly demonstrated, while the raid on Coventry of 14/15th November and the raid on London of 29/30th December afforded ample evidence of the danger they constituted to us.

Ministry of Home
Security Daily and
Weekly
Appreciations,
December 1940

On December 29/30th 10 Heinkel 111's of KG100⁸ carrying only incendiary bombs led an attack on London which in many respects was more catastrophic than many others of greater proportions. These aircraft bombing by instruments achieved a precise and concentrated effect in their target-marking, so that other machines following up were able to bomb with accuracy. Tragic damage was caused, great fires blazed in the area of the Guildhall which had to be regarded as uncontrollable, one conflagration of half a square mile in the City and another of one quarter square mile in the Minories proved beyond the capacity of any fire service to deal with. Thirty major fires burned, and in all 1469 fires had gained a hold at various points. Unfortunately the attack reached its peak when the River Thames was at its lowest ebb, depriving firefighters of a vital source of water supply. Altogether it would be difficult to over-estimate the part played by KG100 in making this raid a success.

FC/S.21802 Ops
November 14 1940

It has already been said that the second phase of the night battle opened dramatically and suddenly with the raid on Coventry on 14/15th November. This statement is only figuratively true, however, for our intelligence had in advance gleaned certain information about the character of the enemy's new intentions. Thus Fighter Command was in a position to issue an Operational Instruction (No. 44) which declared that "according to reliable information," major night bombing operations were likely to be undertaken by the German Air Force between 15th November and 20th November.

The target selected by the enemy was not known, but the Fighter Command instruction suggested several areas as likely to come under attack. These surmises as to the probable objective did not include Coventry.

It was known that the operation was to be controlled by the Commander-in-Chief of the GAF himself, and it was known that the operation was to consist of three phases or was to be carried out on three consecutive nights. Furthermore it was known that KGr100 was to carry Out the first attack, led by its Commanding Officer in person, and that the unit was to use the Knickebein beam system in order to reach the target.

There was something appropriate about the choice of KGr100 to open a new phase in a battle, as well as to inaugurate a type of raid hitherto unheard of, and implicit in this choice was a recognition of the formation's unique place in the enemy plans for waging night Air Warfare. For upon the results of an operation of the kind undertaken at Coventry could turn the future of this fresh conception of aerial bombardment.

Fighter Command lost no time in devising plans to meet the probability of attack as suggested by our sources of intelligence, but these plans (issued under the cover-hands of 'Operation Cold Water'), had hardly been drawn up before the raid on Coventry occurred. The courses of action decided upon were:

- (i) A heavy bomber force of Bomber Command to carry out an attack on a German city.
- (ii) Security patrols of Bomber and Coastal Commands to be carried out against enemy night bombing aerodromes in use.⁹
- (iii) All measures to interfere with enemy W/T navigation aids to be brought into use.
- (iv) The maximum number of night fighter squadrons to operate along enemy avenues of approach to objectives, some being sent to the light beacon at Fecamp with the object of destroying enemy aircraft switching on navigation lights on their homeward flight. Fighters were to include AI Beaufighters (those Beaufighters without AI also being operated in the Tangmere Sector and any Defiants available in the Biggin Hill Sector) and any additional 8-gun fighters that could be put up. Normal methods of controlled interception were to be used.
- (v) Operational aircraft of No. 151 (Hurricane) Squadron to remain at Digby in the No. 12 Group area for the defence of the Midlands.
- (vi) If the Aerial Mine-Laying Squadron (No. 93) had successfully completed tests, it was to be employed.

The dispositions of the night fighter squadrons were as follows:

| <u>No. 10 Group</u> | <u>No. 11 Group</u> | <u>No. 12 Group</u> |
|--|---|---|
| No. 604 (Blenheim) at Middle Wallop | No. 23 (Blenheim) at Ford | No. 151 (Hurricane) at Digby |
| | No. 219 (Blenheim and Beaufighter) at Redhill | No. 29 (Blenheim) at Digby and Wittering |
| | No. 141 (Defiant) at Gravesend | No. 85 (Hurricane) at Kirton-in-Lindsay |
| | No. 264 (Defiant) at Rochford | <u>No. 13 Group</u> No. 600 (Blenheim) at Catterick and Drem. |
| | No. 25 (Blenheim) and Beaufighter at Debden | |

Note 1: FIU (Blenheim and Beaufighter) was at Tangmere and available for operations.

Note 2: No. 247 (Gladiator) Squadron at Roborough in No. 10 Group was available for operations.

Note 3: No. 73 (Hurricane) Squadron had had orders to proceed abroad

on November 3rd, its place was to be taken by No. 87 (Hurricane) Squadron stationed at Exeter and Bibury.

Note 4: In addition aircraft of squadrons normally regarded as day Squadrons were available for night operations.

Note 5: On 14/15th November when Coventry was raided, the airfields at West Malling and at North Weald were unserviceable and the airfield at Ford only partly serviceable. No. 11 Group, however, had received orders to see that night squadrons were located at airfields likely to remain fully serviceable under existing weather conditions.

Analysis of the Raid on Coventry 14/15th November, 1940

A detailed analysis of this raid has been undertaken because it represents an occasion of singular importance in the history of air warfare. For the first time air power was massively applied against a city of small proportions with the object of ensuring its obliteration. It further represents one occasion when the German tactics of night bombing, pursued not only during this phase of operations but throughout the offensive, were successfully consummate.

It also well illustrates the importance of guiding beams, the importance of marking the target with fires and the importance of KGr100 to whom it so often fell to lead the attack.

Weather

The German meteorological forecast at 1700 hours on the 14th was:

| | |
|----------------|--|
| France: | 3-6/10 cloud up to 2500 metres |
| Channel Coast: | 5-8/10 convection cloud from 300-5000 metres, showers. |
| S. England: | 4-7/10 convection cloud, wind N.W. at 500 to NE., |
| Midlands: | 60 km.p.h. |

Our own weather reports showed that there was widespread mist in the Midlands, east and southeast with some fog patches. Visibility elsewhere was good, skies being mainly cloudless and little wind prevailing. Conditions in fact were propitious for bombing attack, particularly as a full moon brightly illuminated the night and obviously gave much assistance to enemy crews.

Timing of the Raid

The enemy planned to send a few aircraft to London in the early hours of the evening, at 1915 and 1925 hours, possibly in the hope of persuading us to believe that the preliminaries for a great attack on the capital were under way. He had timed the bombardment of Coventry to commence at 2020 hours and end at 0610 hours, thus prolonging the trails of the city to the utmost. The schedule of his raids was:

| | <u>Time</u> | <u>No of a/c</u> | <u>Bombing Height</u> | <u>HE in metric tons</u> | <u>Incendiaries in metric tonnes</u> |
|-----------|-------------|----------------------|---------------------------|--|---|
| Coventry: | 2020-0610 | 304 | | 334.8 | 28.96 |
| | 2158 | 2 | | 9 landmines | |
| | 2200 | 8 | | 12 " 2 tons HE | |
| | 2120 | 14 | | 28 landmines | |
| | 2110 | 12 | | 22 " 1 ton HE | |
| | 2205 | 13 | | 28 landmines | |
| | 2315 | 13 | | 28 " | |
| | 2350 | 2 | 4000 metres | 3.2 tonnes | |
| | 2237 | 3 | 4000 " | 3 | |
| | 2235 | 9 | 2200 " | 4.5 | |
| | 2310 | 6 | 3000 " | 5.5 | 28 (explosive incendiaries) |
| | 2255 | 3 | 3600 " | 2.7 | |
| | 2237 | 9 | 3800 " | 8 | |
| | 2215 | 6 | 2100 " | 3 | |
| | 2320 | 2 | 4000 " | 4 | |
| | 2315 | 1 | 4000 " | 0.5 | |
| | 0011 | 10 | 4300 " | 10 | |
| | 0542 | 20 | 4500 " | 19.4 | |
| | | 437 | | (*401.6 and (127 landmines The most authoritative German records give Total tonnage dropped in this raid as 503 metric bombs. | 28.96 and 28 explosive incendiaries |

*The enemy publicly claimed to have dropped 450,000 kg's of bombs (about 442 tons), not very wide of the mark.

Part Played by Luftflotte 3

Records of Luftflotte 3 show that 304 of their aircraft participated in the Coventry attack, making up the major part of the force engaged. Thus it can be assumed that 133 aircraft of Luftflotte 2 made up the remainder of aircraft operating on this night.

Tonnage of Bombs Dropped

Records of Luftflotte 3 show also that 334.8 metric tons of high explosive were dropped by its aircraft together with 23,848 of one type of incendiary bomb and 5112 of a further type.

Units Engaged

Units of Luftflotte 3 engaged against Coventry were as follows:

| | | | |
|-----------------|----------|------------------------|-----------------|
| Fliegerkorps IV | I/LG1 | 12 Ju.88 | 0132-0150 hours |
| | II/LG1 | 12 " | 0203-0235 |
| | III/LG1 | 8 " | 0115-0245 |
| | I/KG27 | 20 He.111 | 0004-0128 |
| | II/KG27 | 14 He.111 | 0015-0205 |
| | III/KG27 | 13 He.111 | 0007-0125 |
| | KGr100 | 13 He.111 | 2020-2105 |
| | KGr606 | 9 Do.17 | 2350-0018 |
| Fliegerkorps V | I/KG51 | 16 Ju.88 | 0210-0300 |
| | II/KG51 | 10 Ju.88 | 0242-0335 |
| | III/KG51 | 10 Ju.88 | 0315-0400 |
| | I/KG54 | 11 Ju.88 | 0356-0500 |
| | II/KG54 | 7 Ju.88 | 0452-0532 |
| | KGr805 | 12 Ju.88 | 0452-0545 |
| | St.KG55 | 2 He.111 | 2320-2330 |
| | I/KG55 | 13 He.111 | 0001-0100 |
| | II/KG55 | 16 He.111 | 2120-2155 |
| | III/KG55 | 9 He.111 | 0105-0135 |
| Fliegerkorps I | KG26 | 28 He.111 | 0001-0342 |
| | KG | 7 Ju.88) 13 Do.17) | 0235-0320 |
| | KG77 | 25 Ju.88 | 0345-0610 |
| | KG1 | 17 He.111) | |
| | | 7 Ju.88) | 0117-0335 |

Course of the Attack

Fighter Command intelligence reports describe 10 enemy aircraft flying from the direction of the Channel Islands, making landfall in Lyme Bay at about 1817 hours and then proceeding towards Coventry over Bristol, this early phase of activity dying down by about 2100 hours. It seems likely that these were the 13 Heinkel 111's of KGr100 from Vannes armed with 5112 incendiary bombs of one type, 5112 of a further type and high explosives, which began attack, using 'fire-raising' pathfinder tactics. This unit claimed to have dropped the greater number of its bombs into the middle of the target area, reporting eight major fires and numerous smaller ones. Since the Coventry guns did not open fire until 2015 hours, it is reasonable to suppose that aircraft of KGr100 kept closely to their timing and supports the assumption that they were first on the scene.

The second phase of activity from the same quarter commenced at 1915 hours when about 100 enemy aircraft started making landfall between Selsey Bill and Portland Bill, flying straight towards the Midlands. It is difficult to place this activity but the majority of these raiders may have belonged to Luftflotte 2, since only 16 He.111 of

II/KG55 (Luftflotte 3) were due over the target towards 2100 hours.

At about 1830 activity had started in another direction with about 50 enemy machines coming into Lincolnshire and Norfolk and proceeding towards Coventry, their operations terminating at about 2330 hours. As few of the aircraft from Luftflotte 3 were due over Coventry until about midnight and later, it seems as though they made the second substantial batch despatched by Luftflotte 2, making with the earlier effort approximately the 133 machines contributed in all by this command towards the attack on Coventry.

About 100 aircraft crossing the coast between Selsey Bill and Dungeness and coming from the Le Havre–Abbeville-Dieppe area made for Coventry. This is likely to have been the main body of Luftflotte 3 machines due over the target towards midnight and shortly afterwards.

Our raid intelligence underestimated the enemy effort, counting 350 aircraft in all the raids and about 280 over the main target, Coventry, but owing to technical difficulties and the number of raids involved it is conceivable that radar did not succeed in counting correctly.

Assignment of Specific Targets

It is of more than passing interest, considering our own conceptions of these raids as designed to smash town centres, that definite targets were allocated to various units in Luftflotte 3. I/LG1, for instance, a notable bomber squadron, had as their target the Standard Motor Car Company's works and the Coventry Radiator and Press Work Co. Ltd, both situated in the S.W. part of the city; II/KG27 were detailed to attack Alvis Aero Engine Works, KGr606, a firm called Cornercraft Ltd, and the Gas Holders in Hill street. I/KGr51 were to destroy the British Piston Ring Co. and II/KG55 the Daimler Works.

Ministry of Home Security reports show that these targets received damage:

Daimler: Half the iron foundry gutted, whole machine shop on Boulton and Paul Production completely wrecked. Remainder of factory out of production for three to four weeks.

Daimler (No. 2 Factory): Damage to roof. Thirty machine tools destroyed, but given services, production in the rest of the factory could be restored in three to four days.

Alvis Ltd: Engine repair shop badly smashed, damage to aircraft section not extensive.

Standard Motors: Superscharger test building wrecked, production in rest of factory restarted by the day after the raid, 50% of personnel at work.

British Piston Ring Co: Entirely idle owing to lack of services.

Enemy comments on our defences are concerned chiefly with anti-aircraft fire and the decoy fires they report having seen, the AA being described as very lively and accurate over the target. Strong balloon barrages were said to be flying over the centre and to the S.W. of the city. Between the coastal area and the target, seven fighters with lights burning were encountered without any engagement ensuing. Searchlights were reported active over Bristol, Birmingham, Portsmouth, the Isle of Wight and Oxford, a group of 20 lights supposed to have been in a circle some 5 kms from the Alvis works.

Fighter Command Patrols

We put up the following fighter patrols:

No. 10 Group: 34 patrols of 1 a/c – 13 Blenheims, 1 Beaufighter, 5 Gladiators, 15 Hurricanes

No. 11 Group: 49 patrols (including 1 F.I.U. patrol)

Hurricanes: 7 patrols – 7 a/c

Defiants: 26 patrols – 30 a/c

Blenheims: 6 patrols – 7 a/c

Beaufighter: 10 patrols – 10 a/c

Five enemy machines sighted but no interception resulted. One hostile bomber jettisoned its load when sighted and flew off to sea under cover of cloud.

No. 12 Group: 24 patrols of 1 a/c

Kirton-in-Lindsey: 1 Blenheim,
4 Hurricanes

Wittering: 3 Blenheims

A Blenheim fired on an He.111 which passed underneath but without effect.

Digby: 5 Blenheims
3 Hurricanes
1 Beaufighter

A Blenheim sighted an enemy machine in the Swaffham area and claimed it as damaged.

Duxford: 7 Hurricanes

No. 13 Group: 10 patrols of 1 a/c

6 Blenheims
4 Hurricanes

No. 14 Group: 1 patrol of 3 Hurricanes

A total of 119 patrols (123 a/c) were thus flown but no decisive interception resulted, although 437 enemy aircraft were engaged in the night's operations.

AA Claims:

2045 hours 1 e/a disintegrated in mid-air in Birmingham area

2122 hours 1 e/a crashed in the Loughborough area

Consequences of the Raid

The importance of Coventry can be summed up by saying that it was the chief centre of aero-engine assembly factories and the machine tool industry.

Probably all the factories in the city were affected to a greater or lesser extent by the dislocation of utility services. Although only one utility station was actually hit, many cables, mains and pipes were severed and indeed, the effect on production through lack of utility services seemed to have exceeded the effect of direct damage to plant. The gas shortage was the most serious¹⁰ and the water situation only slightly less so. Electricity was the best maintained. All factories were closed on 15th November.

Railways

Lines from Coventry to Birmingham, Leamington, Rugby and Nuneaton were blocked, Coventry station was closed. Nuneaton-Rugby (LMS) Main line to the North blocked. By the evening of the 18th however all lines were re-opened except Coventry-Nuneaton (both routes blocked). This service was restored by about the 21st. Coventry Goods Yard working at 25-30% but recovered rapidly.

Roads

Extensive immediate dislocation, all except essential traffic routed round the city. Damage to important highways not serious.

Fires

By 0330 in the morning over 200 fires were reported but water shortage made fire-fighting difficult, debris blazing up from time to time during the afternoon of 15th November, but all fires were in hand by the evening of that day.

Incidents

525 incidents were reported in all.

Food

400-500 retail shops were put out of action, making distribution difficult although stocks were satisfactory. Mobile canteens and field kitchens helped to alleviate the situation.

Casualties

380 killed, 800 seriously injured.

Morale

A certain number of people left Coventry but recovery was quick. On the evening of the 16th, arrangements had been made to transport 10,000 people out of the centre of the city, but on the morning following it was reported that only 300 persons had used them. The King's visit was of great service in maintaining morale.

Unexploded bombs, etc

By the evening of 17th November, 14 parachute mines had been dealt with, 40 unexploded bombs had been removed from key-points, road junctions and railway. 150 unexploded bombs had been confirmed.

Transport for Workers, etc

Transport facilities, urgently needed, were becoming more easy to obtain by 18th November and were being provided to take workers to their factories, to evacuate the homeless, and to disperse key tools from damaged factories.

Factories Hit

Twelve important aircraft factories received severe damage, three others could not continue production owing to lack of utility services.

Nine industrial plants (other than aircraft) were also severely damaged, while six others had to suspend work owing to lack of utility services.

ARP and Other Services

Telephone communications failed at an early stage of the raid, making the work of the civil defences more difficult, but Ministry of Home Security reports show that despite debris hampering the deployment of the services, a high standard of efficiency was maintained. Reinforcements of professional firemen, rescue and ambulance workers were quickly rushed in and troops were later brought in to help.

Conclusion

The opening of the attack by KGr100 with accurate target marking of the city centre, using incendiary bombs laid the foundations of a successful operation. The fires they caused enabled the aircraft following up to concentrate their bombing on an area of a few acres of the city centre. The advantages to the attacker of good pathfinding were all too obvious and to the defender the absolute necessity of dealing quickly with initial fires or devising tactics to make the enemy pathfinders drop their bombs away from their true target. The AA barrage was intense, greater it is said than put up on any one night by the London defences. Its deterrent effect can only be surmised to have been good. It was undoubtedly a devastating raid, well planned and successfully executed by the enemy. It is only puzzling why he did not repeat it, leaving a few days for hasty restorations in industry and in the city generally. Another such raid might well have put Coventry beyond the possibilities of repair.

NOTE: Information for the compilation of this analysis was taken from the British and German documents already named in the note on statistical sources. In addition there was recourse to Ministry of Home Security Daily and Weekly Appreciations for November (including a special report on this raid), and the account by the Key Points Intelligence Branch, Ministry of Home Security.

Progress in Fighter Command and in AA Command

During the second phase of enemy night attack our fighters, still labouring under all the difficulties they had had to face during the bombardment of London, offered little resistance to the raiders. No additions had been made to our specialised twin-engined squadrons, and when the new phase opened, only 2¹¹ of the 6¹² we had, possessed any Beaufighter aircraft. At this juncture we counted two Defiant squadrons,¹³ and the two day-fighter Hurricane squadrons¹⁴ which had been recently turned over to night duties by the Commander-in-Chief at the instructions of the Chief of the Air Staff. No. 73 (Hurricane) Squadron which was the third of the day squadrons reserved for night duties had received orders to proceed abroad on 3rd November, and it was decided that No. 87 (Hurricane) Squadron should take its place among the night fighters. Nor were there any significant increases in the strength of our night fighter force until after a third phase in enemy bombing policy had opened, and during November, December, January and February it could only claim the destruction of 13 enemy machines.

Meantime Air Chief Marshal Dowding relinquished his post as Commander-in-Chief during November and was succeeded by Air Marshal W S Douglas, who immediately turned his energies towards the solution of the problems of night defence so exhaustively explored by his predecessor. His first report demonstrates that he too had quickly become aware of the deficiencies often stressed by Air Chief Marshal Dowding in the past. "I am convinced" he wrote, "that the main obstacle to frequent intercepts by night is the lack of accurate tracking inland from the coast, and most important of all, lack of accurate information with

regard to the height of the enemy bomber.” The Kenley Experiment had been an attempt to answer this very question of continuous and accurate location, and GL was expected to read good heights, but for reasons earlier discussed it brought no results. The new Commander-in-Chief equally saw the possibilities of the Kenley lay-out, but broke up the close network of GL as uneconomical in the use of sets and decided upon a 60 mile GL ‘carpet’ from Kent towards Bristol.

Ibid

Summing up the requirements for a good night fighter defence, he stated:

(i) that there should be at least 20 night squadrons fitted with AI. They would then provide a semi-circle of night fighters from Newcastle to Devonshire, with a squadron each in the Birmingham and Coventry area, and later perhaps a squadron in the Glasgow area.

(ii) that there should be night flying airfields¹⁵ with AI Homing Beacons, Lorenz Blind Landing and other facilities.

(iii) that there should be at least one large Regional Control airfield with a proper flying control staff to ensure the safety of night flying aircraft. (Note: This responsibility then rested with the Sector Controller, whose chief function was to see that interceptions were effected.)

(iv) that special training using the AI by day with crews wearing dark glasses should be carried out. Later practices by night could commence.

(v) that crews selected for night fighting should be specially tested for vision.

Some steps already taken constituted progress in the right direction.

(i) A scientific officer was posted to each of the twin-engined squadrons to ensure that the complex radar equipment would be properly maintained.

AHB/II/55 enc.47
NAD(40)
3rd Meeting
19 November 1940

(ii) Meteorological officers were sent to stations where night squadrons were stationed.

(iii) The formation of a Night Operational¹⁶ Unit.

AOC-in-C/FC
Progress Report
February 5th 1941
FC/S.21197

The Commander-in-Chief’s plan for the expansion of the night fighter force to 20 squadrons involved the formation of 6 additional twin-engined squadrons, but even by February, towards the close of the second phase of German activity, only¹⁷ one of these had in fact come into being, and it was being supplied with Blenheim I’s thrown up by the re-equipment of other squadrons. The truth was that the output of Beaufighters and DB7’s had not come up to expectations. The desired expansion was further hindered by a lack of trained pilots for the twin-engined night squadrons, and early in February the Commander-in-Chief reported a

NAD(41) I

shortage of 74 pilots.¹⁸ Against this 22 were due from the recently established Night OTU and 12 'veteran' pilots with civilian experience had been selected for night duties, a total of 34. It was hoped that that deficit might be made good by the transfer of pilots from other Commands, and a few were later moved from Bomber Command to undertake night fighting.

NAD(40)
November 19th
1940
5.
AOC-in-C FC,
Progress Report
February 5th 1941,
8

By far the most important development in the Command during this period was the decision to install GCI sets in all Fighter Sectors, beginning with the London Sectors. Difficulties in the production of this apparatus existed but in January 6 stations had been put up.¹⁹ The poor weather during January and February, which had so severely curtailed German operations, had also interfered with the calibration of these stations, and with the training of the crews to man them. The equipment at this stage suffered from one limitation in that it was unable to read heights with complete accuracy, but as the GCI network covered the area of the GL carpet, it was proposed to overcome the difficulty by co-operating with the GL sites which could give more accurate heights.

Ibid 11

To facilitate the operation of the newly installed GCI sets, it was decided to combine the small, narrow sectors in No. 11 Group into three larger areas. Debden, North Weald and part of the Hornchurch sector was formed into a single area, controlled from North Weald; the Hornchurch Sector south of the Thames, the Biggin Hill and Kenley Sectors formed a second area under the control of Biggin Hill, while Northolt and Tangmere formed the third area under the control of Tangmere.

FC ORB Appendix
F
Feb. 1941

The advent of GCI for carrying out night interceptions naturally demanded that a technique of control be devised. Accordingly a standardised procedure was decided upon. The Aerodrome Control Officer was responsible for seeing a night fighter safely off the ground,²⁰ and once away, the pilot, having changed over to Channel D of his R/T set called his Sector Control. It was the Sector Controller's business to direct him to his patrol line, ascertaining his whereabouts occasionally by means of "voice fixes". Once on his patrol line the pilot could maintain his position by illuminations provided on the ground or by some predetermined courses and times, worked out before take-off.²¹ When an enemy raid was plotted, the Sector Controller notified its position, height and direction to the GCI station and then gave vectors to a patrolling night fighter which would bring him to a point convenient to the GCI Controller, which in effect meant within range of his set.²²

The GCI Controller's function was to place his fighter in AI contact with the incoming enemy aircraft, and when this contact was firmly established the pilot gave his ground control a "Tally Ho", whereupon the GCI Controller was ready to commence a new interception, using another fighter fed to him from the patrol line by the Sector Controller. In some cases, it was possible for the GCI Controller to handle two interceptions at one and the same time, but this was no easy matter in practice. Following an engagement or if AI contact had been lost, the night fighter pilot, employing Channel D (the R/T frequency kept for communications

with his Sector Control) called the Sector Controller who had to decide whether he wanted the aircraft to land or to return to the patrol line. If he decided that the aircraft was to land, he gave the pilot a general vector in the direction of his base, calculated to bring him within R/T range of the D/F Homing Station. It was then the pilot's duty to call the Aerodrome Control Officer whose function it was to see that the aircraft was landed safely.

Ibid 19

The exploitation of single-engined fighters was carried on in one of four methods:

(i) using GCI the controller endeavoured to guide his fighter towards the bomber until the fighter pilot could see it. This method was used in conjunction with searchlights, where illumination would help to conclude the interception. In practice, however, twin-engined aircraft with AI were almost invariably employed under GCI control and single-engined fighters only rarely.

Ibid 22

(ii) using GL tracks of the bomber and relying²³ on R/T 'voice fixes' for obtaining tracks of the fighter.

Ibid 24

(iii) searchlight assisted interceptions. A new searchlight 'carpet' with the lights in clusters of three had been laid out towards the end of 1940 but its use was restricted by lack of communications. A few SLC sets were available and it was hoped that many more would be forthcoming.

AHB/IIH/240/4/125
(B), FC/S.17528
April 1st 1940
Encl. 31A

(iv) 'Fighter Nights': the term 'Fighter Night' had been used in connection with the defence of Scapa Flow in April, 1940. It had then been decided that on certain nights with a good moon, fighters were to be permitted to operate in conjunction with searchlights over areas normally prohibited to them. On such nights the guns were not permitted to open fire. These occasions were described as 'Fighter Nights'.

FC/S.22104, 3
February, 1941

On 11th December, 1940, 20 Hampden aircraft patrolled Birmingham at intervals of 500 feet during a heavy attack on the city, sighting 26 enemy aircraft. They were, however, too slow and unwieldy to engage, but the experience suggested that sighting in certain circumstances by visual means alone was quite feasible. As a result it was decided to use single-engined fighters in close patrols over target areas, and on 10/11th January 14 Hurricanes took part in a 'Fighter Night' over Portsmouth, claiming the destruction of one enemy machine. A further 'Fighter Night' was flown over Portsmouth on the night 5th February, and again the destruction of an enemy machine was claimed.

'Fighter Nights' were only ordered in conditions of bright moonlight, and when they were in operation, gunfire was restricted altogether or to a height of 2,000 feet below the last layer of patrolling fighters, while twin-engined machines were not permitted to enter a zone within 10 miles of the objective under German attack.

Before passing to the developments in the gun defences of the period, three further methods of night defence which came under the control of the Command require consideration:

Progress Report
No. 93 Squadron
February 8th 1941

(i) Sowing of aerial mines²⁴ in the path of oncoming raiders. No. 93 Squadron engaged on the evolution of this form of night defence had small progress to report in February, 1941. Their work was hampered by technical difficulties relating to the release of the mines, and by the fact that they were employing the slow Harrow machine. Mines were laid on two occasions, and it was claimed that an enemy aircraft had possibly been destroyed. An experimental GCI set had been erected at Wherwell for devising a standard procedure for the conduct of Long Aerial Mine interceptions, but despite the efforts of all concerned, this idea never truly bore fruit and made only a negligible contribution towards the night defences.

AHB/IIH/240/4/128
enc.12A
FC/S.22088/Ops
December 12th
1940

(ii) 'Intruder': It had been decided at an early stage of the war that harassing tactics used against enemy airfields by night would hinder the smooth running of enemy bombing operations. Patrols (called "Security Patrols") had been undertaken by No. 2 Group, Bomber Command until December 1940, when the work began to be undertaken by No. 23 (Blenheim) Squadron. From this time onward, the responsibility for "Intruder" operations fell on Fighter Command, and became a regular feature in support of the night defences.

FC/S.22104
6
February 5th 1941

(iii) Fighter Command were responsible for the operation of a 'free balloon barrage'. Free balloons carrying a lethal charge were launched into the air along the path of enemy bombers. It will be realised that such an operation could only be successful if there was a sufficient density of balloons, and if the prevailing wind conditions did not carry them away from the area in which they could inflict damage. Such a barrage was twice launched over London without resulting in the destruction of enemy raiders, and some of the balloons drifted over Occupied France. The failure might have been due to insufficient density, but in any event, the Air Staff declared against it although the Admiralty were its chief supporters. Difficulties relating to the production of a sufficient quantity of gas made its exploitation on a big scale unlikely. Ultimately the idea was abandoned, without having made any real contribution to the night defences.

DCAS note on
NAD(41) 3
February 8th 1941

This review of the various methods of night defence in use during the period being considered shows clearly that no opportunity of discovering a means of defeating the night bombing menace was neglected. However, it was inevitable that in time some of these methods would gradually fall out of favour as experience and trial indicated which among them would yield the best results. Thus, a better defined pattern of night defence emerged by the time the Command had to face a third phase in the night air war.

When therefore this third phase opened towards the end of February, the first successes which attended the endeavours of the night fighter

force proved the value of all the effort devoted towards its organisation during the preceding months, even though results had during that time been so meagre.

AA Command

Pile:
Despatch Part 1
69

As the enemy shifted the main weight of his attack from London to the provincial centres of industry on 14/15th November, it became necessary to effect a redeployment of the heavy guns. Accordingly the guns defending London were at once reduced in number from 239 to 192, while another 36 guns were removed from the region of the Thames Estuary, and 83 guns were thus used for the reinforcement of cities like Plymouth, Liverpool and Bristol which had not fallen under the bombardment.

GOC-in-C Progress
Report December
9th 1940
AHB/II/55 encl.51

Early in December the General Officer Commanding-in-Chief reported encouragingly concerning the performance of the guns. In September 20,000 rounds had had to be fired at night in order to bring down one enemy machine, in October that figure had decreased to 11,500 rounds and in November had decreased still further to 7270 rounds. By comparison it had required 6000 rounds to bring down an enemy machine by day at the end of the war of 1914-1918. In January, 1941, however, the figure was even better, and it had taken 4087 rounds to shoot down a hostile aircraft, and in February 2963 rounds for each bomber claimed, an even greater improvement. There was, furthermore, hope of better things to come, for the calibration of GL had been delayed on account of poor weather, so that up to the beginning of February only about 10% of the sites had been in full working order. In addition, the results of the training carried out in AA Command by the radio scientists employed for this purpose were only then beginning to show. Finally there had been an unaccountable increase in the percentage of enemy machines known to have been hit but not proved to have been destroyed. This percentage 'curve' showed as follows:

AAC/2/1598 C-in-C
February 5th, 1941,
enclosed in
AHB/II/55 encl. 56

Ibid

| | |
|---------------|------|
| September ... | 28% |
| October | 90% |
| November | 70% |
| December | 140% |
| January | 140% |

Pile: Despatch
Part I 59

On 21st January the old system of "unseen" barrages was changed. The chief reason for this was the limitations of the radar method of control at angles of sight over 45 degrees. As long as guns, either individually or in groups, were left to plot targets, there was a large blind zone above them and for some distance around in which they could not operate. If control were vested in Gun Operations Rooms, however, these blind zones could be eliminated. Accordingly sites were ordered to pass plots to the Gun Operations Room, where predictions were worked out and orders for firing issued. Meanwhile a step forward had been taken in the use of UP weapons, and an operational unit was in action at Cardiff by the beginning of February.

NAD(41) 1st
meeting February
10th 1941
AHB/II/55

The General Officer Commanding-in-Chief, AA Command, in his Despatch calls the whole period of German night attacks "essentially a gun battle". From the time that the night attacks started in June, 1940, until the end of that year, the guns claimed the destruction of 102 enemy machines, while the fighters could only claim the destruction of 35 enemy machines. In January and February of 1941, the guns claimed the destruction of 20½ hostile aircraft and the fighters of 7. This is plain evidence that during a period of evolution for the specialised night fighter defences, the AA guns bore the brunt of the work.

However, in March of 1941, when the fighter defences had begun to feel the benefits springing from the introduction of the GCI method of control, the claims by AA guns began falling behind, and the fighter squadrons began to enjoy greater successes. Thus, while the AA guns in March claimed to have destroyed 17 enemy aircraft, the fighters could claim the destruction of 22 and with the progress of time the night fighter continued to return higher claims for the destruction of night bombers. In truth, both guns and fighters played their part in the battle. Furthermore, it is essential when making such comparisons to remember that no form of defence rests on any single element in it, but on the smooth and well-integrated working of all the parts of which it is comprised.

Summary of the Second Phase

The main features of enemy activity during this phase have been noted: the concentration on provincial centres and on ports, the importance of KGr 100 in the German tactical schemes, and the small results obtained by our night defences. Nevertheless, several other characteristics of the night air war come to attention, including the growing emphasis of the attack towards the west and south-west. In January, for example of 18 raids in which over 50 aircraft were employed, 10 were on western or south-western ports and 6 on London, again illustrating the importance of the capital as the secondary objective.

Ministry of Home
Security Weekly
Appreciations,
December, 1940

During this phase, damage was extensively caused by the increasing use of incendiaries, and fires presented the gravest of problems to the passive defences. Calculations made after the raids on Sheffield showed that for every ton of steel destroyed in factories by high explosive, 10 tons had been destroyed by fire. During the raid on London of 8/9th December, 9 major, 24 serious, 202 medium and 1489 small fires had gained a hold, a total of 1724; on the night of November when Birmingham was raided, 300 fires were caused, 20 of them serious; and the fire attack on the City of London on 29/30th December finally brought home the lesson that the fire services should not be burdened with the task of putting out small fires started by incendiaries, which could well have been dealt with by members of the public before they had started to cause serious damage.

A compulsory system of fire watching was therefore inaugurated by which members of the public were made responsible for dealing with any fire bombs that fell on their dwellings or their places of work, and it is estimated that much property was saved from early in 1941 by prompt action in extinguishing small fires before they spread.

Ibid
November, 1940
Key Points
Intelligence Survey
1940

The Ministry of Home Security, Key Points Intelligence Branch in summarising the effect of air attack on railways in 1940²⁵ asserts that there was no wholesale or lengthy interruption of the main arteries of traffic, and no serious interference was considered to have been caused to the war effort by dislocation of the railway system. The analysis below showing hits scored on railways in November, a month when 23 major raids occurred, has bearing on this statement:

Railways

| | <u>Hits on London</u> | <u>Hits Elsewhere</u> | <u>Remarks</u> |
|---------------------|--|-----------------------------------|--|
| 31/6 Nov | 33 (against 56 the previous week) | 18 (against 42 the previous week) | Main LNER line north of Hatfield blocked Glasgow-Edinburgh main line blocked Birmingham-lines Damaged. |
| 6-13 th | 74 | 18 | Five London termini affected but not for more than some hours. |
| 13-20 th | 34 | 43 | Rise in figure for hits elsewhere reflects attack on Midlands. |
| 20-27 th | figures not available but known that railways suffered badly in the attacks on Birmingham. Stations at Southampton and Bristol had also been hit but with no great dislocation to the workings of communications. Similarly, railways in and around London rarely escaped, But mostly damage was of a quickly enough reparable nature. | | |

During a time of intense attack on provincial cities, it would not be inappropriate to give briefly the importance of each of them to the whole industrial machine engaged on the business of producing the weapons of war.

Ministry of Home
Security
Appreciations
November, 1940

(i) Birmingham: Outside London, Birmingham possessed more 'key points' than any other city, dominating the country's output of non-ferrous metal and machine tools, and making a highly important contribution towards the finishing of steel goods and the manufacture of guns. (Note: see below analysis of damage to key

points after raids on the city of November 19/20th, 20th/21st and 22nd/23rd. In the attack of 22nd/23rd, the fire-services performed the remarkable feat of controlling all fires before the attack was over).²⁶

(ii) Bristol: Bristol was the ninth town of the country so far as its number of 'key points' was concerned. Its importance lay in its docks with their accompanying food and oil installations, and in its aircraft and aircraft component factories, including the huge aircraft factory at Filton.

(iii) Liverpool: Liverpool was the sixth town of the country in relation to the number of its 'key points'. Like Bristol, its importance lay in its docks and their accompanying food and raw material installations.

(iv) Southampton: Southampton was the twelfth town of the country in the number of "key points" it possessed, which included docks, ship-building yard, oil installations and aircraft component factories.

(v) Plymouth: was important chiefly for its service depots and oil installations, and as a naval base.

In the light of the comparative importance of these targets, the distribution of major attacks by the enemy is of interest:

| | | | |
|-------|------------------|---|---------------|
| (i) | Birmingham | 4 | major attacks |
| (ii) | Bristol | 4 | " " |
| (iii) | Liverpool | 3 | " " |
| (iv) | Southampton ... | 4 | " " |
| (v) | Plymouth | 1 | " " |

Key Points
Intelligence Survey
1940

Responsible officials of the Ministry of Home Security declared that "in the case of Coventry, it seems clear that the enemy would have caused a grave position in the aircraft industry if he had pursued his attacks". As it was, they were able categorically to state that "there has been no case of damage which could be interpreted as catastrophic to the aircraft and aero-engine industry". A curious paradox therefore requires explanation. For what reason did the enemy fail to pursue the attack on Coventry, and other attacks on the provincial manufacturing cities? No definite or clear-cut explanation emerges but certain theories must be considered:

- (i) that the enemy over-estimated the effect of the damage he had caused at Coventry and elsewhere, thus overlooking the necessity for repeating the attack.
- (ii) that the temptation to hit as many important targets as possible drew him away from striking at one city until its annihilation was guaranteed.
- (iii) that the enemy's conception of the aims he wanted to achieve were unclear and changeable.

(iv) that a divergence of views among enemy leaders as to the importance of targets caused a dilution of effort.

ADI(K)
Report No. 12 1946

That the last-named reason must have had a considerable influence is supported by various leaders of the GAF who on interrogation emphasised the cleavage which existed regarding the concepts of strategical and tactical employment of a bomber force, and the effect of 'politics' on the conduct of air operations.

Thus conclusion must therefore be reached that this phase of operations was a failure in its relationship to the final effects it produced on the course of the air offensive, and that this failure was largely due to misjudgements in the application of air power by the enemy himself, for our own defences were at this time in no position to inflict losses of a prohibitive kind upon him.

¹ See Appendix 4

² This was said to be due to better crews being prodigally squandered in expensive operations, and to the small regard paid to the economic utilisation of manpower, or to the necessity for retaining a nucleus of experienced personnel who could play their part in future development. Disregard of losses ensured that, technically, bomber crews did not rise above a low level, while draining of training establishments to make replacements left hardly any instructors of real ability. (ADI(K) Report No. 12/1946, para.17.)

³ Major attacks between September 1940 and February 1941:

| | |
|------------------|--------------------|
| September ... 22 | December 11 |
| October..... 25 | January 7 |
| November 23 | February nil |

⁴ Knickebein enabled a narrow beam to be directed to any desired position with an accuracy of 0.1 degrees.

⁵ The 'Ruffians' system was used in conjunction with an apparatus called the 'X-Gérat'. A main beam leading to the target was cut at two points by cross beams at a fixed distance apart and at a fixed distance from the target. The time taken to pass from one cross beam to the other along the line gave the ground speed of the machine, and this in conjunction with the position of the second cross beam relative to the target gave the correct instant for the release of the bombs. This process was in fact carried out automatically by a clock in the aircraft.

⁶ Benito was a complicated method of blind bombing. Transmissions from the ground control were automatically re-radiated from the aircraft to its control. By measuring the time taken for its signal to reach the aircraft and then be re-radiated to it, the ground control could gauge its distance away. A system of D/F provided bearings, so that exact range and bearing were available whenever the ground control wished to ascertain an aircraft position. Bombing was controlled from the ground and bombing signals were sent to the aircraft on VHF or HF W/T.

⁷ The Intelligence Reports of Luftflotte 3 show that these included KGI, KG27, KG51, KG55, KGr606 and KG26, chief exponents of the 'Benito' system.

⁸ Details concerning the part played by KGr100 in this raid are contained in the Intelligence Summaries of Luftflotte 3.

⁹ This part of the plan was put into effect by Bomber Command, 52 aircraft attacking airfields in Holland, Belgium and Northern France with fair results (1 Heinkel III was seen to be on fire at Chartres), and 69 aircraft attacking Berlin and Hamburg. (BC ORB 1940).

¹⁰ There had been 150-200 direct fractures.

¹¹ Nos. 219 and 25.

¹² Nos. 604, 23, 219, 25, 29, 600.

¹³ Nos. 141 and 264.

¹⁴ Nos. 151 and 85.

¹⁵ At a meeting of the Night Air Defence Committee (a Committee of the War Cabinet) on 9th December, the Secretary of State for Air promised that 12 to 14 airfields would be fully equipped for night flying on the highest priority.

¹⁶ No. 54 Night OTU was set up at Church Fenton on December 31st.

¹⁷ No. 68 Squadron. Shortage of pilots however made it unlikely that it would come into the line for a time.

| | | | |
|--------|-----------------------|--------------------------|------|
| No. 23 | 14 operational pilots | 2 non-operational pilots | = 16 |
| No. 25 | 11 " " | 1 " " | = 12 |
| No. 29 | 14 " " | - " " | = 14 |

| | | | | | | | |
|--------|----|---|---|---|---|---|------|
| No. 68 | 2 | " | " | - | " | " | = 2 |
| No.219 | 10 | " | " | 4 | " | " | = 14 |
| No.600 | 14 | " | " | 1 | " | " | = 15 |
| No.604 | 10 | " | " | 4 | " | " | = 14 |

- ¹⁹ *Avebury (Filton Sector)
 Sopley (Middle Wallop)
 Durrington (Tangmere Sector)
 Willesborough (Biggin Hill Sector)
 Waldringfield (Debden Sector)
 Orby (Digby Sector)

*Avebury re-sited at Exminster to cover the approach to the Welsh ports in March, 1941.

²⁰ VHF R/T was used for communication, and contact between pilot and aerodrome control was maintained on Channel A of the four-channel, press button tuning set fitted to fighters.

²¹ Later this system went out of operation since pilots could easily orientate themselves from the AI beacons which were installed at all night flying airfields. It came to be called 'the cab rank', fighters being fed to the GCI station from among those patrolling over AI beacons.

²² The night fighter communicated with his GCI control on Channel B of his R/T apparatus.

²³ This method before long went out of use.

²⁴ This operation received the cover-name of 'Mutton'.

²⁵ See Appendix I.

²⁶

| Damage | Non-ferrous metals | Machine tools | Steel finishing | Guns and Ammunition | Aircraft and Components | Other Factory KP's | Non Factory KP's |
|-------------|--------------------|---------------|-----------------|---------------------|-------------------------|--------------------|------------------|
| Negligible | 2 | 1 | 1 | 2 | 4 | 9 | - |
| Slight | 5 | 1 | 2 | 5 | 5 | 15 | 3 |
| Substantial | 2 | - | - | - | 2 | 5 | 4 |
| Severe | 1 | 1 | - | 1 | - | 1 | - |
| Total | 10 | 3 | 3 | 8 | 11 | 30 | 7 = 72 |

CHAPTER 6

THE THIRD PHASE: 19/20th FEBRUARY TO 12th MAY, 1941

War on Ports

The third phase in the night battle did not open as dramatically or as suddenly as the second phase had done. Indeed the line of demarcation between the second and the third phase is somewhat imprecise. In a sense, therefore, the choice of 19/20th February as its commencing date is a little arbitrary, although it marks a period in which the Germans endeavoured more strenuously to put towns out of action by raids on successive nights, marks a distinctly greater emphasis on the western and south-western ports and a decline in the number of raids carried out on industrial cities of the provinces.

Between 19/20th February and 12th May, the enemy made 61 attacks in which he used more than 50 aircraft, and of these, 33 were major raids in which over 100 tons of bombs were dropped. Of the total of 61 attacks, 36 were directed against western and south-western port towns, 7 were directed against London, and 6 against industrial centres. Of the remainder, 3 were made on Belfast, 6 on Hull, 2 on Newcastle and one on Sunderland. Thus, excepting 7 raids on the capital and 6 on provincial cities, 48 were on ports, or approximately 80% of all the sizeable attacks undertaken during the period, while approximately 60% of all raids were made in the west and south-west. That this phase represented the war on ports needs no further stress. Even the importance of London as a target of secondary importance had startlingly fallen away, for in March the capital suffered 3 times, in April twice and in May once, all major efforts, especially the raid of 10/11th May which was like a grand finale to the whole of the great night battle, with 718 tons of HE and 86 tons of IB dropped by approximately 500 aircraft. Indeed, the last 11 nights in May saw the air war reach a pitch of great intensity with major raids on 7 occasions. The reason for this was that coming events had begun to cast their shadows, and warning had been received that Luftflotte 2 with Fliegerkorps II and all the Fliegerkorps of Luftflotte 3 were to be withdrawn from the west to participate in the impending attack on Russia. Meanwhile orders had gone out that these units were to be kept at the highest pitch of operational readiness, and that there was to be no cessation of the attacks on England, presumably to deceive us as to the exact date on which the Russian Campaign was to open, and to shield the movement of formations to the east.

The almost total concentration of the German Air Force on our ports, especially our western and south-western ports held a high strategic significance. The east and much of the south coast had already largely been denied to our shipping, and an attack of alarming proportions on our Atlantic sea routes had developed, then described as the 'Battle of the Atlantic'. The blows at our western and south-western ports by the Luftwaffe were intended to inflict such damage to them that we should become, to all intents and purposes, isolated from the outside world, upon which we depended for our food and raw materials in no small

measure.

At this stage of the war, the blockade of these islands had become the paramount principle of the enemy's Grand Strategy, and to achieve it, both the naval and the air arm had been in the broad sense integrated. The U-boats would sink the ships at sea, often in collaboration with long range aircraft, those that escaped the U-boat would be sunk in our harbours as they stood unloading their cargoes. If the ships themselves were not sunk, the cargoes on the docksides would be destroyed, or alternative port facilities would be so damaged as to render unloading of cargoes almost impossible. And to ensure the greatest possible devastation, the enemy often attacked a place on successive nights. This third phase, for instance, opened with an attack on Swansea which took place on 19/20th February, and was followed by further attacks on the two following nights. Similarly Plymouth was raided on the night of 20th/21st March and again on the night of the 21st/22nd, while in April the city was bombed on 3 successive nights from the 21st/22nd.

ADI(K) Report
No. 12 1946

It has already been noted that the German Air Force had suffered many losses through crashes on landing and on take off, that there was a lack of competent formation leaders, and that crews were not of the highest possible standard. Nevertheless, it opened this new phase in its operations with many advantages. By March the worst of the winter had passed, and the surfaces of airfields were recovering; while numerically the strength of the Luftwaffe was greater even than it had been when the night air war began in September of 1940. On 1st March, 1941, the establishment for long range bombers stood at 1687, and the strength of the bomber arm stood at 1443. Between June, 1940 and February, 1941, our night defences could only claim the destruction of 192 German machines, a fractional loss when viewed in relation to the high average of aircraft nightly despatched to bomb their targets.

C-in-C's Progress
Report FC ORB
Appendix P. April 1941.
No 80 Wing ORB
April 1940

Ibid

In the main the enemy's approach to the problem of achieving both precision and concentration in bombing remained unaltered. He relied as before on his blind-bombing devices and radio navigational aids. Nevertheless, the progress of operations showed that German crews seemed averse to utilising the various facilities at their disposal, and that they seemed less confident of concentrating a heavy attack by preliminary fire-raising. Indeed the study of captured maps and track notes afforded evidence that little attempt was being made to take advantage of the system of Knickebein beams, and that there was a greater tendency to navigate by the usual methods of dead reckoning.

Our counter measures during this phase frequently prevented the leading fire-raisers from marking the target, and on such occasions, the attack grew very scattered. If on the other hand a good guiding fire had been raised, better concentration was achieved, which was maintained by waves of fresh aircraft after a considerable period of time, giving every indication that reserves were possibly held back to profit by favourable opportunities. Interrogations of prisoners had provided the information which confirmed the evidence of our successes in these directions, and they spoke of their navigational beams becoming "unusable". Our

Wireless Intelligence was also able to say that whereas in the past ground stations could notify aircraft of their position within a few seconds, the effectiveness of our 'meaoning' made it difficult for them to do so, while frequently no 'fix' at all could be passed.

No. 80 Wing ORB
April, 1941

The setbacks received by KGr100 towards the close of the second phase of enemy attack have already been observed and in April more evidence of these setbacks came to hand. During that month, II/KG26, the unit exploiting the 'Benito' system had been active on precisely the same number of occasions as the old 'fire-raisers', KGr100, and had even employed on an average 50% more machines. The strength of II/KG26 had in fact increased from 26 aircraft in January to 44 aircraft by the end of March. Our counter-measures against the 'Benito' system had been organised, and there were pointers that enemy confidence in it was lacking, for only on two occasions during April did more than 25% of the aircraft participating in any one operation receive their signals to bomb, while during the whole months only 17 bombing signals were heard to be transmitted.

No. 80 Wing ORB
April, 1941

To increase the enemy's difficulties in locating targets, decoy fires¹ designed to simulate the effects produced by incendiaries were sited near towns most threatened by attack. The intention was to induce the German crews to drop their bombs into these decoy fires under the impression that they had been raised by the aircraft instructed to mark the target. Between March and May they were lit on 51 occasions, and succeeded in drawing the enemy's fire many times. Their most striking success came on 17th April during a heavy raid on Portsmouth when the decoy fire at Sinaih Common attracted 170 high explosive bombs, 32 parachute mines and about 5000 incendiaries.

The urgent necessity for spoiling the German aim by deceptions and by depriving the bomber crews of their radio aids existed in most pressing measure during this period of danger to our ports, for at all costs they had to be prevented from achieving either precision or concentration in their bombing. Thus the counter-measures of No. 80 Wing possessed considerable significance, and the signs of their success indicated the extent to which they had helped to frustrate the enemy's tactical plans.

Fighter Command Measures to meet the Attack on Ports

C-in-C's Progress
Report, NAD(41) 5,
March 21st 1941

When the third phase in the German night attack opened, Fighter Command was in a stronger position to deal with it than it had ever been before, since the investigations and efforts of the preceding months had begun to bear fruit. The GCI sets which had been installed early in 1941 were the greatest asset to night interception, while the increasingly promising results arising out of their use began erroneously to be associated in the minds of German airmen with our ability to interfere with their beam systems, and they felt that losses due to fighter attacks were connected with their following too easily detectable a channel to their objectives.² This new, psychological factor in undermining the confidence of the enemy in his radio aids was of value in that the less reliance he placed on them the less the likelihood there was of his achieving

dangerous precision and concentration in bombing.

AHBIIH/240/4/129
(B),
FC/S.22515/Ops 3
March 26th 1941
Encl.73A

On 22nd March the Command still possessed only 6 twin-engined squadrons equipped with AI, but 5 of them had by this date received Beaufighters. In addition No. 85 Squadron had almost converted to Havocs and was soon to take its place among the specialised night fighters. In addition were 8 single-engined squadrons, the aerial mine-laying squadron and the 'Intruder' squadron. Thus if the specialised night fighter force had not increased in quantity, its quality was higher, for both the Beaufighter and the Havoc carrying the AI Mark IV were superior to the older Blenheim.

AHBIIA/240/4/124
FC/S.21574 March
12th 1941
Encl.151A

It was, however, essential to make certain redistributions of these squadrons to meet the new turn in German policy. The Commander-in-Chief accordingly decided to give protection to ports and to shipping by placing three squadrons in a position to cover the approaches from the south and the south-west. This number seemed sufficient in view of the limited force available to him, and in view of the lack of scientific aids to night interception in the area. Protection for the Mersey region was given by a squadron comprising both Hurricanes and Defiants (No. 151) and another squadron made up solely of Defiants (No. 256), while one flight of Beaufighters of No. 29 Squadron was placed at the disposition of the AOC No. 9 Group, and was based at Digby. One section of No. 600 (Blenheim/Beaufighter) Squadron had hitherto given protection to the area of the Clyde, but it was not decided that one flight was necessary for this purpose. These moves left the Tyne and Tees area with reduced cover, but No. 68 Squadron, forming at Catterick, was instructed to have at least one machine at readiness each night to fly patrols when required. In addition, the installation of GCI sets in the Crewe and Worcester areas was being urgently expedited, and it was anticipated that the GCI station at Langtoft in the Wittering Sector would soon be working whereupon the two sections of No. 25 Squadron at Biggin Hill would return to that sector. Lastly No. 85 Squadron would before long be ready to work with the GCI station at Waldringfield.

Ibid

AHBIIH/240/4/130
FC/S.22080
January 12th 1941
Encl.39B

These redistributions left certain gaps so far as the twin-engined squadrons were concerned, notably in the Biggin Hill and Colerne Sector. However, they had to be filled by making the best possible use of the single-engine night squadrons and of day squadrons, so far as the situation permitted. Mobility of the night defences was in some degree achieved by a system of reinforcement by which every Group was charged with the responsibility of supporting its neighbours on the flanks, and the chief aims were to operate night fighters in the line of approach of enemy bombers, as well as to station them so that a certain number could defend any localities threatened and the target itself. The truth was that we possessed an insufficient number of night squadrons, especially of specialised night squadrons, and writing early in 1941 the Commander-in-Chief had stated: "the need for specialised night fighters is incontrovertible".

C-in-C's Progress
Report FC ORB
Appendix P, also
C-in-C's Progress
Report NAD(41) 13
May 10th, 1941

By April, the question of dispositions required to be considered afresh, since the enemy was displaying a tendency to pay the greatest attention to targets in the south. During the opening period of the new phase in February, 5 out of 6 targets attacked had been in the south, in March 8 out of 16 targets had been in the south, while between 19/20th March and 11/12th April, 6 out of 12 targets had been in the south, culminating with a major raid on Bristol on the night of the 11/12th. Thus approximately 50% of the enemy's objectives seemed to lie southward.

Furthermore, because of the shortening hours of darkness, and the likelihood of southern places being raided, the Commander-in-Chief resolved to increase the number of night fighter squadrons in the south. Such a redistribution enabled the extended and improved GCI³ and GL facilities in Southern England to operate the full capacity.

No. 600 (Beaufighter) Squadron was therefore moved from Scotland to Colerne, No. 307 (Defiant) Squadron moved from Colerne to Exeter, No. 29 (Beaufighter) Squadron moved from Digby to West Malling, No. 141 (Defiant) Squadron moved from Gravesend to Ayr where it was to convert to twin engine machines (Beaufighters), since Air Ministry authority had been obtained for the conversion of two Defiant squadrons to twin engined fighters and for the formation of one additional (Canadian) twin engine squadron. No. 406 (Canadian) Squadron was thus forming at Acklington during the early part of May, and it was later to be supplied with Beaufighters, when this type of machine became available. Meanwhile No. 68 Squadron reached operational standards at about the same time and was established at High Ercall for the defence of Liverpool and the Midlands.

AHBIIH/240/4/132
FC/S.21384/Air
May 22, 1941
Encl. 47A

The problems of the Commander-in-Chief were acute, since he was endeavouring to deploy his limited night fighter forces in order to meet heavy attacks that it was not yet powerful enough fully to resist. As the enemy was concentrating on coastal objectives during this phase of the battle, many difficulties confronted him in the exploitation of his fighters, especially in that only one localised zone of the defences could be brought into action when fringe targets were attacked. These problems were aggravated when the Germans raided places in the north, for on such occasions they skirted the coast and turned in towards the target from well out to sea in an effort to outflank the most heavily guarded regions of the south and of the Midlands.

A remedy for these outflanking tactics was sought in an arrangement which enabled the disposition of our night fighters to be made after the nature and direction of the attack had revealed itself. AI – equipped squadrons were therefore ordered to operate in alternative sectors, away from their home bases, and to be ready to despatch aircraft to operate over alternative areas at very short notice. The best values of such a system could not, however, be gained without the background of a fuller GCI lay-out, and the plan was not immediately put into effect.

Despite the drawbacks of contending with changing enemy tactics and a succession of intense raids, the results shown by the night fighter force

C-in-C Report to
NAD
AHB/11/55 April
1941 and NAD(41)6
NAD(41)13
10 May 1941

were greatly encouraging. In March it had flown 1005 sorties and claimed the destruction of 22 enemy aircraft, in April it had flown some 1384 sorties and claimed the destruction of 48½ enemy machines, while in May it had flown 3230 sorties and claimed the destruction of 96 enemy machines. During April and May, twin engined fighters fitted with AI claimed to have destroyed 55 enemy aircraft in 878 sorties, while 'catseye' fighters claimed the destruction of 79½ enemy raiders in 1388 sorties. Between March and May, the period approximately covering its third phase, night fighters under GCI control claimed to have accounted for 72 enemy aircraft, while 'catseye' fighters for the same period claimed to have accounted for 86½ enemy bombers.

These figures which were a striking testimony to the decisive part played by the GCI apparatus and to the now well co-ordinated night fighter defences, lead to a comparison of the results obtained by the unaided 'catseye' fighter and the twin-engined machines carrying AI. Observations made during March and April revealed that:

- (i) 'catseye' fighters had little chance of sighting and destroying the enemy except when the moon was above the horizon.
- (ii) AI fighters had five times as good a chance of engaging the enemy in moonlight as in moonless conditions, and seven times as good a chance of shooting them down.

The method of employing single-engine fighters in close patrols over target areas known as 'Fighter Nights' had yielded some results. In 16 operations ordered during this phase of night attack, 40 enemy aircraft were claimed to have been destroyed. On 10/11th May, when a heavy raid had been launched on London, single-engine fighters taking part in a 'Fighter Night' claimed the destruction of 12 enemy aircraft. Altogether night fighters claimed to have destroyed 23 enemy aircraft, the highest number claimed during the whole period of the enemy night offensive. Apart from the 12 bombers claimed by the 'Fighter Night' patrols, 3 fell to twin-engined machines under GCI control, one fell to a twin-engined machine which made contact with its target without the use of AI, while 7 others fell to single-engine fighters on ordinary patrols.

GOC-in-C Progress
Report April 17,
1941

'Fighter Nights' were the subject of some criticism, since the gunners of AA Command found themselves restricted to fire at a height of 2000 feet below the lowest fighter patrol and, furthermore, they found that the presence of our aircraft overhead led to some confusion in the workings of their GL. It was also said that the civilian population grew angry on those occasions when the guns had to refrain from firing. While the 'Fighter Night' might not have been an ideal method of night interception, it brought results at a time when they were badly needed, and so long as the conditions of visibility were good, it was decided to continue with them whenever opportunity presented.

See RAF Narrative
Vol.IV for full details

A review of Fighter Command's activities during this phase of attack would not be complete without a reference to the 'Intruder' squadron⁴ which harassed enemy airfields in Occupied Territory. Bombs were

dropped on runways and hangars, flarepaths were machine-gunned, while machines on the ground were often claimed as damaged. There can be small doubt that 'Intruders' caused enemy aircraft to be diverted to bases other than their own, and that they also caused discomfiture among German ground crews.

AA Command Measures to Meet the Attack on Ports

Just as Fighter Command had been compelled to redispense its squadrons to meet the new phase of German night attack, AA Command found it necessary to divert 58 guns for the protection of the western ports.

Reinforcements for the heavy anti-aircraft guns defending these ports, notably the Clyde, Liverpool and Cardiff were ordered twice in March, the approved scales being raised on the second occasion. The first reinforcement required 81 guns of which 23 came from March production, 58 having to be found from other areas as follows:

| | |
|--------------------------------|-----------|
| Birmingham/Coventry area | 24 |
| Sheffield | 8 |
| Scapa | 8 |
| Brockworth | 4 |
| Weston-super-Mare | 4 |
| Daventry | 4 |
| Leighton Buzzard | 4 |
| Acklington | <u>2</u> |
| TOTAL | <u>58</u> |

The second reinforcement called for 104 guns of which 72 were found from April production, leaving 32 still to be provided. These were ultimately taken from Slough, the Derby/Nottingham area and from Wales after an internal redistribution there.

The table below illustrates how both these reinforcements were achieved:

| | Old Scale | Deployed | First Reinforcement | Second Reinforcement | New Scale |
|-----------------------------------|-----------|----------|---------------------|----------------------|-----------|
| Clyde | 112 | 67 | 19 | 56 | 144 |
| Mersey | 96 | 84 | 12 | 16 | 112 |
| Bristol/ Avonmouth | 80 | 36 | 28 | 12 | 80 |
| Swansea, Pt. Talbot, Llanelly, | 48 | 18 | 18 | 12 | 48 |
| Cardiff, Barry, Newport | 64 | 52 | 4 | 8 | 64 |

It will thus be seen that in some cases the approved scale was raised as well as the strength actually deployed. Cardiff had the protection of an UP (Rocket)⁵ battery which made up for the shortage of heavy guns as compared with the numbers the city was entitled to under the decided establishment. In the main, heavy guns were moved from areas which in the light of experience seemed least likely to suffer attack.

In truth, no reinforcement could be carried out without depriving an area of a measure of its gun-defences. During the first phase of German attack, heavy guns had to be transferred to London from elsewhere, when the second phase commenced, guns had to be moved from London to the provincial cities then under bombardment, and once again during this third phase, guns had to be moved to the western ports. This is not surprising if it is considered that in May 1941, when the third phase of German attack was nearing its close, AA Command possessed a total of 1691 guns, many less than the total of 2232 approved and recommended at the outbreak of war.

Pile: Despatch I
Paras. 9, 8

NAD(41)2
March 24th 1941

The reason for this was that the production of heavy anti-aircraft weapons had shown little increase since war began, although the number of vital points to be defended at home and abroad was increasing at a rate in excess of output. In March the Prime Minister had requested the Minister of Supply to submit a report on the production of 3.7" guns and on 4th April, he had answered that the lack of rise in output⁶ was due to the effect of enemy action both directly on the firms employed in making them, and indirectly on the sub-contracting firms.

NAD(41)3
April 4th 1941

The shortage of guns provoked the Air Staff to express the opinion that the maximum use of the UP weapon should be made. But deliveries were seriously behind forecast, and the UP weapon could hardly be utilised if projectors and ammunition were not delivered according to the arranged programme. A total of 7500 projectors had been received in ADGB but lack of ammunition made it impossible for them all to be used. In fact, up to the end of March 1941, only 18600 rounds had been received, 8400 of which were issued or were under issue to AA Command, enabling only 840 of 7500 available projectors to be brought into action, with but 10 rounds apiece. This unsatisfactory situation was put down to difficulties with cordite and in the development of production methods for filling. In a Progress Report submitted to the Night Air Defence Committee on 23rd April, 1941, the General Officer Commanding AA Command had also expressed his concern over the delay in the production of UP ammunition, but at the 4th Meeting of the Night Air Defence Committee on 23rd June he was still compelled to say that UP crews and projectors were idle for want of ammunition, while of some 30 UP batteries (1920 projectors) by then deployed in the Heavy AA role, primarily for the defence of dock areas only 9 were in action owing to shortage of UP ammunition.

NAD(41)9
April 24th 1941

GOC-in-C Progress
Report April 17th
1941

In spite of a lack of weapons, new types of GL which were coming into being, and the new system of gun-control, whereby the conduct of the battle was transferred to the Commander in the Gun Operations Room, helped to maintain good results against enemy raiders. During March 17

enemy raiders were claimed to have been destroyed through the expenditure of 105000 rounds of ammunition, or an average of 5870 rounds per aircraft claimed as destroyed. The rise in comparison to the February figure of 2963 rounds per aircraft claimed as destroyed occurred because raiding was heavy and the multiplicity of targets led to break-downs in the method of predicted concentrations. Furthermore, the firing of zone concentrations though effective in protecting the target area, resulted in a heavy use of ammunition without correspondingly increasing the number of machines claimed as destroyed. Heavy attack also led to a partial disorganisation of communications, again forcing resort to zone concentrations. An increase in the number of GL sets could correct the fault. 'Fighter Nights' also brought about a restriction in the number of targets which could be engaged, and an expenditure of ammunition that resulted in few claims, for much of the shooting was calculated mainly to keep the enemy up at the altitudes at which the fighters were patrolling.

In April the AA guns claimed 39½ enemy aircraft destroyed at a cost of 3165 rounds each, a figure approximating to that in the previous best month – February. In May the Command claimed the destruction of 23½ bombers destroyed at an average cost of 4610 rounds per aircraft. During May also sporadic attacks on airfields were made at low altitudes, and on the evening and night of 11/12th May, the Light Anti-Aircraft defences had their chance, claiming the destruction of 8 enemy machines. Thus for the period between March and May which corresponds roughly to the third phase of German night attack, a total of 86 hostile aircraft were claimed as having fallen to the guns.

Attacks on Shipping at Night: The Minelaying Campaign

Air War at Sea

No recital of the events which marked the third phase of the night battle would be complete without reference to the growing number of attacks carried out against shipping by the enemy during the hours of darkness, and reference must also be made to an increase in effort to mine our coastal areas, especially the great estuaries through which much shipping had inevitably to pass.

FC ORB Appendix
D 9 March 1941

AHBIIH/240/4/124
FC/S.21574 Air
Encl.143B

The movements of enemy units as early as February provided us with an indication that he intended to quicken his interest in shipping. I/KG26, a crack unit had moved from Beauvais to Aalborg, II/KG76 returned from Germany re-equipped with Ju 88's and began anti-shipping operations in our eastern coastal area. I/KG27, I/KGI, and elements of KG 2, 3, 30, 53 and Gr122 were also known to be engaged in such work, and they operated from bases in extreme Northern France, Belgium and Holland.⁷ By March a naval officer stated at a conference held at Headquarters, Fighter Command, that "moonlight attacks on shipping are now becoming a menace from Southwold to the North". But no solution to this problem seemed imminent and ships had to rely largely upon their own AA armament.

However, the number of attacks made on shipping by night continued to mount. In January 14% of attacks had been made by night, in February the figure rose to 28%, fell in March to 18% rising once again to 37% in April and 59% in May. In June it stood as high at 66%. The figures of attacks delivered on shipping between February and April are also a revealing commentary:

| | <u>Sunk</u> | <u>Damaged</u> | <u>Undamaged</u> | <u>Percentage of attacks</u> | | | |
|----------|-------------|----------------|------------------|------------------------------|-----|-----|-------|
| February | 3 | 2 | 11 | 72% | day | 28% | night |
| March | 3 | 12 | 4 | 82 | " | 18 | " |
| April | 11 | 29 | 33 | 63 | " | 37 | " |

The following figures show the incidence of attacks in March and April as between the N.E. Scottish Coast, the East Coast from the Firth of Tay to Dungeness, and south west from Portsmouth to Anglesey:

| | <u>March</u> | <u>April</u> |
|---------------|--------------|--------------|
| Scottish Area | 8 | 40 |
| East Coast | 5 | 14 |
| South West | 5 | 18 |

Intelligence
Summary:
FC ORB
Appendices
April 1940

In addition our raid intelligence had estimated that 614 mine-laying aircraft had visited our coasts during April. There was little we could do although possessing this good evidence that the attack on ports was being delivered concurrently with an attack on shipping and an intense campaign of mine-laying. Certain weaknesses in the system of early warning in the west and in South Wales were slowly strengthened, and more radar stations were to come into operation in that region. But in the meanwhile, there was no effective fighter defence against low-flying minelayers owing to the limitations of AI below heights of about 5000 feet. This was in fact a serious problem of its own and required a separate and special answer that was not forthcoming until considerably later, but in due course a partial solution was sought in the area of controlling the AI fighters from CHL stations which possessed the plan position indicator. Meanwhile, however, ships had to rely on their own armament to beat off attacks.

Summary of the Part Played by the Night Defences

The night defences claimed a total of 271 enemy aircraft destroyed between March and May 1941, against an estimated total of 12100 sorties overland flown by the GAF. This represents an average of about one aircraft claimed destroyed for 44 enemy sorties.

The slowness in the production of weapons of all kinds placed us under the greatest handicaps throughout the whole of the German night offensive, and even during its third and final phase. When the attack on ports was at its height, Fighter Command could call upon a total of 15 night squadrons, only 5 of which carried AI. Similarly, AA Command was short of guns.

AHB/IIH1/18
Dowding:
Despatch 255

However, the preparations of the period before the third phase opened, the effects of training, of organisation and of the various scientific aids both to gunnery and to night interception had telling effect. The effect of GCI was as revolutionary and decisive to night fighters as GL was to the gunners. And yet it possessed its disadvantages, for 'saturation' point is quickly reached, and when mass raids are in progress only a limited number of fighters can be operated. This occurred during the heavy attack on London of 11/12th May, when only three GCI interceptions resulted in the destruction of enemy aircraft, while 'catseye' fighters scored great successes.

C-in-C Progress
Report
June 19th 1941

The contrast is easily accounted for. In such a highly concentrated raid carried out in conditions of good visibility, 'catseye' fighters are working under the most favourable circumstances. On the other hand, the difficulties of intercepting isolated raiders in anything but brightest moonlight was beyond the capacity of the 'catseye' fighter. "Both types are effective in conditions suitable to them. Their roles are complementary not competitive" wrote the Commander-in-Chief, Fighter Command, in June of 1941.

Ibid

Despite the striking way in which the fighters as well as the guns acquitted themselves, the result of the third phase (as indeed of the whole night battle) must be regarded as inconclusive, for in almost three months of a major night offensive we had not succeeded in inflicting anything approaching prohibitive losses on the enemy. Our successes were chiefly encouraging so far as the night fighters were concerned in comparison with all the bleak and abortive efforts of the months before March of 1941.

The abrupt cessation of this third phase of the night battle and indeed of the main German air offensive on 11/12th May is perhaps best explained by a captured German document ("Der Ablauf des Krieges gegen England", the text of a lecture delivered on 7th July 1944, prepared by the 8th Abteilung, the GAF Archives and Historical Section) which says that on 22nd May 1941 Luftflotte 3 took over command of all units remaining in the West whose numbers eventually fell from 44 to 8 Bomber Gruppen, while Luftflotte 5 gave its attention to the North Norwegian Frontiers, and from there shipping attacks against our Russian Convoys were launched. The switch over of Luftflotte 2 from the Western to the Eastern front about May 1941 according to this German source represented the 5th Phase of the Air War in the West, which had begun with an attack on the RAF (Battle of Britain). Second, the night attack on London (7/8th September to 14/15th November, 1940); third, the night attack on industrial targets (beginning on 14/15th November with the attack on Coventry); forth, the night attack on ports (initiated in November 1940 but truly taking shape in February 1941); fifth, "an attack on harbour installations and on shipping and the mining of estuaries" (which began earlier but were intensified in the latter half of May 1941).

It is of interest that the document under consideration mentions that in the 5th phase of the Air War in the West, big attacks would be launched only as reprisals and on political grounds. Here, therefore, is the

confession of the enemy's sudden powerlessness in the West, and his desire not to provoke attacks upon himself which he knew he could not fully payback. His policy had changed, the West no longer had major importance for him and his air power was moved to its new striking ground.

Analytical Summary of the Night Battle
(7/8th September 1940 to 11/12th May 1941)

The Fighter Defences

When the night battle commenced, we had 6 specialised night fighter squadrons consisting of Blenheims (with very few Beaufighters), fitted with AI. When the main battle ended in mid-May we had 5 squadrons fully equipped with Beaufighters and fitted with Mark IV AI. In the meanwhile, however, the number of single engine squadrons devoting themselves uniquely to night fighting had increased. By the beginning of February 1941, there were 7 of them, and by mid-May there were 8. They were equipped for the most part by Defiants, although Hurricanes were also used. (See Note 1).

Quantitatively, therefore, there had been no great change in the specialised night squadrons between the time the battle opened and the time it drew to a close. Qualitatively, however, the changes had been significant, for the Beaufighter was superior in performance and in armament to the Blenheim, whose main defects had been lack of speed, lack of armament and lack of visibility from the pilot's cockpit. Furthermore, Mark IV AI despite certain shortcomings was far in advance of anything yet produced.

From March 1941, the night fighter force began to show rapidly improving results (See Note 2), about half the number of enemy aircraft claimed as destroyed falling to the twin-engine squadrons and the other half to the single-engined squadrons. The following figures reveal certain points of interest:

| | | | | <u>1941</u> | | |
|------------------------------|-----------------|----------------|-----|-----------------------------|----------------|----------------|
| <u>AI Twin Engine Sqdns:</u> | | | | <u>Single Engine Sqdns:</u> | | |
| <u>(AI)</u> | | | | <u>(cat's eye)</u> | | |
| <u>Sorties</u> | <u>AI</u> | <u>Combats</u> | | <u>Sorties</u> | <u>Visuals</u> | <u>Combats</u> |
| | <u>Contacts</u> | | | | | |
| Jan. | 84 | 44 | 2 | 402 | 34 | 9 |
| Feb. | 147 | 25 | 4 | 421 | 33 | 9 |
| March | 270 | 95 | 21 | 735 | 34 | 25 |
| April | 542 | 117 | 50 | 842 | 45 | 39 |
| May | 643 | 204 | 74 | 1345 | 154 | 116 |
| Totals | 1686 | 385 | 151 | 3745 | 201 | 198 |

(See Note 3 for Results of Fighter Nights).

The most noticeable feature is that the twin-engine squadrons equipped with AI made nearly double the number of contacts with the enemy in under half the number of sorties made by the single-engine type. The reason was that the beneficial efforts of the GCI method of control were being felt. In the GCI method we had at last found some answer to the problem of accurately and continuously locating both bomber and fighter, so essential to successful interception. The problem of accurate height finding had also been brought closer to solution by means of GCI and, equally important, the fighter pilot could now be positioned so that he could bring his AI to bear to the greatest advantage, thus considerably increasing his chances of successful engagement.

There were other important contributory reasons for the improvement shown by the night fighters:

- (i) the systematic training of AI crews;
- (ii) the development of the night organisation (better maintenance, airfield control to ensure greater safety for the night flyer, a headquarters organisation to study every aspect of the problem of fighter defence by night, and a system of providing this organisation with the maximum amount of data through the squadron intelligence officer etc.);
- (iii) the growing confidence within the night fighter force.

It would, however, be untrue to give any impression that the GCI method of control had immediately solved all the problems of night fighter defence. There were still certain technical limitations to contend with and, against a high concentration of raids, the elaborate GCI/AI control system was difficult to work, for only a small number of fighters could be operated against enemy bombers at the same time.

An analysis of results obtained in March and April had shown:

- (i) that cat's eye fighters had little chance of sighting and destroying hostile aircraft except when the moon was above the horizon.
- (ii) that the AI equipped fighters had five times as much chance of engaging the enemy in moonlight as in moonless conditions.
- (iii) that AI equipped fighters then had some seven times as good a chance of shooting the enemy bomber down.

Investigations had further revealed:

- (i) that the interception of isolated raiders in all but the brightest moonlight conditions was, for practical purposes, beyond the capacity of the cat's eye fighter.

(ii) that close protective patrols by cat's eye fighters was only profitable in good moonlight and in clear weather. The raid over London on 10/11th May had served to show again that this form of patrol, even under ideal conditions was profitable only in highly concentrated areas of enemy activity. In order to obtain a fighter concentration the Commander-in-Chief subsequently ordered that patrols from outlying airfields should fly straight to the target area, even if they could remain over it for a comparatively short time.

Though the advent of the GCI had revolutionised our technique of night fighting and though the Commander-in-Chief wrote: "I still believe that AI assisted by GCI control will prove to be the most profitable means to night interception", the roles of the twin-engine fighter equipped with AI and of the single engine cat's eye fighter were, in fact, complimentary, not competitive during the night battles.

As we have seen, in numbers our specialised night squadrons had shown no increase throughout the whole period of the battle, but their quality had indeed shown marked improvement. The lesson, earlier hinted at by Lord Dowding was that many aircraft haphazardly searching the sky were of little use, but small numbers of aircraft, properly exploited by the use of scientific instruments, had brought results, even better results, perhaps, than we had hoped for. In night defence, the importance of high precision control and the importance of specialisation had been well demonstrated, both these things becoming possible by the application of scientific principles to the problems we faced.

AA Guns and Searchlights

The problems confronting us in the case of AA guns and searchlights were not dissimilar from those we had to overcome in the operation of night fighters. As we have seen, practically all gunnery equipment was designed for visual shooting at 'seen' targets both by day and by night. Thus searchlights were deployed with heavy guns round important cities and 'gun defended areas' were created. Both guns and searchlights relied upon the unreliable acoustic method of location, and the so-called 'fixed azimuth system' which had been set up for the defence of London, broke down completely. The 'barrage system' which took its place meant that guns were firing according to any method of control they liked, the result was a great volume of fire described by the GOC-in-C, AA Command as "largely wild and uncontrolled shooting". The beneficial results of this lay in its deterrent effect upon German bomber crews and in its effect on public morale. The fourth was that with guns as with fighters, the problem of continuously and accurately locating the enemy had to be solved before shooting became effective.

By October 1940, radar control of guns was introduced no longer making it necessary for the target to be 'seen'. This enabled a system of unseen barrages to be developed and that method of fire remained in use until January of 1941.

But this by no means exhausts the account of AA Command's difficulties. "..... I was constantly faced with manpower problems" says the GOC-in-C, in his despatch. "The quality of conscripts allotted to the Command were of inferior quality and out of 1000 recruits in one Brigade, for example, 5% had immediately to be discharged, 2% were considered mentally deficient and 18% were of a medical category too low for anti-aircraft work." The manpower problem led to reduction in the number of searchlight units, and later to the introduction of mixed units and to the manning of anti-aircraft equipment by the Home Guard. The training of recruits at the outset was woefully deficient, and when radar with its complexities began to find its way into the Command, many young scientists lived and worked on the gun-sites in order to give gunnery officers the benefit of their technical knowledge and help in the training of gunners. Shortage of equipment meant that more of the units were fully equipped with the weapons they should have had although gaps were filled as best they could be, the position was never satisfactory (see Notes 4, 5 and 6). From September until March, however, while Fighter Command was striving to develop a means of operating night fighters really effectively against the enemy bombers, the chief burden of defence fell to the guns and, apart from those hostile machines claimed as destroyed (see Note 1), the moral effect of AA fire both on the enemy and on the public must be taken into account.

During the early night raids, the searchlights met with surprising success, chiefly because of the comparatively low heights at which the enemy flew. A change of tactics, however, soon frustrated the lights, for their effectiveness at heights above 12000 feet was negligible and the old, acoustic method of control gave no guarantee that the fighter would not be illuminated instead of the bomber. This led to some distrust on the part of the night fighter crews who were taken aback at being exposed suddenly to fire from the enemy's guns. We have seen how the experiment of using GL for plotting purposes was tried out in the Kenley sector later extended in area to cover a bigger section of the country. At first the capricious nature of the AI fitted to the Blenheim aircraft then engaged in co-operation with the searchlights and the inferior performance of this aircraft, together with many other factors, yielded disappointing results. Even the coming of the Beaufighter with Mark IV AI did not improve matters. Fundamentally, successful interception – even by this method of searchlight control – required greater accuracy of plotting and greater accuracy of height finding than was possible with the use of GL. SLC, the form of radar control for searchlights had come into being before the night battle ended, but so few sets were there that the searchlight could make no vital contribution to successful night fighting until later on. Indeed on 23rd June the GOC-in-C, AA Command told the Night Air Defence Committee that though the performance of SLC was satisfactory, only 54 out of 2000 sets required were then available to him.

Thus the importance of high precision control for guns and searchlights had (as in the case of fighter control) been well demonstrated. Only use of scientific instruments and the specialised training of the crews engaged in operating them could really bring results.

The Enemy

There is evidence that the Germans were concentrating their energies into an attempt to solve the problem of achieving precision and concentration of bombing even before the outbreak of war, for by September 1939, blind-bombing aids had been employed against Warsaw by the specialist unit, KG100. When our intelligence discovered that these radio aids were in existence and that their use against us was impending, it transpired that two Knickebein stations had been installed, one at Kleve near the Dutch frontier and one at Bredstedt near Husum in Schleswig-Holstein. The indications were therefore, that attacks were going to be launched by German bombers from bases in North-West Germany. Whether these attacks were to be carried out by day or by night is not clear, though it is conceivable that the enemy had considered both alternatives.⁸

However, in June 1940, when all the air bases of North West Europe fell to the enemy, he was presented with an unexpected opportunity for daylight attack against Southern England using bombers escorted by fighters, while by night, virtually the whole country lay exposed to aerial bombardment.

Bombing devices as we have remarked are not necessarily confined to use in darkness. They can well be employed for hitting at targets by day, especially if bombing was to take place from high altitudes. When the Germans found they were obliged to call off daylight attacks in the summer of 1940 and turn to a policy of night bombardment, the advantages of a blind bombing system must immediately have been clear to them. Thus the exploratory phase of night bombardment which began in June 1940 was used primarily to give crews experience of night operations using navigational aids, for when the battle was joined in earnest early in September 1940, many units were capable of releasing bombs by radio navigational methods.⁹

Throughout the night battle beams were regularly laid over targets and nine transmitters were operating in all to carry out these duties. Furthermore the enemy persistently tried out a great many variations in these radio-navigational devices¹⁰, not only with the object of improving accuracy, but probably with the object of outwitting our countermeasures. When in November 1940 we endeavoured to launch bombing attacks against his installations, we discovered that they were most heavily protected by balloons and AA fire. It grows clear, therefore, that he attached great importance to the whole complex blind bombing system he had set up, seeing in it two particular virtues. Firstly, it would help to overcome the limitations inherent in a bomber force raised principally for daylight operations and secondly, it would, he hoped, lay the foundations of accurate and concentrated bombing. Indeed, the degree of accuracy thought to be possible was very great. On 8/9th May 1941, for instance, beams were laid across the Rolls Royce Works at Derby. Due to our countermeasures, II KGr100 failed to locate the Rolls Royce works and instead bombed Nottingham, but the German communiqué which followed this raid claimed that the Rolls Royce works at Derby had been

attacked. Our counter-measures were effective, and they included the clever use of decoy fires (Starfish) when the attack on Midland towns started in November 1940, but it would be impossible to claim that they were completely successful. Nor as we have seen had our night fighters or our AA guns been able to inflict prohibitive losses on the enemy. Tactically, therefore, the German Air Force had not entirely failed in achieving its objectives, and it had certainly inflicted damage, even if this damage was not decisive. Strategic indecision and lack of singleness in policy proved its main undoing.

The question remaining to be answered then is whether decisive damage was not inflicted because of some strategic misconception. Re-examining the main phases of their bombing policy we see that it falls into three main phases.

Following an exploratory phase which commenced in June 1940, the main night battle began with the raid on London of 7/8th September. Thus:

| | |
|---------------------------------------|--|
| 1940 September 7/8 th : | Attack on London (Subsidiary targets: Ports, industry). |
| November 14/15 th : | Attack on Industrial towns, strong secondary concentration on ports. (London becomes subsidiary target). |
| 1941 January/February ¹¹ : | Increasing emphasis on ports. |
| March: | Emphasis maintained on ports. |
| April/May: | Emphasis maintained on ports. |

Why did the Germans choose to expend so great an effort on reducing London? The answer may be that they hoped to force morale to breaking point in the heavily populated metropolitan area which to them represented the core of the economy and the symbol of the power they wished to destroy, and indeed London had considerable importance both as a centre of communications and as an industrial region. However, by virtue of its great size, London could not be destroyed by the bomber forces which the enemy disposed. The task would have occupied perhaps years.

Realising this he turned to the industrial towns, hoping to gain a decisive effect by the use of air power. But the attacks on these towns, heavy though they were, proved not to be heavy enough to render them more than temporarily incapacitated from the point of view of production.

Finally, the German Air Force was assigned the task of smashing ports and their facilities, when enemy ground strategy visualised the reduction of these islands by total war at sea. The air force as well as naval forces together, it was hoped, would bring the 'Battle of the Atlantic' to a favourable conclusion, and make a decisive difference to the course

of the war.

By the end of May, however, German pre-occupation with the Eastern theatre made them move the greater part of their bomber force to the Russian Front, leaving a small number of units to carry on with the sea-war by attacks on convoys and by mine-laying.

Any conclusions regarding German strategic conceptions would of necessity include many speculative elements, but it has been suggested that the German General Staff had learned by the Spring of 1941 that wars could not be won by aerial bombardment alone. Be that as it may, the night battles for them remained inconclusive, since for their own reasons, it was called off in May 1941. Nevertheless, the Ministry of Home Security in its survey¹² of damage inflicted concluded that "effective damage has not been serious in relation to the national war effort". The reasons for this were firstly, the policy of placing new factories outside major town areas and, secondly, the general dispersal of the key industries by splitting up their shops and locating them in isolated positions in various outlying districts. From our point of view, therefore, with our main war effort comparatively unimpaired, we were able to continue fighting the war until it was won.

Note 1

- (a) Specialised night squadrons: September 1940: Nos, 23, 25, 29, 219, 600, 604.
- (b) Specialised night squadrons: 6 February 1941: Nos. 219, 604 (Beaufighters) with Mark IV Al: Nos. 25, 29 (Blenheim/Beaufighter) with Mark IV Al.

In addition: No. 23 (Blenheim/DB7) Sqdn without Al for Intruder operations.
No. 93 (Harrow/Wellington/DB7) Sqdn for Aerial Mine Laying.

Single-engine fighters: No. 85 (Hurricane/Defiant)
87 (Hurricane)
96 (Hurricane)
141 (Defiant)
151 (Hurricane/Defiant)
264 (Defiant)
307 (Defiant)

- (c) Specialised night squadron: 9th May 1941: Nos. 25, 29, 219, 600, 604 (Beaufighter).

In addition: No. 23 (Havoc) for Intruder operations.
No. 93 Sqdn for Aerial Mine Laying.

Single-engine fighters: No. 87 (Hurricanes)
96 (Defiant/Hurricane)
141 (Defiant)
151 (Defiant)
256 (Defiant)
264 (Defiant)
255 (Defiant/Hurricane)
307 (Defiant)

Note 2

Results of night fighting for the whole period of the night battle.

| (AWAS Estimates) | | |
|------------------|----------------------|-----------------------------|
| <u>Month</u> | <u>Enemy Sorties</u> | <u>Claimed as Destroyed</u> |
| 1940 September | 6135 | 4 |
| October | 5845 | 3 |
| November | 5495 | 2 |
| December | 3585 | 4 |
| 1941 January | 1965 | 3 |
| February | 1225 | 4 |
| March | 3510 | 22 |
| April | 4835 | 48½ |
| May | 4055 | 96 |

Note 3

Results of Fighter Nights:

| | | | | | | |
|--------------|---------------------|-------------------------|----|-----|---------|-----------|
| 1941 January | 10/11 th | Portsmouth | 1 | e/a | claimed | destroyed |
| February | 21/22 nd | Swansea | 1 | " | " | " |
| March | 3/4 th | Cardiff | 1 | " | " | " |
| | 12/13 th | Liverpool | - | | | |
| April | 8/9 th | Coventry | 3 | " | " | " |
| | 9/10 th | Coventry | 3 | " | " | " |
| | 10/11 th | Coventry/ Birmingham | 3 | " | " | " |
| | 16/17 th | London | - | | | |
| May | 3/4 th | Liverpool | - | | | |
| | 5/6 th | Glasgow | 3 | " | " | " |
| | 6/7 th | Liverpool | 1 | " | " | " |
| | 6/7 th | Glasgow | 5 | " | " | " |
| | 7/8 th | Liverpool | 3 | " | " | " |
| | 8/9 th | Barrow | - | | | |
| | 8/9 th | Derby | 1 | " | " | " |
| | 8/9 th | Hull | 4 | " | " | " |
| | 10/11 th | London | 12 | " | " | " |
| | 17 Fighter Nights | | 41 | " | " | " |

Note 4 AA Divisions:

- 1st Metropolitan area of London
- 2nd Northern East Anglia, East Midlands, Humber
- 3rd Solway Firth, Scotland, Northern Ireland
- 4th North West England, West Midlands, North Wales
- 5th South Wales, South-west and Southern England
- 6th South East England, Northern East Anglia
- 7th North East England

An additional organisation directly controlled from HQ AA Command was responsible for the AA defences of the Orkneys and the Shetlands. At the end of 1940, 5 new divisions were created to ease the existing situation.

- 8th Covering the south coast as far east as Bournemouth
- 9th South Wales
- 10th Humber
- 11th West Midlands and Central Wales
- 12th Solway Firth and Northern Ireland

In addition, to ease the supervision of organisation, 3 AA Corps were created.

- 1 AA Corps in the South (1, 5, 6, 8 & 9 Divs. Corresponding with RAF Fighter Groups Nos. 10 and 11).
- 2 AA Corps in the Midlands (2, 4, 10 & 11 Divs. Corresponding with RAF Fighter Groups Nos. 9 and 12).
- 3 AA Corps in the North (3, 7 & 12 Divs. Corresponding with RAF Fighter Groups Nos. 13 and 14).

Note 5 AA Command; Equipment

| | |
|-------------------------|---|
| At the outbreak of war: | 695 Heavy Guns of an approved total of 2232 |
| | 253 Light Guns of an approved total of 1200 |
| | (including 74 Bofors 40mm) |
| | 2700 Searchlights of an approved total of |
| | 4128 (recommended total 4700) |

| | |
|---------------------|-------------------|
| At the end of 1939: | 850 Heavy Guns |
| | 510 Light Guns |
| | 3361 Searchlights |

| | |
|---------------------|-------------------|
| At the beginning of | |
| July 1940: | 1200 Heavy Guns |
| | 549 Light Guns |
| | 3932 Searchlights |

May 1941: 1691 Heavy Guns
940 Light guns
4532 Searchlights (owing to shortage of man power the number of equipments in action had to be reduced before May 1941).

Note 6 AA Command: Strength

At mobilisation: 106,690 (mostly Territorial Army)
At July 1940: 157,319
At May 1941: 300,000 (approximately)

Note 7 Results: Claims by AA Command

| | |
|--------------|-----------------|
| 1940 July | 4 e/a destroyed |
| August | 16 |
| September | 31 |
| October | 21 |
| November | 20 |
| December | 10 |
| 1941 January | 12 |
| February | 8½ |
| March | 17 |
| April | 39½ |
| May | 31½ |

Comparative Claims: AA & Fighters

| | <u>Enemy Sorties</u> <u>(overland only)</u> | <u>AA</u> | <u>Fighters</u> |
|--------------|--|-------------|-----------------|
| 1940 June | 859 | | 16 |
| July | 829 | 4 | 3 |
| August | 3180 | 16 | 3 |
| September | 6135 | 31 | 4 |
| October | 5845 | 21 | 3 |
| November | 5495 | 20 | 2 |
| December | 3585 | 10 | 4 |
| 1941 January | 1965 | 12 | 3 |
| February | 1225 | 8½ | 4 |
| March | 3510 | 17 | 22 |
| April | 4535 | 39½ | 48½ |
| May | 4055 | 31½ | 96 |
| Total | <u>42218</u> | <u>210½</u> | <u>218½</u> |

¹ Known as "Starfish". See Appendix 12.

² Prisoners of war revealed their belief that we concentrated fighters and guns along the path of the beams. We had in fact sent fighters up to 'hunt in the beams' but they had met with no success. It is of additional interest that at this period our Wireless Intelligence reported that German bomber crews were displaying great anxiety for information concerning the whereabouts of our night fighters.

³ GCI stations numbered eleven at the end of April: Sopley (Middle Wallop Sector), Durrington (Tangmere Sector), Willesborough (Biggin Hill Sector), Waldringfield (Debden Sector), Langtoft (Wittering Sector) Exminster (Exeter Sector), Orby (Digby Sector). There were also stations at St. Quivox, Wartling and Hack Green. Errors in reading heights accurately had handicapped the early GCI interceptions, but an improved form of height measurement developed at Sopley was being incorporated at all stations.

⁴ No. 23 (Blenheim) Squadron.

⁵ 128 UP weapons were deployed in the area and were in action with ammunition and GL control (UP: unrotating projector or what came popularly to be called 'rocket batteries').

⁶ For the three months before the war, the output of 3.7 guns was 39, 36 and 62. The output for January 1941 was 54 (18 mobile, 36 static), for February 90 (41 mobile, 49 static) and for March 102 (45 mobile, 57 static).

⁷ Intelligence also noted the following units engaged in attacks on shipping by night during April and May.

West: I/KG1 (Brest and Dinard: Vannes and Dinard as alternative bases) I/KG27, III/KG27 (Orleans/Bricey with Caen and Dinard as alternative bases. This unit was frequently allotted shipping objectives by night, with airfields in Devon and Cornwall as alternative targets); II/KG27 (Bourges with Dinard as an alternative base), I/KG28 and II/KG55.

East: I/KG53 (used Merville and Wittmundhafen as alternatives, once each), II/KG53, KG3, 1 and 4/(F)122; II, III/KG76, I and II/KG30 (Ju.88, Eindhoven and Gilze Rijen) and possibly Gr.106, coastal unit operating from Amsterdam/Schellingwoude.

North: I/KG26 (Aalborg and Stavanger).

⁸ There was a possibility that the enemy contemplated sending bombers by day escorted by the ME.110 or even by themselves, without escort and relying on speed to avoid fighter defences.

⁹ These included KGr100, KG51, KGr805, 1 KG27, St.KG55, 11 KG55, 1 KG54, 1 and 11 LG. 1 111 KG.27, 111 KG51 etc (as shown in Luftflotte 3 Intelligence Reports).

¹⁰ The types mainly used (apart from M/F Navigational Beacons) were: Knickebein, 'Ruffians', and 'Benito'.

¹¹ 19/20 February has been suggested as the date on which the third phase commenced, because Swansea was then attacked on successive nights, but in truth the line of demarkation between the second and third phase cannot easily be laid down, the policy of raiding industrial towns and the policy of raiding ports running concurrently.

¹² General Report of Damage to Key Point Targets as affecting the National War Effort 1941.

CHAPTER 7

ACTIVITY FROM 12th MAY TO 31st DECEMBER, 1941

Air War at Sea: Reshuffle of German Forces¹

Enemy preoccupation with the Russian Front had from mid-May brought about the virtual cessation of large-scale air bombardment of this country. A great many units had moved eastwards and rearrangement in the West had thus become necessary. On 4/5th June, when a raid on Birmingham was carried out, several Flieger Korps were still operating, but by the middle of the month most of the bomber squadrons had been brought under the Command of IX Flieger Korps. Other commands in Western Europe included Flieger-fuhrer Atlantik which had been assigned on anti-shipping role, a Nachtjagd division whose function resembles that of our own 'Intruders', and Nachtjagdkommando Bretagne which devoted itself to sea reconnaissances. Mention must also be made of Stuka aircraft which under the auspices of Jafu 2 had commenced operations against vessels passing through the Straits of Dover, a task they continued to perform until the end of 1941. The enemy bomber force in the West was, however, soon depleted to an even greater degree by the calls of the war against Russia, and the Germans realised that any clear-cut distinctions between the duties to be undertaken by the few remaining units was impossible. By July, therefore, aircraft of Fliegerfuhrer Atlantik were attacking land targets, aircraft of IX Flieger Korps were bombing ships and the Nachtjagddivision which had been engaged on 'Intruder' work had taken up reconnaissance and nuisance raiding. Even aircraft of purely reconnaissance units like 3/(F)122 had to be called in to make up the numbers when land targets were attacked. By October, elements of KG2, KG30, KG40, KuF Gr406, KGr106, KGr606 and F.123 formed the bulk of the long range bombers in the West. The Nachtjagddivision had first become a Nachtjagd Kommando and then Flieger Korps XII. Nachtjagd Kommando Bretagne with some ME.110s continued to do shipping reconnaissance.

The Enemy's New Policy

The Germans were doing two things in the West with their now limited air power. Firstly they intensified their attacks on coastwise shipping and their campaign of mine-laying, both objectives in keeping with their broad strategy of waging the war at sea with all the resources at their disposal. Secondly, they hoped it seemed to employ the small offensive force in the most effective manner possible by mounting attacks of great accuracy and concentration. For this purpose two units specialising in the use of radio bombing devices were not at first transferred to the Russian theatre of war. No. 80 Wing (Radio Counter Measures) records show that the Germans were expected very considerably to increase the number of their Knickebein stations capable of being employed simultaneously so that our counter measures would be overwhelmed by this move. To meet such a contingency No. 80 Wing itself began greatly extending the scope of the jamming systems in July, 1941, but the threat in fact never materialised and by the end of July both these specialist units had moved

away from the West.

The eclipse of KGr100 and 111/KG26 is perhaps explained by the effectiveness of our counter-measures, by the increasing success of our night fighters and the greater accuracy of our anti-aircraft. German flying personnel had been led to believe that each of their new navigational systems was immune from interference, only to find that this was not the case. Prisoner of War reports showed that their faith in the theories of their scientists had thus been greatly undermined, while a notion that the better results had been obtained by our night fighters through a process of 'hunting in the beams' only served to add to their scepticism. In fact our night fighters were doing better because of the increasing use of GCI and AI. The failure of an attack on Birmingham of 8/9th July could not have helped to increase faith in the efficiency of those bombing devices. On this night the enemy had mustered a sizeable force in the hope of delivering a precise and concentrated blow. In order to confuse our defences, two diversionary raids were planned, one on Plymouth (in which KGr100, the specialist unit participated), and one on Yarmouth. Meanwhile the main raid proceeded over the sea both to the east and west of the objective, turning sharply inwards only when level with Birmingham. 111/KG26 using the 'Benito' procedure were to lead the attack and mark the target by raising fires, while four Ju.88s of 3/(F)122 were to follow ten minutes later and bomb with radio aids to ensure that the marking would be well done. The plan failed completely, and it is of interest that the enemy was himself aware of it at the time, for his records show that of 88 machines detailed to make the raid, only 22 reported having arrived over the objective and dropped bombs. In fact, one Ministry of Home Security Report refers to no attack on Birmingham on this night, and only two bombs fell on the city and three in the suburbs that night. From about this time both KG26 and KGr100 almost abandoned the use of the blind-bombing aids, and were shortly afterwards transferred to the eastern front.

No.80 Wing ORB
August 1941

The use of radio aids declined throughout the year, although some units such as 11/KG40 sometimes employed them. Nevertheless No. 80 Wing reported that the enemy were proceeding with the installation of stations capable of transmitting beam signals and suitable counter measures to meet this extension were accordingly put in hand. It is possible that this programme was undertaken by the enemy in the hope that developments on the Russian front would permit him to take up the air bombardment of this country on an intensive scale again, a hope that never materialised.

Summary of Raids between 12th May and 31st December, 1941

During this period the German Air Force launched only 3 major raids² against our cities: Birmingham on June 4/5th (108 tons of H.E.), Southampton on 21/22nd June (136 tons of H.E.) and Hull on 17/18th July (174 tons of H.E.). In 33 raids in which more than 30 aircraft were involved took place, 24 of them on ports and 9 on industrial centres. On 12/13th August Birmingham was raided and on 12/13th October Manchester was the objective. These were the 2 last attacks of

consequence on inland towns until the year ended. The following table shows the distribution of these raids, apart from which the enemy effort was directed against shipping and towards a mine-laying campaign:

| | | | |
|-------------------------------|----------|-------------|-----------|
| Birmingham | 6 raids | Liverpool | 2 |
| Manchester | 2 “ | Hull | 6 |
| London | 1 “ | Chatham | 1 |
| (said to be a reprisal for an | | Southampton | 4 |
| RAF raid on Berlin) | | Sunderland | 2 |
| | | Newcastle | 7 |
| | | Birkenhead | <u>2</u> |
| | <u>9</u> | | <u>24</u> |

Ministry of Home Security appreciations show that German attacks met with a varying degree of success, and a scrutiny of enemy records is a useful indication of their own estimates of what they had achieved. On 12th June for example they show that only 23 out of 67 machines ordered to bomb Birmingham reached their objectives, on 14th June only 35 out of 73 machines sent to Chatham reports success, while on 15/16th October only 13 out of 45 machines reached the Hull area. An attack on Manchester of 12/13th October thought by the enemy to have been well carried out was in fact a failure and, similarly, an attack on Birkenhead of 22nd/23rd October also failed though German records show that all the machines detailed to make the raid had reached the target area. On both these occasions no blind-bombing devices were used and the failure of the raids could be attributed to the faulty navigation of aircrews with no great experience behind them as much as to the effectiveness of our defences.³

Despite the dwindling weight of the attacks made, however, Ministry of Home Security Reports point out that the inevitable damage to house property, to public utilities, to railways and industrial premises could not be ignored, especially in its local consequences, even if its effect on the whole of the war effort was negligible. In addition about 1585 persons were killed between 12th May and 31st December, 1941.

General Activity

An analysis of the sorties made by the German Air Force between June and December, 1941, against land and sea targets and the claims of Fighter Command helps to present a picture of the activity over this period.

| <u>Month</u> | Enemy Sorties against land <u>Targets</u> | Enemy Sorties against sea <u>Targets</u> | Enemy a/c claimed destroyed <u>Fighters</u> | Enemy a/c claimed destroyed <u>AA Guns</u> |
|--------------|---|--|---|--|
| June | 1980 | 1545 | 27 | 12 |
| July | 1352 | 1065 | 26 | 1 |
| Aug. | 935 | 861 | 3 | 3 |
| Sept. | 838 | 548 | 8 | 1 |
| Oct. | 849 | 564 | 11 | 1 |
| Nov. | 695 | 470 | 7 | 3 |
| Dec. | 695 | 99 | 3 | 3 |

The decline in the scale of enemy effort thus becomes well illustrated. The sharp drop in the number of sorties made between July and August is accounted for by the movement of German aircraft from the western to the eastern front, and the drop between October and November is accounted for by the arrival of winter conditions and poor visibility.

On 11th August the Commander-in-Chief, Fighter Command reported that the percentage of enemy machines destroyed in proportion to the number of raiders was not as high as it was in May. He offered an explanation for this situation. The enemy was now flying erratic courses to evade interception and was also employing the tactic of keeping at very low heights out to sea, making detection a difficult matter. Up to this date, AI fighters had claimed the destruction of more than twice the number of enemy machines claimed destroyed by the 'catseye' fighters, and in the opinion of the Commander-in-Chief, this was a fair indication of the relative efficiency of the two methods of night interception. On 19th November he again commented on the decreasing scale of losses being inflicted on the enemy. Vigorous evasive action had become a routine measure with enemy pilots when approaching or leaving our coasts, and they flew low over the sea in the knowledge that by doing so they could not be 'seen' by our radar. The limitations of our AI apparatus further added to the problems of intercepting these low-flying enemy aircraft,⁴ for at heights below 5000 feet the echo of the target was generally lost in the returns from the sea. Similarly the GCI set was unable to detect machines at low altitudes except at short range. However, it was hoped that CHL stations which were designed for the detection of low-flying aircraft when used to control aircraft would help to overcome these drawbacks, while a new technique was said to enable AI Mark IV to make contacts at heights of 3000 feet. Meanwhile new forms of AI were in the course of production. Before these new measures could take real effect the period under review in this narrative closes.

As the table shows, June, July and October were the most successful for the night fighters. The reason was that in June the Germans made 7 attacks on overland targets, in July they made 7 and in October 6, thus offering the fighters opportunities for making interceptions.⁵ AA guns had no great successes to claim for much the same reasons as made the task of the fighters difficult. Fast-flying raiders making attacks on coastal targets over which they did not remain long gave only fleeting chances.

AHBIIH/240/10/22
FC Ops Instruction
No.84
FC/S.24310 Ops July
23rd, 1941 Encl.6A.

The enemy's widely extended night attacks on shipping during the period under review presented Fighter Command with an almost unanswerable problem. Consistent fighter patrols provided for convoys by daytime as well as the growing effectiveness of the anti-aircraft armament on ships compelled the Luftwaffe to conduct their anti-shipping operations after dark. It was felt that the presence of fighters near convoys at night only served to confuse the ship's gunners, and in July the decision was taken to withdraw the air escort during the hours of darkness. It was also decided that:

(i) Groups should endeavour to intercept enemy bombers on their way to or from the convoy at nights.

(ii) Though 'catseye' fighters had little chance of sighting the enemy except in moonlight conditions, when visibility was favourable they should be aided by GCI indications and often by the bursts from the AA guns of the ships and their escorts.

(iii) AI fighters should be used whenever it seemed that results might be obtained, such as when bombers were operating at heights at which the AI set was effective.

(iv) That control from CHL stations with the Plan Position Indicator should be tried.

(v) Convoys should open fire at all aircraft heard approaching at night without making identification, and fighters passing above convoys should do so at a height of over 7,000 feet.

NAD(42)2
March 31st 1942

Thus convoys were left to rely on the protection of their own armament by night, but enemy attacks on shipping continued to cause anxiety, for the Commander-in-Chief, Fighter Command, had to admit appreciable damage to shipping even during the early part of 1942.

Summary of Developments in Fighter Command and AA Command

NAD(41)3
May 12th, 1941

AHBIIH/240/11/22
FC/S.24475
Encl.21A

On 12th May, the day on which the great enemy night assault came to an end, the Commander-in-Chief, Fighter Command told the Night Air Defence Committee that "AI with GCI was the most profitable means of night interception, notwithstanding the successes obtained by 'catseye' fighters". He demanded acceleration in the provision of Beaufighters. On 11th June he wrote: "the expansion of the Night Fighter Force is now in sight, and we may expect the supply of GCI sets to come forward at a quicker rate in the future". The hope was that 'Target Force E'⁶ would be realised by the end of the year and that 25 night squadrons would then be available, including two 'Intruders' but excluding the Helmore searchlight units.

Indeed, expansion was the keynote for the months between June and the end of the year. Two night squadrons were formed on 16th June and two more on the 30th ⁷, equipped with Defiants in the first instance. It was also found that there were sufficient Beaufighters soon to start the re-

NAD(41)4
June 23rd, 1941

No.60 Group ORB
May-October, 1941

equipment with this type of machine No. 406 (Blenheim) Squadron and No. 141 (Defiant) Squadron. At about the same time the Air Ministry were considering the question of additional night fighter airfields so that flexibility in the exploitation of the night squadrons could be achieved, and so that forces could be strongly concentrated wherever necessary.⁸ The installation of GCI sets made progress and 15 of them came into operation between May and October.⁹

NAD(4)41
June 23rd, 1941
et seq

RAF Narrative
ADGB Vol.IV Part I

Expansion was not, however, smoothly achieved. Difficulties about the supply of radar devices for the fighter, gun and searchlight defences, and in relation to the operators required to handle them constantly supervened. The Commander-in-Chief, Fighter Command, expressed dissatisfaction with the standard of training acquired by AI operators and doubt concerning the capacity of the training establishments to produce them in the numbers required. He was assured by the Secretary of State for Air that 70 operators a month would be coming out of the schools by mid-July. Similarly a shortage of trained radio mechanics existed. An intake from Canada had failed to prove themselves and the services and even the Civil Defences were combed for suitable persons. The establishment of No. 60 OTU in April, No. 51 OTU¹⁰ in August and the establishment later in the year of Nos. 60 and 55. OTU helped to ensure an adequate flow of pilots into the night squadrons.

NAD(41)4
June 23rd, 1941

Pile: Despatch 1
Paras 4, 13

NAD(2)42
March 31st, 1942

AA Command were suffering from like handicaps and in June the General Officer Commanding stated that only 54 of the 2,000 SLC equipments wanted were available, while among the UP batteries both crews and projectors stood idle for want of ammunition.¹¹ Manpower shortages also afflicted the Command and were solved by the introduction of women and members of the Home Guard into units. The re-deployment of the searchlights in November, 1941 brought up the perennial problem of re-training 'listeners' on the sound locators as SLC operators, while only 1082 of the 4000 equipments required had become available even by March of 1942.

NAD(41)6
November 17th,
1941

At a meeting of the Night Air Defence Committee on 17th November, the Prime Minister said that our resources would not permit us to develop all the alternative forms of night defence. We should have to judge from experience upon which to concentrate and which to discard. On this date it was decided to discontinue attempts to lay aerial mines in the path of incoming raiders, hitherto carried out by No. 93 Squadron with very small success, chiefly because of a series of technical difficulties and because a suitable method of control for the aircraft carrying out this work could not be arrived at.

Ibid(41)4
June 23rd, 1941

Meanwhile the formation and training of units carrying the Helmore searchlight¹² was making progress, and trials had proved so promising that the Commander-in-Chief, Fighter Command said he regarded their development as "the most promising aid to night fighting since the introduction of AI". The 10 Turbinlite Flights which had been deemed necessary had been formed by the end of 1941, and all save one were available for operations. However, as it was decided that they should be used against the enemy only if he attacked in strength, and as no suitable

occasion arose, it was not possible to employ them in that year.

In September the General Officer Commanding Anti-Aircraft Command submitted a new plan for the deployment of the searchlights which discarded earlier ideas that they should be used in clusters. Accordingly this redeployment was put in hand and on 3rd November, Fighter Command issued an instruction concerning its mode of operation.

The basis of the new scheme was a mathematical conception known as the 'Fighter Box'. This was the area within which a night fighter using the visual indication provided by the searchlight beam could intercept a raider which flew into it. The size of the 'box' was 44 x 14 miles. The country was divided into a system of 'boxes' around the various Gun Defended Areas.

In the centre of each 'box' was a stationary vertical searchlight beam around which the fighter circled until he received information that a hostile machine was entering his 'box'. At the ends of each 'box' searchlights were spaced at about six-mile intervals, while in the middle the spacing was about 3½ miles. A series of 'boxes' placed contiguously thus created a belt in which lights were thin at the edges, where they constituted an 'Indicator Zone' and dense in the middle where they constituted a 'Killer Zone'.

In 1941 interceptions using this system had hardly begun, but it is of significance that the 'Fighter Box' remained the basis of searchlight deployment for the rest of the war.

It remains to summarise the pattern of our night defences at the end of 1941. After the lean times of 1940, which might be regarded as a period of development, the first mark of progress was reached in January 1941 when GCI sets were installed. Together with AI, which though a much earlier discovery, was at the same time being fitted to Beaufighter aircraft in its Mark IV form, results began to show, proving by March that here at last was a suitable and specialised method of night interception, long sought after. Meanwhile, 'catseye' fighters had shown that they too had a contribution to make if employed in conditions of good visibility.

By March, 1941, therefore, the AI-equipped fighter and the 'catseye' fighter had become our established forms of night fighter defence. As 1941 progressed, however, experience led to the conclusion that the AI/GCI form was of primary importance. It had become the cornerstone of the night defences. Thus the end of that year saw the night defences composed of:

- (i) the AI equipped fighter working under GCI control.
- (ii) the 'catseye' fighter when conditions of good visibility prevailed.
- (iii) the AA gun under radar control.
- (iv) the UP weapon.

Behind these stood the Turbinlite aircraft and the new system of searchlight interception within 'Fighter Boxes', both holding out high hope but untried in 1941.

¹ This is revealed in a captured document 1C – Berichte – Führungsabteilung Gruppe 1G.

² When it was intended to drop over 100 metric tons of bombs.

³ On 12/13th Manchester; the following German units participated: 18 Ju.88s of 111/KG30, 4 Do.17s of 11/KG40, 10 Do.17s of 11/KG2, 5 Ju.88s of KGr606, 9 He.111s of 111/KG40. Two aircraft were reported missing from this raid. On 22nd/23rd Birkenhead; the following German units participated: 7 Ju.88s of KGr606, 6 He.111s of 111/KG40, 9 Do.217s of 11/KG2, 22 Ju.88s of 111/KG30. On this occasion no aircraft were reported missing. KG30 were the mainstay of IX Flieger Korps at this time and the large number of their aircraft engaged on these two operations is noteworthy.

⁴ The increased speed of German aircraft also made their interception difficult. By November we had a Mosquito squadron forming but it was non-operational in 1941.

⁵ 13 of these 20 raids were made against coastal targets thereby increasing the problems of interception, especially as the raiders reduced the time spent over the objective to the minimum, then rapidly making off to seaward.

⁶ Twenty-five night squadrons were available by 31st Dec.

⁷ Nos. 456, 125, 409, 410.

⁸ See Appendix 11.

⁹ See Appendix 13.

¹⁰ No. 60 OTU was moved from Leconfield to East Fortune in May, No. 55 OTU was at Cranfield. No. 54 OTU had been established at Church Fenton in December, 1941.

¹¹ On 17th November some 50 UP batteries were deployed. NAD(41)6, 17th November, 1941.

¹² Given the name Turbinlite.

MAJOR ATTACKS ON BRITISH TARGETS¹
August 1940 – June 1941

(Compiled from German Records)

| <u>Date</u> | <u>Target</u> | <u>HE</u> <u>(Metric</u> <u>Tons)</u> | <u>Inc.</u> ² | <u>Date</u> | <u>Target</u> | <u>HE²</u> <u>(Metric</u> <u>Tons)</u> | <u>Inc.</u> |
|--------------|---------------|---|--------------------------|--------------|------------------|---|-------------|
| <u>1940</u> | | | | | | | |
| Aug. 28/29 | Liverpool | 103 | 190 | Nov. 1/2 | London | 227 | 130 |
| 29/30 | " | 130 | 313 | 2/3 | " | 117 | 126 |
| 30/31 | " | 127 | 225 | 4/5 | " | 184 | 16 |
| Sep. 7 | London | 316 | 356 | 5/6 | " | 139 | - |
| 7/8 | " | 333 | 378 | 6/7 | " | 223 | 4 |
| 8/9 | " | 202 | 257 | 7/8 | " | 242 | 9 |
| 9/10 | " | 259 | 315 | 8/9 | " | 133 | - |
| 10/11 | " | 175 | 1018 | 9/10 | " | 124 | - |
| 11/12 | " | 208 | 328 | 10/11 | " | 212 | 7 |
| 13/14 | " | 125 | 200 | 12/13 | " | 165 | 92 |
| 15 | " | 133 | 108 | 14/15 | Coventry | 503 | 881 |
| 15/16 | " | 234 | 279 | 15/16 | London | 474 | 1142 |
| 16/17 | " | 207 | 308 | 16/17 | " | 104 | - |
| 17/18 | " | 317 | 651 | 17/18 | Southampton | 198 | 300 |
| 18/19 | " | 339 | 628 | 19/20 | Birmingham | 403 | 870 |
| 19/20 | " | 312 | 603 | 20/21 | " | 132 | 296 |
| 20/21 | " | 154 | 79 | 22/23 | " | 227 | 457 |
| 21/22 | " | 162 | 329 | 23/24 | Southampton | 150 | 464 |
| 22/23 | " | 140 | 361 | 24/25 | Bristol | 161 | 333 |
| 23/24 | " | 310 | 601 | 27/28 | Plymouth | 110 | 175 |
| 24/25 | " | 256 | 384 | 28/29 | Liverpool | 356 | 860 |
| 25/26 | " | 260 | 441 | 29/30 | London | 380 | 820 |
| 26/27 | " | 270 | 239 | 30 Nov/1 Dec | Southampton | 152 | 598 |
| 27/28 | " | 167 | 437 | Dec. 1/2 | " | 147 | 586 |
| 28/29 | " | 325 | 205 | 2/3 | Bristol | 122 | 615 |
| 29/30 | " | 311 | 136 | 8/9 | London | 387 | 3188 |
| 30 Sep/1 Oct | " | 295 | 106 | 11/12 | Birmingham | 277 | 685 |
| Oct. 1/2 | " | 250 | 115 | 12/13 | Sheffield | 355 | 457 |
| 2/3 | " | 130 | 300 | 20/21 | Liverpool | 205 | 761 |
| 4/5 | " | 189 | 236 | 21/22 | " | 280 | 940 |
| 5/6 | " | 242 | 176 | 22/23 | Manchester | 272 | 1032 |
| 7/8 | " | 211 | 143 | 23/24 | " | 195 | 893 |
| 8/9 | " | 257 | 264 | 27/28 | London | 111 | 318 |
| 9/10 | " | 264 | 245 | 29/30 | " | 127 | 618 |
| 10/11 | " | 269 | 718 | <u>1941</u> | | | |
| 11/12 | " | 213 | 126 | Jan. 2/3 | Cardiff | 115 | 392 |
| 12/13 | " | 148 | 24 | 3/4 | Bristol | 154 | 1488 |
| 13/14 | " | 249 | 131 | 10/11 | Portsmouth | 142 | 1409 |
| 14/15 | " | 304 | 299 | 10/11 | Manchester | 111 | 735 |
| 15/16 | " | 538 | 177 | 11/12 | London | 144 | 598 |
| 16/17 | " | 346 | 187 | 12/13 | " | 155 | 823 |
| 17/18 | " | 322 | 134 | 16/17 | Avonmouth | 124 | 1480 |
| 18/19 | " | 172 | 132 | Feb. | No major attacks | | |
| 19/20 | " | 386 | 192 | | | | |
| 20/21 | " | 356 | 192 | Mar. 8/9 | London | 130 | 693 |
| 21/22 | " | 115 | 52 | 10/11 | Portsmouth | 193 | 1291 |
| 25/26 | " | 193 | 193 | 11/12 | Birmingham | 122 | 830 |
| 26/27 | " | 253 | 176 | 12/13 | Liverpool | 303 | 1782 |
| 27/28 | " | 127 | 40 | 13/14 | Glasgow | 272 | 1650 |
| 28/29 | " | 176 | 111 | 14/15 | " | 231 | 782 |
| 29/30 | " | 236 | 109 | 15/16 | London | 103 | 397 |
| 30/31 | " | 178 | 92 | 16/17 | Bristol | 165 | 940 |

| <u>Date</u> | <u>Target</u> | <u>HE</u> <u>(Metric</u> <u>Tons)</u> | <u>Inc.</u> | <u>Date</u> | <u>Target</u> | <u>HE</u> <u>(Metric</u> <u>Tons)</u> | <u>Inc.</u> |
|-------------|---------------|---|-------------|-------------|---------------|---|-------------|
| <u>1941</u> | | | | | | | |
| Mar 18/19 | Hull | 316 | 2140 | Apr 26/27 | Liverpool | 113 | 426 |
| 19/20 | London | 467 | 3397 | 29/30 | Plymouth | 210 | 531 |
| 20/21 | Plymouth | 159 | 881 | May 2/3 | Liverpool | 105 | 167 |
| 21/22 | " | 187 | 1003 | 3/4 | " | 363 | 1387 |
| Apr 7/8 | Dumbarton | 132 | 465 | 4/5 | Belfast | 219 | 2667 |
| 8/9 | Coventry | 315 | 710 | 5/6 | Clydeside | 351 | 1300 |
| 9/10 | Birmingham | 285 | 1110 | 6/7 | " | 199 | 1090 |
| 9/10 | Newcastle | 152 | 1396 | 7/8 | Liverpool | 232 | 807 |
| 10/11 | Birmingham | 246 | 1183 | 7/8 | Hull | 110 | 268 |
| 11/12 | Bristol | 193 | 701 | 8/9 | Nottingham | 137 | 189 |
| 15/16 | Belfast | 203 | 808 | 8/9 | Hull | 167 | 540 |
| 16/17 | London | 890 | 4200 | 8/9 | Birmingham | 137 | 189 |
| 17/18 | Portsmouth | 346 | 1280 | 10/11 | London | 718 | 2393 |
| 19/20 | London | 1026 | 4522 | 16/17 | Birmingham | 160 | 58 |
| 21/22 | Plymouth | 139 | 1000 | June 4/5 | " | 108 | 167 |
| 22/23 | " | 146 | 994 | 21/22 | Southampton | 136 | 143 |
| 23/24 | " | 118 | 574 | July 17/18 | Hull | 174 | 172 |

¹ By major attack the Germans understood one in which it was intended to drop more than 100 tons of HE bombs

² The numbers of incendiaries is given in terms of containers, each container holding 36 1-kg bombs.

DISTRIBUTION OF GERMAN NIGHT ATTACKAUGUST 1940 – JULY 1941
(in terms of Major Raids)London

| | | <u>No. of Raids</u> | <u>Metric Tons of HE</u> |
|------|-----------|---------------------|--------------------------|
| 1940 | September | 22 | 5359 |
| | October | 25 | 6124 |
| | November | 13 | 2724 |
| | December | 3 | 624 |
| 1941 | January | 2 | 299 |
| | March | 2 | 233 |
| | April | 2 | 1916 |
| | May | 1 | 711 |
| | | <u>70</u> | <u>17990</u> |

Industrial Cities

| | | | |
|------|----------|-----------|-------------|
| 1940 | November | 4 | 1038 |
| | December | 4 | 1099 |
| 1941 | January | 1 | 111 |
| | March | 1 | 122 |
| | April | 3 | 846 |
| | May | 3 | 434 |
| | June | 1 | 108 |
| | | <u>17</u> | <u>3758</u> |

Ports

| | | | |
|------|----------|-----------|-------------|
| 1940 | August | 3 | 360 |
| | November | 6 | 1127 |
| | December | 4 | 754 |
| 1941 | January | 4 | 535 |
| | March | 8 | 1826 |
| | April | 11 | 1911 |
| | May | 8 | 1746 |
| | June | 1 | 136 |
| | July | 1 | 174 |
| | | <u>46</u> | <u>8569</u> |

MAJOR ATTACKS (BY CITIES): AUGUST 1940 - JULY 1941

| | | |
|--------|-----------|-----------|
| London | September | 22 |
| | October | 25 |
| | November | 12 |
| | December | 3 |
| 1941 | January | 2 |
| | March | 3 |
| | April | 2 |
| | May | 1 |
| | | <u>70</u> |

MAJOR ATTACKS (BY CITIES): AUGUST 1940 - JULY 1941

(Continued)

| | | |
|-------------|----------|-----------|
| Coventry | November | 1 |
| | April | <u>1</u> |
| | | <u>2</u> |
| Birmingham | November | 3 |
| | December | 1 |
| | March | 1 |
| | April | 2 |
| | May | 2 |
| | June | <u>1</u> |
| | | <u>10</u> |
| Liverpool | August | 3 |
| | November | 1 |
| | December | 2 |
| | March | 1 |
| | April | 1 |
| | May | <u>3</u> |
| | | <u>11</u> |
| Southampton | November | 3 |
| | December | 1 |
| | June | <u>1</u> |
| | | <u>5</u> |
| Bristol | November | 1 |
| | December | 1 |
| | January | 2 |
| | March | 1 |
| | April | <u>1</u> |
| | | <u>6</u> |
| Plymouth | November | 1 |
| | March | 2 |
| | April | <u>5</u> |
| | | <u>8</u> |
| Sheffield | December | 1 |
| Manchester | December | 2 |
| | January | <u>1</u> |
| | | <u>3</u> |
| Cardiff | January | 1 |
| Portsmouth | January | 1 |
| | March | 1 |
| | April | <u>1</u> |
| | | <u>3</u> |

MAJOR ATTACKS (BY CITIES): AUGUST 1940 - JULY 1941
(Continued)

| | | |
|----------------------|-------|------------|
| Belfast | April | 1 |
| | May | <u>1</u> |
| | | <u>2</u> |
| Hull | March | 1 |
| | May | 2 |
| | July | <u>1</u> |
| | | <u>4</u> |
| Clydeside | March | 2 |
| | April | 1 |
| | May | <u>2</u> |
| | | <u>5</u> |
| Newcastle | April | 1 |
| Nottingham | May | <u>1</u> |
| TOTAL OF MAJOR RAIDS | | <u>133</u> |

Total tonnage of HE bombs dropped in major raids 30,314 metric tons.

NOTABLE RAIDS ON TOWNS IN RELATION TO MOON PERIODS – 1941

| | Jan 05 19 | Feb 04 17 | Mar 06 19 | April 04 17 | May 04 17 | June 02 15 | July 02 31 15 | Aug 28 14 | Sep 27 12 | Oct 26 12 | Nov 25 11 | Dec 25 10 | Total No. of Attacks During Year |
|----------------|---|--|--|----------------------------------|--|------------------|-------------------------|-----------------|-----------------|-----------------|--------------------|-----------------|--|
| | <u>East Coast Towns and Ports</u> | | | | | | | | | | | | |
| TYNESIDE | 6/7 27 | | | 7/8 9/10 14/15 25/26 | 3/4 5/6 15/16 | | | | 1/2 30/01 | 2/3 21/22 | | 8/9 | |
| Monthly Totals | 2 | | | 4 | 3 | | | | 2 | 2 | | 1 | 14 |
| TEES-SIDE | | | | 15/16 | 5/6 6/7 11/12 15/16 | | | 18/19 19/20 | 2/3 | 2/3 21/22 | 3/4 7/8 9/10 | | |
| Monthly Totals | | | | 1 | 4 | | | 2 | 1 | 2 | 3 | | 13 |
| HULL | | 14/15 | 4/5 13/14 15/16 18/19 31/01 | 15/16 | 3/4 5/6 7/8 8/9 11/12 28/29 | 28/29 | 10/11 17/18 22/23 | | 20/21 | 12/13 | | | |
| Monthly Totals | | 1 | 5 | 1 | 6 | 1 | 3 | | 1 | 1 | | | 19 |
| | <u>South Coast Towns and Ports</u> | | | | | | | | | | | | |
| LONDON | 5/6 6 7 9/10 11/12 12/13 19/20 21 28 29/30 30 31 | 3 13/14 14/15 15/16 17/18 19/20 20/21 26/27 | 4/5 8/9 9/10 15/16 18/19 19/20 20/21 | 10/11 16/17 19/20 20/21 | 10/11 | | 27/28 | | | | | | |
| Monthly Totals | 12 | 8 | 7 | 4 | 1 | | 1 | | | | | | 33 |

| Moon periods begin Moon periods end | | Jan 05 19 | Feb 04 17 | Mar 06 19 | April 04 17 | May 04 17 | June 02 15 | July 02 31 15 | Aug 28 14 | Sep 27 12 | Oct 26 12 | Nov 25 11 | Dec 25 10 | Total No. of Attacks During Year |
|--|--|-----------------|-----------------|---|---|---|------------------|---------------------|-----------------|-----------------|-----------------|-----------------|-----------------|--|
| PORTSMOUTH | | 9/10 10/11 | | 4/5 5/6 9/10 10/11 12/13 31/01 | 8/9 9/10 10/11 11/12 17/18 23/24 26/27 27/28 | 3/4 | 11/12 13/14 | | | | | | | |
| Monthly Totals | | 2 | | 6 | 8 | 1 | 2 | | | | | | | 19 |
| SOUTHAMPTON | | | | 11/12 12/13 18/19 | 10/11 12/13 | | 21/22 | 7/8 | | | | | | |
| Monthly Totals | | | | 3 | 2 | | 1 | 1 | | | | | | 7 |
| <u>West and South-West Coast Towns and Ports</u> | | | | | | | | | | | | | | |
| BELFAST | | | | | 7/8 15/16 | 4/5 | | | | | | | | |
| Monthly Totals | | | | | 2 | 1 | | | | | | | | 3 |
| CLYDESIDE | | | | 13/14 14/15 | 7/8 | 5/6 6/7 | | | | | | | | |
| Monthly Totals | | | | 2 | 1 | 2 | | | | | | | | 5 |
| MANCHESTER | | 9/10 | | 11/12 | 14 | 2/3 7/8 | 1/2 | | | | 12/13 | | | |
| Monthly Totals | | 1 | | 1 | 1 | 2 | 1 | | | | 1 | | | 7 |
| MERSEYSIDE | | 9/10 | | 12/13 13/14 14/15 | 7/8 15/16 26/27 | 1/2 2/3 3/4 4/5 5/6 6/7 7/8 30/31 31/01 | 24/25 | | | | 20/21 22/23 | 1/2 | | |
| Monthly Totals | | 1 | | 3 | 3 | 9 | 1 | | | | 2 | 1 | | 20 |

| | Jan 05 19 | Feb 04 17 | Mar 06 19 | April 04 17 | May 04 17 | June 02 15 | July 02 31 15 | Aug 28 14 | Sep 27 12 | Oct 26 12 | Nov 25 11 | Dec 25 10 | Total No. of Attacks During Year |
|--|-----------------------------|-----------------|-----------------|--|--------------------------------|------------------|---------------------|-----------------|-----------------|-----------------|-----------------|-----------------|--|
| Moon periods begin Moon periods end | | | | | | | | | | | | | |
| SWANSEA | 4/5 13/14 17/18 | 19/20 20/21 | | | | | | | | | 28/29 | | |
| Monthly Totals | 3 | 2 | | | | | | | | | 1 | | 6 |
| CARDIFF | 2/3 | 26/27 | 3/4 4/5 | 12/13 | | 30/01 | | | | | | | |
| Monthly Totals | 1 | 1 | 2 | 1 | | 1 | | | | | | | 6 |
| BRISTOL | 3/4 4/5 9/10 16/17 | | 16/17 29/30 | 3/4 4/5 9/10 11/12 | 7/8 | | | | | | | | |
| Monthly Totals | 4 | | 2 | 4 | 1 | | | | | | | | 11 |
| PLYMOUTH | 13/14 | | 14/15 21/22 | 15/16 21/22 22/23 23/24 28/29 29/30 | 5/6 12/13 15/16 16/17 | | 4/5 8/9 | | | | | 17/18 | |
| Monthly Totals | 1 | | 2 | 6 | 4 | | 2 | | | | | 1 | 16 |
| <u>Inland Towns</u> | | | | | | | | | | | | | |
| DERBY | 15/16 | | | | | | 8/9 | | | | | | 2 |
| LEEDS | | | 14/15 | | | | | | | | | | 1 |
| NOTTINGHAM | | | | | 8/9 14 | | | | | | | | |
| Monthly Totals | | | | | 2 | | | | | | | | 2 |
| BIRMINGHAM | 1/2 | | | 7/8 9/10 10/11 | 16/17 | 4/5 11/12 | | 12/13 | | | | | |
| Monthly Totals | 1 | | | 3 | 1 | 2 | | 1 | | | | | 8 |

[illegible]

ATTACKS ON THE BRITISH ISLES IN 1941
(Compiled from German Records)

| Month | Major Raids* | | | Misc. Raids** | | Secondary Targets*** | | Shipping | | Total | | Major Raids on Cities | Total No. of Raids |
|-----------|--------------|------------|---------|---------------|-------|----------------------|------|------------|---------|------------|---------|---|--------------------|
| | No. of Raids | Tons of HE | Incend. | Tons of HE | Inc. | Tons of HE | Inc. | Tons of HE | Incend. | Tons of HE | Incend. | | |
| January | 7 | 945 | 6925 | 605 | 2033 | 428 | 4761 | 81 | - | 2059 | 13719 | London: 2, Cardiff: 1, Bristol: 1, Avonmouth: 1, Manchester: 1, Portsmouth: 1 | 322 |
| February | - | - | - | 856 | 3195 | 44 | 352 | 147 | - | 1047 | 3547 | | 422 |
| March | 12 | 2648 | 15786 | 1088 | 4229 | 207 | 47 | 264 | - | 4207 | 20062 | London: 3, Portsmouth: 1, Birmingham: 1, Liverpool: 1, Glasgow: 2, Hull: 1, Plymouth: 2, Bristol-Avonmouth: 1 | 462 |
| April | 16 | 4673 | 20661 | 1502 | 6123 | 347 | 404 | 272 | - | 6794 | 27188 | Coventry: 1, Dumbarton: 1, Birmingham: 2, Newcastle: 1, Belfast: 1, Bristol: 1, London: 2, Portsmouth: 1, Plymouth: 5, Liverpool: 1 | 502 |
| May | 12 | 2754 | 10460 | 1821 | 4314 | 523 | 754 | 236 | - | 5334 | 15528 | Birmingham: 1, London: 1, Nottingham: 1, Hull: 2, Dumbarton: 2, Glasgow: 1, Belfast: 1, Liverpool: 3 | 652 |
| June | 2 | 244 | 310 | 510 | 814 | 169 | 429 | 272 | 8 | 1195 | 1561 | Southampton: 1, Birmingham: 1 | 247 |
| July | 1 | 174 | 172 | 686 | 1163 | 133 | 65 | 178 | - | 1171 | 1400 | Hull: 1 | 191 |
| August | - | - | - | 293 | 48 | 210 | 23 | 169 | - | 672 | 71 | | 256 |
| September | - | - | - | 344 | 18 | 108 | 16 | 167 | - | 619 | 34 | | 170 |
| October | - | - | - | 464 | 44 | 155 | 9 | 136 | - | 755 | 53 | | 121 |
| November | - | - | - | 186 | 55 | 160 | 84 | 187 | - | 533 | 139 | | 92 |
| December | - | - | - | 164 | 100 | 59 | 17 | 63 | - | 286 | 117 | | 55 |
| TOTALS | 50 | 11438 | 54314 | 8519 | 22136 | 2543 | 6961 | 2172 | 8 | 24672 | 83419 | | 3492 |

* Major raid: when the intention was to drop over 100 tons of HE Bombs.

** Miscellaneous raids: comprise nuisance raids mainly.

*** Secondary Targets: means minor raids on places.

GAF EFFORT: CASUALTIES CLAIMED BY NIGHT1940

| | Enemy Sorties against Land Targets and in Home Waters | | E/A Destroyed | | | Total |
|-----------|---|----------|---------------|-----|--------------|-------|
| | Total | Overland | Fighters | AA | Other Causes | |
| June | 1367 | 859 | 16 | - | - | 16 |
| July | 1527 | 829 | 3 | 4 | 2 | 9 |
| August | 4050 | 3180 | 3 | 16 | 4 | 23 |
| September | 6950 | 6135 | 4 | 31 | 3 | 38 |
| October | 6520 | 5845 | 3 | 21 | 7 | 31 |
| November | 6025 | 5495 | 2 | 20 | 5 | 27 |
| December | 3940 | 3585 | 4 | 10 | - | 14 |
| | 30379 | 25928 | 35 | 102 | 21 | 158 |

1941

| | Enemy Sorties against Land Targets & in Home Waters | | Sorties | Fighters | | | | Destroyed | AA | Other Causes | Total |
|-----------|--|----------|----------------------|----------|-------------------|---------|-------------------|------------------|------|-----------------|-------|
| | | | | Contacts | | Combats | | | | | |
| | Total | Overland | | AI | Visual | AI | Visual | | | | |
| January | 2295 | 1965 | T/E 84 S/E 402 | 44 - | - 34 | 2 - | - 9 | 3 | 12 | 2 | 17 |
| February | 1820 | 1225 | T/E 147 S/E 421 | 25 - | - 33 | 4 - | - 9 | 2) 2)4 | 8½ | 4½ | 17 |
| March | 4125 | 3510 | T/E 270 S/E 735 | 95 - | 20 34 | 21 - | 10 25 | 11/4) * 7)22 | 17 | 4 | 43 |
| April | 5125 | 4535 | T/E 342 S/E 842 | 117 - | 10 45 | 50 - | 5 39 | 27/1) 20½)48½ | 39½ | 2 | 90 |
| May | 4625 | 4055 | T/E 643 S/E 1345 | 204 - | 13 154 | 14 - | 6 116 | 34/3) 59)96 | 31½ | 10½ | 138 |
| June | 1980 | 1545 | T/E 536 S/E 942 | 94 - | - 24 | 37 - | - 15 | 19/1) 7)27 | 12 | 3 | 42 |
| July | 1352 | 1065 | T/E 557 S/E 338 | 80 - | - 25 | 23 - | - 18 | 20) 6)26 | 1 | 6 | 33 |
| August | 935 | 861 | T/E 549 S/E 592 | 82 - | 1 5 | 4 - | - 1 | 3 | 3 | 4 | 10 |
| September | 838 | 548 | T/E 361 S/E 344 | 74 - | 3 7 | 10 - | - 3 | 7) 1)8 | 1 | 2 | 11 |
| October | 849 | 564 | T/E 621 S/E 496 | 106 - | 10 10 | 33 - | 3 3 | 8/1) 2)11 | 1 | 2 | 14 |
| November | 695 | 470 | T/E 417 S/E 345 | 80 - | 4 8 | 14 - | 1 - | 7 | 3 | 1 | 11 |
| December | 695 | 99 | T/E 440 S/E 211 | 46 - | 1 2 | 6 - | - - | 3 | 3 | 3 | 9 |
| | 25332 | 20442 | T/E 4967 S/E 7007 | 1047 | T/E 62 S/E 381 | 218 | T/E 25 S/E 239 | 258½ | 132½ | 44 | 435 |

* 2nd figure denotes results of visual interception by AI equipped fighters.

T/E – Twin Engine
S/E – Single Engine

NOTES ON MINOR RAIDS

During the offensive against London from 7/8th September-14/15th November, raids elsewhere were on a very small scale, the bomb load with a few exceptions hardly ever exceeding an average of about 10 tons. In September the secondary attack was directed at Liverpool which was visited some 15 times, while Crewe was bombed once. In October the attack was distributed between Liverpool, Manchester, Coventry and Birmingham, with the emphasis on Birmingham and again on Liverpool. Coventry was raided some half-dozen times, Birmingham about 11 times, Liverpool about 9 times and Manchester about 3 times. During this month, certain attacks of slightly higher proportions were delivered. On the 15/16th about 26 tons of HE bombs were dropped on Birmingham, on the 17/18th the figure was some 20 tons, on the 20/21st some 47 tons, on the 25/26th about 25 tons, on the 27/28th about 35 tons, and on the 29/30th about 75 tons were dropped on Birmingham and Coventry. Similarly about 35 tons were dropped on Liverpool on the 25/26th and 28 tons on the 27/28th. In November (up to the 14/15th) the only noteworthy raid was on Birmingham when about 20 tons of HE were delivered. Unfortunately no detailed enemy records are available for the most precise figures to be supplied (except in the case of major raids), nor must the many nuisance raids of the period be ignored, when a handful of aircraft kept the greater part of the country under alert and occasionally bombed a place.

When the defensive turned towards industrial cities and ports on 14/15th November (with the attack on Coventry) the small-scale raiding of London commenced, interspersed with a few major attacks on the capital. From 14/15th November London was visited almost nightly and Southampton and Liverpool also came in for attention. On the 21/22nd about 50 tons of bombs were launched at London, and on the 18/19th about 16 tons of HE bombs and 26 land mines went down on Southampton.

In December the scale of this minor raiding rose to still heavier proportions, and several attacks were not so far short of major raids. Towns chiefly affected are given below together with the total tonnages dropped in minor raids during the month.

| | |
|-------------|-----------------------------|
| London | 271 metric tons of HE bombs |
| Birmingham | 147 |
| Portsmouth | 103 |
| Southampton | 66 |
| Sheffield | 82 |
| Plymouth | 21 |
| Bristol | 86 |

The major raid on Bristol of 2/3rd December was followed on the 5/6th by a sizeable minor raid (about 75 tons HE). The major raid on Sheffield was similarly followed up by minor raids of some weight, and Southampton, Birmingham and London were all raided more than once. German records which have proved reliable in other respects give the total weight of bombs launched against land and sea targets as 3482 metric tons, of which 2478 were launched in major attacks (Grossangriffe) against cities.

In January 1941, the following cities were chiefly affected by minor raiding and are given with the tonnage of bombs dropped during these lighter attacks.

| | |
|-----------|----------------------------|
| Liverpool | 35 metric tons of HE bombs |
| London | 390 |
| Bristol | 50 |
| Avonmouth | 84 |
| Swansea | 90 |
| Plymouth | 30 |
| Derby | 61 |

The total tonnage of bombs launched against all targets is shown as 2059 tons of HE of which 945 were dropped during major raids. 428 tons of the total were expended on 'nuisance' raids. No raids of importance occurred during February until the third phase of the German attack opened on the 19/20th.

This third phase opened with a succession of three attacks on Swansea, beginning on 19/20th February, and though there were no major raids during the month, several cities were affected by the smaller scale attacks. These were chiefly (with tonnage of bombs dropped):

| | |
|--------------|-----------------------------|
| London | 214 metric tons of HE bombs |
| Chatham | 66 |
| Swansea | 163 |
| Cardiff | 46 |
| Gt. Yarmouth | 30 |

In March, major raids were resumed on a fair scale, and the tendency, already manifest, to undertake a sequence of attacks on a place became more noticeable, and by the time the big night offensive terminated in May, there were numerous examples of this. The table below gives the most notable among them and includes major raids in the sequence:

| Place | Sequences of Attacks (Major Raid with Asterisk) | | | | |
|-------------------|---|--------------|-------------------------------|--|---|
| | January | February | March | April | May |
| Avonmouth | 3/4*, 4/5 | | | 3/4, 4/5, 9/10, 10/11 | |
| Barrow-in-Furness | | | | | 3/4, 4/5, 7/8, 9/10 |
| Birmingham | | | | 7/8, 9/10*, 10/11*, 11/12 | |
| Bristol | | | | 3/4, 4/5, 9/10, 11/12* | |
| Cardiff | | | 3/4, 4/5 | | |
| Clydeside | | | 13/14, 14/15 | | 5/6, 6/7 |
| Coventry | | | | 8/9, 10/11 | |
| Hull | | | 13/14, 15/16, 18/19* | | 3/4, 5/6, 7/8*, 8/9, 11/12 |
| Merseyside | | | 12/13*, 13/14, 14/15 | | 3/4*, 4/5, 5/6, 6/7, 7/8*, 30/31, 31/1 June |
| Plymouth | | | | 21/22*, 22/23*, 23/24*, 28/29*, 29/30* | 12/13, 15/16, 16/17 |
| Portsmouth | 9/10, 10/11* | | 4/5, 5/6, 9/10, 10/11*, 12/13 | 8/9, 9/10, 10/11, 11/12, 23/24, 26/27, 27/28 | |
| Southampton | | | 11/12, 12/13 | | |
| Swansea | | 19/20, 20/21 | | | 5/6, 6/7 |
| Tees-side | | | | | |
| Tyneside | | | | 7/8, 9/10* | 3/4, 5/6 |

It will be noted that Birmingham and Coventry apart, all the places attacked in sequences were ports, conforming to the German policy during this third phase of attempting to isolate the British Isles from the outside world by U-Boat attacks on shipping at sea and by air bombardment of ports.

From June, following the end of the main night offensive, until the end of 1941, all attacks with four exceptions¹ were of a minor character (i.e. it was intended by the enemy to drop less than 100 tons of bombs). During this period considerable attention was paid to shipping and the chief places to suffer were ports such as Liverpool, Southampton, Hull and Tyneside. Below is a list of the most noteworthy raids (excluding the four major raids already referred to) during which key points were damaged.

| Place | June | July | Aug | Sep | Oct | Nov | Dec |
|--------------|-----------------|---------------------------|-----------------|------------------|---------------------------|-------------------|-------|
| Aberdeen | | | 5/6, 7/8 | | | | |
| Birmingham | 11/12 | 8/9 | 12/12 | | | | |
| Chatham | 13/14 | | | | | | |
| Derby | | 8/9 | | | | | |
| Gt. Yarmouth | | 8/9 | 7/8 | | | | |
| Grimsby | | | | | | | 7/8 |
| Hull | 28/29 | 10/11, 14/15, 22/23 | 17/18 | 20/21 | 12/13 | | |
| Ipswich | | | | | 11/12 | | |
| London | | 27/28 | | | | | |
| Manchester | 1/2 | | | | 12/13 | | |
| Merseyside | 24/25 | | | | 12/13, 20/21, 22/23 | 1/2 | |
| Plymouth | | 4/5, 8/9 | | | | | 17/18 |
| Portsmouth | 11/12, 13/14 | | | | | | |
| Southampton | 25/26 | 7/8 | | 20/21 | | | |
| Sunderland | | | | 11/12 | | 7/8 | 20/21 |
| Swansea | | | | | | 28/29 | |
| Tees-side | | | 18/19, 19/20 | 2/3 | 21/22 | 3/4, 7/8, 9/10 | |
| Tyneside | | | | 1/2, 30/1 Oct | 2/3, 21/22 | | |

Note on Night Attack of Airfields

From 1st June – 31st December 1940, night attacks on airfields numbered 255, of which 190 were between 1st October and 31st December.

From 1st January – 31st June 1941, night attacks on airfields number 189, between 31st June and 31st December 1941, night attacks on airfields numbered 38. Of all airfields attacked during this year, 144 were situated east of a line from Selsey Bill to John o'Groats.

Note: figures of tonnages dropped during minor raids are approximate but are as accurate as evidence available can make them.

¹ 16/17th May Birmingham, 4/5th June Birmingham, 21/22nd June Southampton, 17/18th July Hull.

GERMAN LONG RANGE BOMBER STRENGTHIN THE WEST

(Assessed at the opening stage of each phase of the night battle)

| | | Establishment | Strength | Serviceability |
|---------------------|----------------|---------------|----------|----------------|
| 7 th | September 1940 | 1504 | 1241 | 787 |
| 16 th | November 1940 | 1687 | 1333 | 709 |
| @ 1 st | March 1941 | 1867 | 1443 | 781 |
| @@ 21 st | June 1941 | 261 | 213 | 136 |

@ includes Ergänzung St.

@@ excludes Ergänzung St.

NIGHT INTERCEPTION

I have decided to make KENLEY a test Sector for night interception and to supply it with all possible facilities in order that the system described below or some modification thereof, may be generally established as soon as possible.

2. The basic principle is that one searchlight per section (approximately one in six) shall be equipped with the GL set or some other radio equipment which will enable the position of an aeroplane (including its height) to be determined.

3. The present difficulties in the way of night interception, even with AI, are that the tracks resulting from Observer Corps plots are extremely spasmodic and inaccurate. This is quite understandable, because enemy aircraft now generally fly at great altitudes and almost never within sight of the ground.

4. Most encouraging results have been obtained from the GL sets already installed in the Kenley Sector; they have proved more capable of maintaining continuous tracks than have the Observer Corps or even the RDF Stations on the South Coast, which are still suffering from the after-effects of bomb attacks.

5. The technique would be that the Sector Controller would make up his mind that such-and-such a raid offered a good opportunity for interception. He would give the order to concentrate on that raid and, thereafter, no searchlight would be permitted to expose on any other echo.

6. Even on the selected raid no searchlight other than the 'master' searchlights would be permitted to expose (with the exception later described).

7. The first master searchlight to pick up the echo would determine the height of the aircraft and at once pass it by direct land-line to sector Headquarters. The Sector Controller would thereupon transmit the enemy's height to the fighter on patrol.

8. The Sector Controller would then give vectors to his fighter to bring him in contact with the head of the enemy's track (which, incidentally, can be located by means of the GL more accurately and with less lag than is possible with Observer Corps sound plots).

9. On a clear night, therefore, the Controller's task is simply to direct his patrolling fighter so that it can see a single searchlight beam.

10. If the fighter pilot sees a single beam he will know that it is pointing at the target and, having been given the heights, he knows exactly where to look.

11. If he sees two beams converging he will know that two master beams have opened up and that the enemy is to be found at their point of convergence.

12. The subsidiary searchlights would be strictly prohibited from opening up in any circumstances except when they could see a target actually illuminated and held in the beam of another light. If the target were lost, even for a moment, the subsidiary searchlights must immediately douse.

13. The point which we must discover by experiment is how accurately the searchlight radio sets can give the height of the enemy. If this can be done with approximate exactitude the method, on a clear night, should enable any fighter to make an interception, whether fitted with AI or not.

14. When the fighter patrol is working above a continuous cloud floor, the Controller's vectors, supported by the position of a pool of light on the upper surface of the cloud, should enable a fighter fitted with AI to make interceptions on a good percentage of occasions.

15. It is, of course, necessary that the fighter shall be fitted with IFF of a type which will give indications to the searchlight's radio set; otherwise the fighter's track will constantly be confused with that of the bomber.

16. While this procedure was being carried out it would be quite possible to operate a second fighter over the sea from a RDF station; and, when some dexterity has been obtained by the Sector Controller, it will probably be possible to operate two land patrols in a Sector in addition to the sea patrol. This, however, is a refinement which must not be allowed to interfere with the original experiment.

17. There are indications that even the superior performance of the AI Mk. IV set will not result in a high proportion of interceptions by methods hitherto employed.

18. The special features which give promise that the above-described procedure will give better results than any system hitherto tried are:

(i) The height will be approximately known.

(ii) The fighter pilot will know that whenever he sees a searchlight beam it is pointing directly or almost directly at the target.

(iii) The tracking of the bombers' course on the Sector Operations Table will be very much improved.

19. Other refinements, such as the fitting of a Lorenz set to take advantage of the enemy's beams, may be later introduced, but I wish to avoid complicating the initial trials by any non-essential adjuncts.

(Sgd) H. C. T. DOWDING

Air Chief Marshal

Air Officer Commanding-in-Chief

Fighter Command, Royal Air Force

FC/S.21197

21.9.40

MEMORANDUM ON THE CONTROL OF NIGHT FIGHTERS AND INTERCEPTION TECHNIQUE

Every effort is being made to accelerate the provision of equipment to enable Sectors to operate their night fighters by the methods outlined in this memorandum, and by so doing to give pilots greater opportunity to destroy the enemy and greater security to return safely when their mission has been completed.

Provision of VHF Equipment

2. The following ground equipment is being provided and will be available at all Night Fighter Aerodromes and Sector Operations Rooms which control night fighter aircraft. This equipment is not at present available at all sectors and aerodromes, but steps are being taken to introduce the various items as speedily as possible.
3. At Night Fighter Aerodromes: Each Night Fighter Aerodrome is being designed to accommodate one or two night fighter squadrons. The aerodrome is to have a control room in which the arrival and departure of aircraft, the lighting of the aerodrome, the homing of aircraft, and the control of ZZ landings is to be centralised directly under the Aerodrome Control Officer.
4. The control room will be provided with three R/T cabins with suitable landlines to two homing tenders, a receiving station and to a high powered transmitting station. The homing tenders will be employed both for homing aircraft to the aerodrome and for controlling ZZ approaches. ZZ should be used on all occasions, in order to provide practice for pilots and ensure that the aerodrome lighting is used for the minimum period necessary when bringing pilots down.
5. The tenders will be equipped with receivers and aircraft transmitters, but for long range transmission it will be possible to couple one of these tenders with the high powered transmitting station at the aerodrome. One or both tenders may be used for the homing of aircraft operating homing wave length which will be the same frequency as that fitted in Channel 'A' of the aircraft operating from the aerodrome. In addition a listening watch will be kept in the Aerodrome Control Room on Command Guard Frequency and in case of emergency one of the tenders must be available to be coupled with the high powered transmitter in order to home aircraft from other aerodromes on Command Guard Frequency.
6. At the Sector Operations Room: Sector Operations Rooms are already equipped with four separate high powered transmitters and one fixed Sector Homing Station. Aircraft operating under the control of the Sector Controller will be controlled on Channel 'D'. Voice fixing will be used, and in consequence the Sector Fixing Stations as well as the Sector Controller will use the same frequency as that fitted in Channel 'D' of the aircraft. For reinforcing purposes each night fighter Squadron holds six Channel 'D' crystals of every Sector within 150 miles (See Operational Instruction No. 72).
7. Where Sectors control day fighters as well as night fighters the frequency fitted in Channel 'D' of the night fighters will be the same as the 'Pip Squeak' frequency in the day fighters. This is so that the Fixer Stations will not be required to change frequencies at dusk and dawn.
8. Certain Night Fighter Aerodromes such as Tangmere and Middle Wallop are also Sector stations, and will, therefore, be able to use the Sector's high powered transmitters, and the Sector homing station to replace one of the tenders provided for in para 4 above.
9. At the GCI: The GCI Controller will have at his disposal a VHF Tender with transmitter and receiver. These tenders have two channels and can operate on two different frequencies without changing crystals. Where a GCI Controller is required to control aircraft from different Sectors the crystals fitting in the two channels of the VHF tender will be the channel 'B' crystals

of the two Sectors which operate most frequently with that GCI Station. The GCI VHF tenders will also hold a Command Guard crystal and such other crystals as may be required for reinforcing purposes. Alternatively, the reinforcing aircraft may change frequency to one of the two frequencies on which the GCI VHF tender normally operates. These arrangements are detailed in Operational Instruction No. 72.

10. For accurate interception control of the GCI Controller requires a separate frequency to ensure that his instructions will not be interrupted by transmissions from elsewhere. The VHF tender at the GCI Station will therefore operate on the same frequency as Channel 'B' of the aircraft which are being controlled.

Description of Operational Procedure

Using aircraft equipped with AI and GCI Control (See Appendix 'A')

11. After taking off a pilot will operate on Channel 'D' and be controlled to his patrol line by the Sector Controller who will obtain occasional fixes of his position by means of voice fixing. Once on the patrol line the pilot should be able to maintain his position by an illuminated patrol line or by pre-determined patrol courses and times. Patrol courses and times should be worked out before taking off and should be noted on the recognition card carried by each pilot. (Instructions giving full details of the standard form of recognition card will be issued by this Headquarters).

12. The Sector Controller will feed aircraft one by one from the patrol line to the GCI by giving the pilots vectors which will bring them to a convenient point for the GCI Controller to take over and operate them on Channel 'B'. This feeding must be well practised so that the GCI Controller will not have to wait for another aircraft after putting one into AI contact with the enemy; nor should he have to bring an aircraft from a distant point before commencing an interception.

13. It cannot be over-emphasised that only by good systematic co-operation between the GCI Controller and the Sector Controller can real use be made of a number of fighters in the air. The period during which hostile raids are crossing the area of the GCI is limited, and between them the Sector Controller and the GCI Controller must endeavour to secure the maximum number of AI contacts during that period.

14. The GCI Controller is to put the fighter into AI contact with an incoming raid as quickly as possible. He will not attempt to control the fighter once good AI contact has been made. The AI operator is to "flash his weapon" at extreme AI range and directly contact is obtained he is to inform the pilot. Once good AI contract has been established the pilot will give "Tallyho" and switch on to separate inter-communication. Therefore the GCI Controller will take on another fighter which has in the meantime been fed to him by the Sector Controller. The rate of supply of fighters to the GCI Controller should be arranged so that one can be handed over, at a suitable feeding point, at least once every 10 minutes. It is anticipated that this rate of supply will be increased when the technique of GCI Control is improved with practice and when the team work between the Sector Controller, GCI Controller and the pilot has been perfected.

15. Once in AI contact the pilot will endeavour to close and engage the enemy. When he has achieved this or has lost contact he will return to Channel 'D' and call the Sector Controller. The Sector Controller will fix his position and instruct him whether to return to patrol line or to land. If the pilot is ordered back to the patrol line he will continue to be controlled and fixed by the Sector Controller as before until fed to the GCI.

16. If the pilot is ordered to land, the Sector Controller will give one vector designed to bring the aircraft within R/T range of the D/F homing station. The pilot will then use Channel 'A' to call the Aerodrome Control Officer and will be homed to the aerodrome and if necessary his landing will be assisted by means of ZZ or Lorenz.

17. If after an AI chase the pilot finds he is out of R/T range of the Sector station, or if for any reason he becomes lost, or if the weather at his aerodrome has deteriorated and he finds it necessary to proceed to some other aerodrome, the pilot will transfer to Channel 'C' which is fitted with the Command Guard Frequency, and will make use of the Inter Sector Emergency Control system (which was previously known as the Fighter Command Night Fighter Regional Control system – see para 29). In order to ensure that this system is always available for emergency use the Command Guard Frequency must not be used for other purposes without special permission as laid down in Operational Instruction No. 72, para 9.

Using GCI control with aircraft not fitted with AI

18. When aircraft without AI are being operated by a Sector in conjunction with a GCI the procedure to be adopted will in principle be similar to that described in paras 11-17 above. A major difference will arise, however, in that the GCI Controller will be required to control the fighter until visual contact has been obtained or until the enemy bomber is out of range or enters an artillery zone. It will therefore be found that each fighter remains under the control of the GCI Controller for a far longer period than in the case of the fighter equipped with AI.

19. Aircraft without AI require more illumination in one form or another in order to obtain an interception. Consequently they will either depend on co-operation with searchlights, or searchlights and GLs, or on conditions of bright moonlight to make final visual contact with the enemy.

20. In view of the above paragraphs it will be appreciated that the task of feeding the GCI will be neither so complicated nor so important, and Sector Controllers may consider it more profitable to allot two fighters to remain under the GCI control and to employ the remainder of his fighters on other means of interception such as GL if available. If this is done the GCI Controller should endeavour to control these two fighters on interceptions alternately in such a way that while one is carrying out an interception the other is returning to the point on the circumference of the radius of action of the GCI at which the enemy raids are entering the GCI area. It is not advisable that the GCI Controller should attempt to control two interceptions simultaneously.

GL Interceptions

21. Although the GCI is being produced in sufficient numbers to cover most of England there are certain areas where a GL layout is also available for interceptions. An interception by GLs is controlled by the Sector Controller from the Sector Operations Room. As the fighter approaches the enemy aircraft frequent D/F fixes will be required in order to obtain an accurate picture of the fighter's track. The fighter pilot will be controlled on Channel 'D' and fixed by voice fixing.

22. It must be appreciated that with GL interceptions the channel on which the interception is conducted will normally be the same as the channel used for maintaining aircraft on patrol. This is because fixing is required both for interception purposes and for maintaining the aircraft on patrol. The number of fighters that can be employed on GL interceptions is therefore seriously

restricted in any one Sector which has at its disposal only a single fixer layout. It is therefore most desirable that GL interceptions should be conducted from a different operations room other than that by which aircraft are being fed to a GCI.

Interceptions by fighters on patrol with the aid of searchlights

23. Steps are being taken to improve the control of searchlights in order to ensure that not more than three clusters expose at any one time on a raid and that the searchlights do not attempt to illuminate enemy aircraft which are converging or flying close to one another. If these steps prove successful, it is hoped that the confusion which has handicapped searchlight interceptions so much in the past will be avoided. Detailed instructions on the control of searchlights and on the co-operation of searchlights with fighters will be issued in the near future. In addition searchlights controlled by the SLC apparatus are about to be introduced in quantity and it is expected that searchlight cluster intersections will then give much more frequent illuminations.

24. When the approved system of searchlight control is in operation, Sector Controllers will be required to maintain fighters flying on patrol lines across the path of approach of the enemy. Single engined night fighters without AI are the most suitable type to use for this purpose. These fighters will be directed to their patrol lines and their positions fixed from time to time by the Sector Controller on Channel 'D'. Since this method of interception is likely to prove successful only in clear weather when the searchlights are effective, it is assumed that it will usually be possible to mark patrol lines by means of flares or stationary searchlights. The use of stationary searchlights for marking patrol lines should be restricted and only adopted when flares cannot be used for the purpose.

25. Fighters on patrol should not be required to maintain position rigidly along their patrol line which if clearly marked will be avoided by enemy aircraft they should endeavour to search either side of the line returning from time to time to pin-point their position. They should take every opportunity to investigate and follow any intersection of clusters which they see, and report to the Sector Controller so that he can fix the position of the fighter and identify precisely the raid on which the searchlights are being exposed. If a raid becomes illuminated the Sector Controller will be informed by the SCO and will immediately direct one of the fighters from the patrol line to the position of the illuminated target.

26. Night Fighters employed solely for interception with the aid of searchlights will not require the GCI frequency in Channel 'B'. On the other hand it may be necessary to provide facilities for such fighters to patrol and to be controlled by adjacent Sectors and in order to enable this to be done the operational and fixer frequency (Channel 'D' crystal) of the adjacent Sector will be used in Channel 'B'. If fighters are ordered on a patrol line in an adjacent sector it is preferable that they should come under the control of the Sector Controller of the adjacent Sector concerned in order that they can take full advantage of the searchlight organisation with which they are operating.

Lorenz Equipment and AI Beacons

27. No mention has been made in the above paragraphs of the use of Lorenz Equipment and AI Beacons. These aids to homing and blind approaches are being installed at night fighter aerodromes, and should provide additional aid to pilots returning from patrol. The provision of Lorenz and AI Beacons will not, however, alter the system of R/T Control outlined in the above paragraphs.

Inter-Sector Emergency Control System

28. All Night Fighter Aerodromes will eventually be required to keep a listening watch on Command Guard Frequency throughout the hours of darkness. This watch will be kept on receiver, coupled with a high powered transmitter, in the Control Room at the Night Fighter Aerodrome. The aerodrome Control Officer must be prepared at all times to make available one D/F homing tender coupled to a high powered transmitter and operating on Command Guard Frequency, in order to home aircraft from other Stations without delay.

29. It may happen that an aircraft which has been homed on the inter-sector control system may not require to land but to pass to another Night Fighter Aerodrome. For this purpose each aerodrome control room is to have a chart giving the course and call sign of every other Night Fighter Aerodrome within a 150 mile radius.

30. On the back of the recognition cards carried by all night fighter pilots (see note at end of para 11) will be a list of all Night Fighter Aerodromes giving their call signs and any details of lighting which may be useful to the pilot. On becoming lost aircraft will go on to Channel 'C' and the pilot will call the Night Fighter Aerodrome which he judges to be nearest to him. It is not anticipated that a pilot will be so far afield that he will not be able to judge to some extent which the nearest Night Fighter Aerodrome will be. In the worst event he may have to call two or three aerodromes before receiving a reply.

31. Certain Regional Control Aerodromes outside Fighter Command are also being linked up with the Inter-Sector Emergency Control System and these will be equipped with homing facilities on Command Guard wave length in a similar manner to Night Fighter Aerodromes.

32. If a pilot requires to land at a Night Fighter Aerodrome to which he has been homed on the Inter Sector Emergency Control System, the Aerodrome Control Officer using Command Guard Frequency will give the necessary permission and will provide ZZ assistance.

From: Headquarters, Fighter Command.

To: Headquarters, No. 9 Group
Headquarters, No.10 Group
Headquarters, No.11 Group
Headquarters, No.12 Group
Headquarters, No.13 Group

Headquarters, No. 14 Group (for, information).
Officer Commanding, Controllers Training Unit

Date: 9th September 1941

Ref: FC/S.19398/Ops.3(a)

Night Fighter Control – Reinforcement

The question of Inter-Sector and inter-Group reinforcement has recently been under discussion and it has been decided that all reinforcing aircraft should now be fitted with a VHF set tuned to the frequencies of the GCI and Sector Station to be reinforced, and that all other types of reinforcement from the R/T point of view should be abolished.

2. The future policy is to fit all twin-engine aircraft with two VHF sets, and steps to implement this are already being taken. Aircraft in Nos. 25, 604, 29 and 219 Squadrons are being modified to take a second TR 1133 set in that order of priority. The remaining Squadrons will be fitted as soon as the necessary equipment is available.

3. In the meantime until the programme in para 2 has been fulfilled reinforcement will be carried out either by:

- (a) having an aircraft standing by with a set tuned into the necessary frequencies.
- (b) having a spare set ready with the required frequencies.

(a) entails locking up an aircraft for the night against the possibility of having to carry out a reinforcement, and (b) means a delay while the sets are being changed. Of these alternatives the second is to be preferred although it is dependent on the availability of spare sets.

4. The attached Appendix is a provisional list suggesting the Sectors and GCI Stations which Night Fighter Squadrons should be ready to reinforce. It will be noted that this Appendix has been made to conform with the present dispositions of Squadrons and their affiliated GCI and Sector Stations, and on the assumption that twin VHF sets will be available. Groups are invited to comment on the suitability of the arrangements proposed in this Appendix and offer such suggestions as they may wish for changing the allocations made in it. As and when new Squadrons form and new GCI Stations open it will of course be necessary to revise the list.

5. In view of the formation of new night fighter squadrons at most of the Flank Sectors the need for reinforcement as detailed in Fighter Command letter FC/S.22515/Ops.3 dated 14th May 1941, receive instructions from you in the light of paragraphs 1-3 above.

Air Marshal
Air Officer Commanding-in-Chief
Fighter Command, Royal Air Force

APPENDIX 'A' TO FC/S.19398/Ops.3(a) 9th September, 1941

| Group | Squadron | Existing | | Reinforcing Sectors and GCI Stations | | | |
|-------|----------|----------------|---------------|--------------------------------------|--------------|-----------------|-------------------|
| | | Sector Station | GCI Station | 'A' Sector | GCI | 'B' Sector | GCI |
| 9 | 68 | Atcham | Hack Green | Valley | Trewan Sands | Honiley | Comberton |
| | 456 | Valley | Trewan Sands | Atcham | Hack Green | Speke | Barrow-in-Furness |
| 10 | 604 | Middle Wallop | Sopley | Exeter | Exminster | Tangmere | Durrington |
| | 307 | Exeter | Exminster | Portreath | Treleaver | Colerne | Huntspill |
| | 600 | Portreath | Treaver | Exeter | Exminster | Fairwood Common | Ripperston |
| | 600 | Colerne | Huntspill | Fairwood Common | Ripperston | Honiley | Comberton |
| 11 | 85 | North Weald | Waldringfield | Coltishall | Neatishead | Biggin Hill | Willesborough |
| | 29 | Biggin Hill | Willesborough | Tangmere | Durrington | Kenley | Wartling |
| | 219 | Tangmere | Durrington | Kenley | Wartling | Middle Wallop | Sopley |
| 12 | 25 | Wittering | Langtoft | Digby | Orby | Coltishall | Neatishead |
| | 255 | Coltishall | Neatishead | Wittering | Langtoft | North Weald | Waldringfield |
| 13 | 141 | Ayr | St. Quivex | Turnhouse | Dirleton | Ouston | Northstead |
| | 406 | Ouston | Northstead | Turnhouse | Dirleton | Catterick | Middlesborough |

Night Fighter Control Reinforcement

(FC/S.25908/Ops.3(a) 24 October 1941

| Group | Squadron | Existing | | Reinforcing Sectors and GCI Stations | | | |
|-------|----------|----------------|---------------------|--------------------------------------|-------------------|-----------------|-------------------|
| | | Sector Station | GCI Station | 'A' Sector | GCI | 'B' Sector | GCI |
| 9 | 68 | Honiley | Comberton | Valley | Trewan Sands | Atcham | Hack Green |
| | 456 | Valley | Trewan Sands | Atcham | Hack Green | Speke | Barrow-in-Furness |
| 10 | 604 | Middle Wallop | Sopley | Colerne | Cricklade | Tangmere | Durrington |
| | 307 | Exeter | Exminster | | (Plymouth Wrafton | Colerne | Huntspill |
| | 600 | Portreath | (Treleaver Scillies | Colerne ('A' Flt) | | Fairwood Common | Ripperston |
| | | | | Exeter ('B' Flt) | | | |
| 11 | 85 | North Weald | Waldringfield | Coltishall | Neatishead | Biggin Hill | Willesborough |
| | 29 | Biggin Hill | Willesborough | Tangmere | Durrington | Kenley | Wartling |
| | 219 | Tangmere | Durrington | Kenley | Wartling | Middle Wallop | Sopley |
| 12 | 25 | Wittering | Langtoft | Digby | Orby | Kirton | Hampston Hill |
| | 225 | Coltishall | Neatishead | Wittering | Langtoft | North Weald | Waldringfield |
| | 409 | Digby | Orby | Kirton | Hampston Hill | Coltishall | Neatishead |
| 13 | 141 | Ayr | St. Quivex | Turnhouse | Dirleton | Custon | Northstead |
| | 406 | Ouston | Northstead | Turnhouse | Dirleton | Catterick | Middlesborough |

SYSTEM OF COMMUNICATIONS FOR CONTROL OF NIGHT FIGHTERS

The allocation of the 4 channels of the TR 1133A and B sets fitted to night flying aircraft will be standardised throughout the Command as follows:

Channel 'A' – Local Homing and ZZ landing – Ops 1

Channel 'B' – GCI Interception control – Ops 2

Channel 'C' – Command Guard

Channel 'D' – Sector Control and voice fixing – Ops 3 (Fixer)

2. Normally the four frequency channels of the R/T sets fitted in night fighter aircraft will be set up to conform with the above allocation but in certain circumstances it will be necessary for special arrangements to be made. Those circumstances will arise when aircraft from one Sector are required to reinforce another Sector to be:

- (a) Under the GCI control of the reinforced sector.
- (b) Under the Sector control of the reinforced sector.
- (c) Under both sector and GCI control of the reinforced sector.

3. To meet the above conditions sufficient warning will normally be allowed to enable aircraft R/T sets to be re-tuned to the appropriate frequency of the Sector being reinforced. If the requirement is limited to either (a) or (b) above, the normal Sector control frequency or GCI frequency, as appropriate, of the Sector being reinforced.

If, on the other hand, aircraft are required for reinforcing purposes as stated in requirement (c) above then the normal Channel 'D' frequency of the aircraft will be replaced by the Sector control frequency of the Sector to be reinforced and the normal Channel "B" frequency by the GCI frequency of the Sector to be reinforced.

4. In an emergency, where prior warning is not possible the Command Guard may be used in the first reinforcing aircraft under the control of either the Sector or GCI Station concerned, but in the case of subsequent aircraft the aircraft sets themselves must be re-tuned. It will be appreciated that under these conditions the safety facilities provided by the Command Guard organisation will be restricted to a certain extent, and any pilots and ground stations employing the Command Guard for operational purpose must be warned to cease communication on this frequency should they hear an aircraft calling for assistance. Prior permission for the use of the Command Guard must invariably be obtained from the Group Controller and will in turn inform the Command Night Operations Staff Officer of the circumstances resulting in the necessary use of the Command Guard. This is essential so that the Command Night Operations Staff Officer can inform other Groups that the Command Guard is already in use temporarily for operational purposes and is not, therefore, available for further such use. For obvious reasons of safety it is emphasised that the Command Guard may only be used for operational purposes as an emergency measure where the necessary delay in effecting the change of crystals, etc, in the aircraft cannot be accepted.

5. To obviate any possibility of confusion in the allocation of Sector VHF frequencies to channels a frequency allocation list will be despatched to all Groups and Sectors giving the frequencies of each Sector and GCI station and the appropriate channel to which they are allotted for day and night use. This allocation list is to be held readily available by all Sector Controllers and Group and Sector Signals Officers.

6. Safety Organisation

A safety organisation is being set up whereby Bomber Command Regional Stations and other selected night flying aerodromes are being equipped with VHF R/T and D/F. In addition the under-mentioned Fighter Stations will keep watch on Command Guard during blackout periods:

| | | |
|----------|-----------------|--------|
| Tangmere | Fairwood Common | |
| Manston | Honily | |
| Hunsden | Acklington | Exeter |

7. The primary purpose of the guard Stations referred to in para 6 is to provide a network for the assistance of aircraft which have lost touch with their home stations and to direct them so that they can regain touch. Guard stations will however be prepared to provide homing and landing facilities for aircraft unable to regain their base.

8. The layout of guard stations detailed in para 6 may be adjusted as the full regional aerodrome organisation develops. As a further measure, additional stations may be required to set watch on the Command Guard frequency on instructions being issued by a Group Controller.

9. Crystal Distribution and Method of Setting up Aircraft R/T Sets on other Sector Frequencies

Arrangements are being made forthwith for the distribution of six crystals of the Channel 'B' and Channel 'D' frequencies of each Sector to all other Sectors within a range of 150 miles. These crystals are to be dispersed among suitable store huts on the aerodrome but must be readily available and clearly labelled with the name and Channel allocation of the Sector to which they are allotted. Immediately one or more aircraft are ordered to reinforce another Sector the Sector Controller will inform his Duty Signals Officer or the Duty Signals Officer at the aerodrome providing reinforcement as to which Sector is to be reinforced, the type of reinforcement required (para 2(a), (b) or (c)), and the number of aircraft reinforcing. The Duty Signals Officer at the Sector or reinforcing aerodrome will be responsible for the immediate issue of the appropriate crystals to the Squadron concerned and will inform the Squadron Signals NCO which channels require to be changed. The Squadron Signals NCO will be responsible for the immediate setting up of the required number of R/T aircraft sets of the new frequencies and the installation of these sets in the appropriate aircraft. If sufficient spare complete aircraft sets are available in the Squadron Signals workshop these will be set up, tuned and installed in the aircraft in turn. If spare sets are not available the R/T sets will be removed from the aircraft concerned, set up on the new frequencies and replaced in the aircraft as quickly as possible. During this period of changeover to new frequencies the Duty Signals Officer concerned will be kept closely informed of progress and will report to the Sector Controller as each aircraft is ready and available for reinforcement.

'STARFISH' OPERATIONS IN 1941

| | |
|-----------|--|
| February | 4 lit (3 times at Swansea, once at Cardiff), bombs drawn twice. |
| March | 17 lit, 16 drew bombs, notably 4 th Cardiff 104 HE, 16 th Bristol 74 HE |
| April | 17 lit, 11 drew fire 17 th near Portsmouth 170 HE bombs, 32 parachute mines 5000 lb. drawn. |
| May | 17 lit, 52 HE and several hundred IB drawn in all. Exceptional conditions of visibility causes average of bombs drawn by each lighting to be lower. |
| June | 5 lit, 6 HE 300-400 Explosive IB drawn in all. |
| July | 4 lit, 28 HE drawn: 7 th Southampton 12 HE bombs 8 th Birmingham 13 HE bombs 27 th London 3. Naval authorities lit two decoy fires near Hull on 17/18 th which drew 11 HE bombs. 22/23 rd 'Short Starfish' near Hull drew 3 HE bombs. |
| August | 1 lit near Hull. On Aug 31/Sep 1 st Naval authorities lit 'Starfish' near Hull when 8 HE bombs were drawn. 40 HE bombs fell within 2 miles of this site. |
| September | 1 lit near Sunderland. 2 Q Lightings near Swansea drew 5 HE bombs on the 18 th . 23 rd /24 th dummy factory near Swansea drew 4 HE bombs. |
| October | 3 'Short Starfish' lit, 1 strategic 'Starfish' near Cheddar – no bombs drawn. |
| November | No operations. |
| December | No operations. |

GCI

Progress in Installation

1941

January: Sopley, Waldringfield, Orby, Durrington, Willesborough, Ambury.

February:

March: Stowminster. Ambury re-sited at Exminster.

April: St. Quivox, Wartling, Hack Green, Langtoft.

May: Cumberton, Trewsan Sands.

June: Treleaven, Hampton Hill.

July: Huntspin, Neatishead, Ripperstone, Wrafton.

August:

September: Cricklade.

October: Dirleton, Newford, Hope Cove, Lunastea (Northern Ireland),
Bruinderry (Northern Ireland).

November:

December: Trimley Heath, Foreness.
Mobile GCI at Boarscroft moved to East Hill later.

'INTRUDER PATROLS':DECEMBER 1940 – DECEMBER 1941

| | | <u>No. of Night Operations</u> | <u>Claims</u> | <u>Airfields Bombed</u> | <u>Our Losses</u> |
|-------|-----------|------------------------------------|---------------|-----------------------------|-----------------------|
| 1940 | December | 3 | - | 13 | 1 |
| 1941 | January | 7 | - | 13 | 2 |
| | February | 6 | - | 3 | - |
| | March | 11 | 3 | 28 | 2 |
| | April | 16 | 2 | 17 | 1 |
| | May | 13 | 11 | 38 | - |
| | June | 14 | 1 | 19 | 1 |
| | July | 18 | - | 56 | - |
| | August | 17 | - | 37 | 2 |
| | September | 10 | 2 | 17 | 1 |
| | October | 12 | 1 | 23 | - |
| | November | 8 | - | 11 | - |
| | December | 10 | 1 | 15 | 1 |
| Total | | 145 | 21 | 290 | 10 |

THE ATTACK AND DEFENCE OF COASTWISE SHIPPING

NOVEMBER 1940 TO DECEMBER 1941

| 1. GAF DAYLIGHT OFFENSIVE SORTIES | | | | 2. ATTACKS BY GAF ON MERCHANT VESSELS WITHIN 40 MILES OF COAST AND AN RAF AERODROME | | | | | | | | 3. FC DAYLIGHT DEFENSIVE SORTIES | | | |
|--------------------------------------|--------|---------------------|-----------------------------|--|-------|-------------------|-------|---------------------|-------|--------|-------|-------------------------------------|---------|---------------------------|-----------------------------|
| MONTH | (a) | (b) | (c) | (a) | | (b) | | (c) | | (d) | | (e) | (a) | (b) | (c) |
| | Total | Against Shipping | Proportion of (b) to (a) | Vessel Sunk | | Vessel Damaged | | Vessel Undamaged | | Totals | | Proportion of Night Attacks | Total | To protect Shipping | Proportion of (b) to (a) |
| | | | | Day | Night | Day | Night | Day | Night | Day | Night | | | | |
| 1940 | | | | | | | | | | | | | | | |
| November | 5130 | 2350 | 46% | | 11 | | 17 | | 64 | 81 | 11 | 12% | 14154 | 402 | 3% |
| December | 2335 | 1155 | 49% | 4 | - | 11 | - | 18 | - | 33 | - | - | 6843 | 504 | 7% |
| 1941 | | | | | | | | | | | | | | | |
| January | 1375 | 950 | 69% | 2 | - | 9 | 1 | 20 | 4 | 31 | 5 | 14% | 3836 | 350 | 9% |
| February | 1603 | 985 | 61% | 7 | 3 | 13 | 2 | 21 | 11 | 41 | 16 | 28% | 5736 | 443 | 8% |
| March | 2075 | 1610 | 78% | 21 | 3 | 32 | 12 | 36 | 4 | 89 | 19 | 18% | 11672 | 2103 | 18% |
| April | 2490 | 1706 | 69% | 10 | 11 | 29 | 28 | 85 | 33 | 124 | 72 | 37% | 16102 | 7876 | 49% |
| May | 2290 | 1223 | 53% | 7 | 11 | 8 | 15 | 26 | 34 | 41 | 60 | 59% | 15812 | 8287 | 52% |
| June | 1125 | 789 | 70% | 3 | 20 | 12 | 25 | 25 | 34 | 40 | 79 | 66% | 12635 | 7331 | 58% |
| July | 665 | 495 | 74% | 1 | 7 | 1 | 20 | 9 | 41 | 11 | 68 | 86% | 9924 | 6475 | 65% |
| August | 625 | 380 | 61% | 1 | 2 | 6 | 14 | 10 | 18 | 17 | 34 | 67% | 8282 | 5685 | 69% |
| September | 561 | 390 | 70% | - | 6 | 2 | 17 | 14 | 24 | 16 | 47 | 75% | 6444 | 4416 | 69% |
| October | 464 | 280 | 60% | 1 | 4 | 2 | 9 | 5 | 20 | 8 | 33 | 80% | 6682 | 4072 | 61% |
| November | 555 | 334 | 60% | 1 | 8 | 5 | 17 | 17 | 13 | 23 | 38 | 62% | 6631 | 3952 | 60% |
| December | 443 | 244 | 55% | 1 | 2 | 1 | 11 | 4 | 14 | 6 | 27 | 82% | 5594 | 3591 | 64% |
| Totals | 21,736 | 12,891 | 59% | 147 | | 319 | | 604 | | 561 | 509 | 48% | 130,347 | 54,787 | 42% |

- NOTES:
- (a) Figures throughout Col. 1 are based on contemporary estimates.
 - (a) "Night" includes twilight throughout Col. 2.
 - (b) Col. 2(b) includes vessels structurally undamaged but in which crews suffered casualties.

NIGHT ATTACK ON COASTWISE SHIPPING

NOVEMBER 1940 TO DECEMBER 1941

Attacks by GAF on Merchant Vessels
Within 40 miles of Coast and RAF Airfield

| Month | Vessel Sunk | Vessel Damaged | Vessel Undamaged | Totals | Proportion of Night to Day attacks |
|------------|-------------|----------------|------------------|--------|------------------------------------|
| 1940 | | | | | |
| November @ | 11@ | 17@ | 64@ | 11 | 12% |
| December | - | - | - | - | - |
| 1941 | | | | | |
| January | - | 1 | 4 | 5 | 14% |
| February | 3 | 2 | 11 | 16 | 28% |
| March | 3 | 12 | 4 | 19 | 18% |
| April | 11 | 28 | 33 | 72 | 37% |
| May | 11 | 15 | 34 | 60 | 59% |
| June | 20 | 25 | 34 | 79 | 66% |
| July | 7 | 20 | 41 | 68 | 86% |
| August | 2 | 14 | 18 | 34 | 67% |
| September | 6 | 17 | 24 | 47 | 75% |
| October | 4 | 9 | 20 | 33 | 80% |
| November | 8 | 17 | 13 | 38 | 62% |
| December | 2 | 11 | 14 | 27 | 82% |

@ Figures for November represent no distinction between vessels sunk, damaged or undamaged by day and by night.

AWAS ESTIMATESWeight of Bombs Dropped on Great Britain by Night (HE and IB)

| | | |
|-------------|-----------------------|--------------------------------------|
| <u>1939</u> | <u>Metric Tonnage</u> | |
| November | 10 | |
| <u>1940</u> | | |
| January | 1 | |
| February | 2 | |
| March | 53 | |
| April | 84 | |
| May | 38 | |
| June | 859 | |
| July | 829 | |
| August | 3180 | |
| September | 6135 | |
| October | 5845 | |
| November | 5505 | |
| December | <u>3585</u> | |
| | <u>26126</u> | |
| <u>1941</u> | | |
| January | 2373 | |
| February | 1333 | |
| March | 4168 | |
| April | 5368 | |
| May | 4673 | |
| June | 1528 | |
| July | 1150 | |
| August | 308 | |
| September | 246.42 | |
| October | 387.6 | |
| November | 209.11 | |
| December | <u>142.21</u> | |
| | <u>20910.34</u> | = 47036.34 (Total for 1940 and 1941) |

Weight of Bombs Dropped on London by Night (HE and IB)

| | | |
|-----------------|----------------|-------------------------------------|
| <u>1940</u> | <u>Tonnage</u> | |
| August | 771.22 | |
| September | 1542.43 | |
| October | 2285.13 | |
| November | 1513.80 | |
| December | 275.80 | |
| | <u>6388.38</u> | |
| <u>1941</u> | | |
| January | 151.08 | |
| February | 59.89 | |
| March | 365.30 | |
| April | 845.35 | |
| May | 465.44 | |
| June | 7.05 | |
| | <u>27.25</u> | |
| | <u>1901.36</u> | = 8289.74 (Total for 1940 and 1941) |

COMPARATIVE FIGURES OF BOMBS DROPPED ON BRITISH TARGETS

| <u>Month and Year</u> | <u>AWAS Estimate</u> <u>(tonnes)</u> | <u>German Documents</u> <u>Figure</u> <u>(tonnes)</u> |
|-----------------------------|---|---|
| <u>1940</u> | | |
| August | 6770 | 2627 |
| September | 9975 | 9314 |
| October | 6910 | 9280 |
| November | 6115 | 6802 |
| December | 4110 | 3908 |
| <u>1941</u> | | |
| January | 2463 | 2472 |
| February | 1418 | 1028 |
| March | 4225 | 4665 |
| April | 5413 | 7500 |
| May | 4687 | 5334 |
| June | 1538 | 979 |
| July | 1151 | 1043 |
| August | 318 | 506 |
| September | 248 | 453 |
| October | 383 | 621 |
| <hr/> | | |
| TOTALS (excluding May 1941) | 51,037 | 51,198 |
| <hr/> | | |

ANALYSIS OF AN ATTACK ON LIVERPOOL12/13TH MARCH 1941

The attack on Liverpool of 12/13th March was typical of the many undertaken by the GAF during the third phase of the night offensive, and an analysis of it reveals the main characteristics of German operations during this period. It shows, among other things, the decline in importance of KGr100 as 'pathfinders' and the rise of the 111 KG26 in this role. It shows also the increasing loss of faith in blind-bombing devices. It was, moreover, one of a sequence of attacks on Merseyside which began on 1/2nd May and ended on 7/8th May.

Luftflotte 3 records say that on this occasion KGr100, though early over the target, dropped their bombs by normal navigational methods, and that no units used any radio aids except 111 KG26. They employed the 'Benito' procedure. It may have been hoped by the enemy that the 'Benito' transmissions, unlike the older established 'Knickebein', would escape decisive interference from our radio counter-measures, while it was known also that the effectiveness of beams decreased when they were directed towards targets as far away as Liverpool. In any event, the identification of a prominent coastal city like Liverpool need not have been difficult under reasonable weather conditions.

This raid on Liverpool had been preceded by a severe raid on Birmingham and followed by two big raids on Clydeside. It was thus significant that some movement of GAF bomber units occurred at the time, and that many operated from bases other than those they normally used. A concentration of aircraft at Amsterdam, Schipol and at Chateaudun had been noted by our intelligence, KG53 and KG3 were flying from bases in Holland, while elements of KG54 and KG55 were flying from Le Bourget and Caen, instead of from their usual airfields at Evreux, St. André, Chartres and Dreux. These movements were accounted for by the need for units to be well situated for attacking targets in the north and north-west, and by the still only partial serviceability of airfields in France, which had not entirely recovered from the effects of winter weather. Indeed, KG54 and KG55 participated in the attack on Liverpool after a spell of absence from operations which had begun in mid-January.

Weather. Although the moon was full, ground visibility was moderate, visibility in the air, however, was described as good.

Altogether 169 aircraft of Luftflotte 3 were scheduled to carry out the raid of which 146 are recorded as having reached their target. 170 aircraft, chiefly of Luftflotte 2 (possibly including a few machines of Luftflotte 5) comprised the remainder of the force, so that a total of 339 aircraft were engaged, not all of which bombed Liverpool, some having to break off for a variety of reasons. Unfortunately the records of Luftflotte 2 are not available so that it is impossible to obtain a complete picture of their activities. Enemy records show that a total of 303 metric tons of High Explosive bombs and 1982 containers of incendiaries, each container holding 36 1-kg bombs, were to be dropped on the city. Ministry of Home Security appreciations describe how in the dock areas near Birkenhead, 408 fires were started, while 126 fires broke out in Liverpool itself, nine of them of a major character, and 26 fires also occurred in Bootle. The number of fires thus bears out that a very great quantity of incendiaries were in fact dropped.

The first enemy aircraft arrived over Liverpool at 2040 hours, having come from the Somme area and from the Pas de Calais area. Absence of evidence makes it difficult to say whether they were machines of Luftflotte 2, but it seems likely, for the first machines of Luftflotte 3 were not over the objective until 2205 hours. These were aircraft of KGr 806, and they were to be followed by aircraft of KGr100 at 2209 and of 111 KG26 at 2211. The attack came in 9 different phases and lasted from 2040 for about 6 hours. These phases were:

Approx. 55 a/c at 1925-2230hrs from Somme/Dieppe area via Beachy Head/Isle of Wight

| | | | | | | |
|---|----|---|---|-----------|---|---|
| " | 35 | " | " | 1925-2130 | " | Channel Isles area via Start Point/St. Alban's Head |
| " | 30 | " | " | 1925-2200 | " | Cherbourg/Caen area via St. Albans's Head/ Selsey Bill |
| " | 80 | " | " | 1930-0300 | " | Holland/Denmark area via Southwold/Humber |
| " | 20 | " | " | 1930-2300 | " | Calais/Boulogne via East Kent |
| " | 13 | " | " | 1950-2200 | " | Fécamp area via Selsey Bill/Isle of Wight |
| " | 30 | " | " | 2020-0300 | " | Belgium area via Thames Estuary/East Coast |
| " | 35 | " | " | 2130-2350 | " | St. Brieue Bay area via Start Point/Plymouth |
| " | 5 | " | " | 2100 | " | Stavanger area via Kinnaird's Head |

The total of over 300 enemy aircraft counted by our raid intelligence thus accords well with the figure of 330+ machines actually despatched by the enemy to Liverpool and on other missions, including nuisance raids and mine laying in the area of Liverpool Bay and Anglesey. It will be seen that the attack converged on the country from various points south and east, and that no attempt was made to outflank the defences, and German records speak of strong AA fire over Bristol, Birmingham, London, Portsmouth, Southampton and the Thames Estuary, with strong and well-directed fire over Liverpool itself. Fighters were also said to have been encountered at the south coast and as far as Liverpool.

Fighter Command flew many night patrols against the raiders, the details being as follows:

| | | | |
|--------------|---------------|--------|----------------|
| No. 9 Group | 24 patrols of | 32 a/c | |
| No 10 Group | 19 | " | " 19 a/c |
| No. 11 Group | 46 | " | " 59 a/c |
| No. 12 Group | 48 | " | " 48 a/c |
| No. 13 Group | 15 | " | " 15 a/c |
| No. 14 Group | <u>5</u> | " | " <u>5</u> a/c |
| | <u>157</u> | | <u>178</u> |

The fighters inflicted casualties on the enemy, and apart from 3 aircraft claimed as damaged and 4 claimed as probably destroyed, they claimed the destruction of 4 enemy machines. Detailed claims were as follows:

| <u>Squadron Number</u> | <u>Group No.</u> | <u>Aircraft</u> | <u>Enemy Aircraft</u> | <u>Place</u> | <u>Claim</u> |
|------------------------|------------------|-----------------|-----------------------|--------------------------|--------------|
| 604 | 10 | Beaufighter | Ju.88 | Crashed at Warminster | Destroyed |
| 264 | 11 | Defiant | He.111 | Crashed in sea | " |
| 96 | 9 | Hurricane | He.111 | Down at Wychbold | " |
| 264 | 11 | Defiant | He.111 | Crashed over Beachy Head | " |
| 604 | 10 | Beaufighter | Type unknown | At sea | Prob. Dest. |
| 219 | 11 | Beaufighter | Ju.88 | " " | " " |
| 255 | 12 | Defiant | He.111 | Retford | " " |
| 151 | 12 | Hurricane | Ju.88 | At sea | " " |
| 604 | 10 | Beaufighter | Ju.88 | S. Coast | Damaged |
| 307 | 9 | Defiant | He.111 | Nr. Ruthin | " |
| 604 | 10 | Beaufighter | He.111 | S. Coast | " |

Comparison of claims between T/E AI and S/E Fighters:

| | <u>Destroyed</u> | <u>Prob. Destroyed</u> | <u>Damaged</u> | <u>Sorties</u> |
|-----|------------------|------------------------|----------------|----------------|
| AI | 1 | 2 | 2 | 38 |
| S/E | 3 | 2 | 1 | 140 |

The T/E AI fighters thus had a very successful night, although the full moon conditions enabled the single-engine squadrons also to operate effectively. Records of Luftflotte 3 show that seven of their aircraft had been lost, while two others crashed over Occupied Territory.¹ It is not certain whether they fell to fighter attack or to AA guns, nor is it certain how many aircraft in all were lost by the enemy.

AA guns in the Thames and Medway area (North and South) and in the Inner Artillery Zone were in action from about 1930-0400 hours while guns in the Mersey region were firing continuously from 2048 – 0305 hours. In addition the gun defences of most of the important midland cities and of important points on the south and south-west coasts were very active throughout the night. The results claimed were: two enemy aircraft destroyed over the Mersey, one destroyed over Birmingham, one probably destroyed and four damaged. The enemy reported that the defences over the target were good.

While the raid on Liverpool was in progress other German aircraft had been detailed to attack various airfields including Boscombe Down, Upavon, Tangmere, Upper Heyford, St. Athan, St. Eval and Exeter. Fighter Command records, however, show that Tangmere, Coltishall and St. Eval were the only ones actually subjected to bombing.

¹ 1 He.111 of 11/KG27. 2 He.111 of 1 and 11/KG55
2 Ju.88 of 11/KG76. 1 He.111 of 111/KG26
Crashed over Occupied Territory: 1 He.111 of 111/KG26 and 1 He.111 of 1/KG27

Meantime our own 'Intruders' were busy over Caen, Rosieres, Amiens-Glisy, Arras, Achiet, Cambrai, Lille and Norville. Six patrols were flown and bombs were dropped at some of these places.

The Birkenhead and Wallasey areas suffered most in this raid, and many industrial firms were affected by the loss of electricity supply. In Liverpool itself damage to house property was considerable and widespread and the problem of dealing with the numbers who had been rendered homeless was acute.

Twenty-seven Key Points were affected, 7 factories, 4 food, 2 oil and 3 raw material stores, 1 dock, 1 electricity power station, 2 gas works, 1 water-pumping station and a W/T station. The flour mill and the oil installation were severely damaged. Fires occurred in the Huskisson Dock and the Princes Dock, Liverpool, and in the Bidston Dock. The dock road adjacent to this latter was closed owing to fires and the 'Mammoth' floating crane was sunk. The enemy reported the presence of a convoy of about 40 ships in the River Mersey, and of ships in the docks at Birkenhead, this was no doubt an inducement to them to undertake a large-scale attack. The working of the Wirral Railway was affected and services were suspended. Owing to the presence of an unexploded bomb, both lines between Seaforth and Waterloo LMS Stations on the Liverpool-Southport branch were closed for 2 days.

Considering the weight of the raids, Ministry of Home Security sources did not regard its effects as in any sense decisive, though the use of parachute mines in great numbers caused extensive damage to buildings and fire bombs also wrought great damage.

FIGHTER COMMAND:ORDER OF BATTLE OF NIGHT FIGHTERS(At Opening of Main Phases of Enemy Night Offensive)7th September 1940

No. 10 Group

| <u>Squadron</u> | <u>Sector</u> | <u>Airfield</u> | <u>Type</u> |
|-----------------|---------------|-----------------|-------------|
| No. 87 (B Flt) | Filton | Bibury | Hurricane |
| No. 604 | Middle Wallop | Middle Wallop | Blenheim |

No. 11 Group

| | | | |
|-----------------|-------------|-------------|----------|
| No. 141 (B Flt) | | Biggin Hill | Defiant |
| No. 25 (A Flt) | Debden | Martlesham | Blenheim |
| No. 25 (B Flt) | North Weald | North Weald | Blenheim |
| No. 600 | Hornchurch | Hornchurch | Blenheim |

No. 12 Group

| | | | |
|---------|-------------------|-------------------|----------|
| No. 23 | Wittering | Wittering | Blenheim |
| No. 29 | Digby | Digby | Blenheim |
| No. 264 | Kirton-in-Lindsay | Kirton-in-Lindsay | Defiant |

No. 13 Group

| | | | |
|-----------------|-----------|-----------|----------|
| No. 219 | Catterick | Catterick | Blenheim |
| No. 141 (A Flt) | Turnhouse | Turnhouse | Defiant |

Note: One section of FIU (Blenheim) stationed at Tangmere available for operations.14th November 1940

No. 10 Group

| <u>Squadron</u> | <u>Sector</u> | <u>Airfield</u> | <u>Type</u> |
|-----------------|---------------|-----------------|-----------------------------|
| No. 87 | Exeter | Exeter | Hurricane (1 Flt at Bibury) |
| No. 604 | Middle Wallop | Middle Wallop | Blenheim |

No. 11 Group

| | | | |
|---------|-------------|-----------|--|
| No. 23 | Tangmere | Ford | Blenheim |
| No. 219 | Kenley | Redhill | Beaufighter |
| No. 141 | Biggin Hill | Gravesend | Defiant |
| No. 85 | Biggin Hill | Gravesend | Hurricane (1 Flt at Kirton-in-Lindsay) |
| No. 264 | Hornchurch | Rochford | Defiant |

No. 12 Group

| | | | |
|---------|-------|-------|-------------------------------|
| No. 151 | Digby | Digby | Hurricane |
| No. 29 | Digby | Digby | Blenheim (1 Flt at Wittering) |

No. 13 Group

| | | | |
|---------|-----------|-----------|----------|
| No. 600 | Catterick | Catterick | Blenheim |
|---------|-----------|-----------|----------|

Note: Between 14th November, and 17th November, the flight of No. 85 Squadron at Gravesend moved to Debden.

Some aircraft of FIU stationed at Tangmere available for operations.

No. 307 (Defiant) Squadron forming at Jarby (IOM)

16th February 1941

No 9 Group

| <u>Squadron</u> | <u>Sector</u> | <u>Airfield</u> | <u>Type</u> |
|-----------------|---------------|-----------------|-------------|
| No. 96 | Speke | Cranage | Hurricane |
| No. 307 | Speke | Squires Gate | Defiant |

No. 10 Group

| | | | |
|---------|---------------|---------------|-------------|
| No. 87 | Filton | Charmy Down | Hurricane |
| No. 604 | Middle Wallop | Middle Wallop | Beaufighter |

No. 11 Group

| | | | |
|---------|-------------|-------------|-------------------|
| No. 219 | Tangmere | Tangmere | Beaufighter |
| No. 264 | Kenley | Biggin Hill | Defiant |
| No. 141 | Biggin Hill | Gravesend | Defiant |
| No. 85 | Debden | Debden | Hurricane/Defiant |

No. 12 Group

| | | | |
|---------|-------------------|-------------------|-----------------------------|
| No. 25 | Wittering | Wittering | Blenheim/Beaufighter |
| No. 151 | Wittering | Wittering | Hurricane/Defiant |
| No. 29 | Digby | Digby | Blenheim/Beaufighter |
| No. 255 | Kirton-in-Lindsay | Kirton-in-Lindsay | Defiant (1 Section only) |

No. 13 Group

| | | | |
|---------|-----------|-----------|-----------------------------|
| No. 600 | Catterick | Catterick | Blenheim (1 Sec at Drem) |
|---------|-----------|-----------|-----------------------------|

Note: Some aircraft of FIU (Beaufighter/Blenheim) at Tangmere available for operations.

No. 256 (Defiant) Squadron in training at Colerne, No. 68 (Blenheim) Squadron forming at Catterick.

No. 23 Squadron (Blenheim/Beaufighter/Havocs) stationed at Ford had begun to undertake 'Intruder' operations in December, 1940.

11th May 1941

No. 9 Group

| <u>Squadron</u> | <u>Sector</u> | <u>Airfield</u> | <u>Type</u> |
|-----------------|---------------|-----------------|----------------------|
| No. 96 | Speke | Cranage | Defiant/Hurricane |
| No. 256 | Speke | Squires Gate | Defiant/Hurricane |
| No. 68 | Turnhill | High Ercall | Blenheim/Beaufighter |

No. 10 Group

| | | | |
|---------|---------------|---------------|-------------|
| No. 600 | Colerne | Colerne | Beaufighter |
| No. 87 | Colerne | Charmy Down | Hurricane |
| No. 307 | Exeter | Exeter | Defiant |
| No. 604 | Middle Wallop | Middle Wallop | Beaufighter |

No. 11 Group

| <u>Squadron</u> | <u>Sector</u> | <u>Airfield</u> | <u>Type</u> |
|-----------------|---------------|-----------------|----------------------------------|
| No. 219 | Tangmere | Tangmere | Beaufighter |
| No. 264 | Biggin Hill | West Malling | Defiant (1 Flt at Nutt's Corner) |
| No. 29 | Biggin Hill | West Malling | Beaufighter |
| No. 85 | Debden | Hunsdon | Havoc |

No. 12 Group

| | | | |
|---------|-------------------|-------------------|-------------------|
| No. 25 | Wittering | Wittering | Beaufighter |
| No. 151 | Wittering | Wittering | Defiant |
| No. 255 | Kirton-in-Lindsay | Kirton-in-Lindsay | Defiant/Hurricane |

No. 13 Group

| | | | |
|---------|-----|-----|----------------------------------|
| No. 141 | Ayr | Ayr | Defiant (1 Flt at Acklington) |
|---------|-----|-----|----------------------------------|

Note: In addition some aircraft of FIU (Beaufighter) at Ford were available.

Aircraft of No. 93 (Aerial Mine-Laying) Squadron were operating from Middle Wallop.

No. 23 (Havoc) Squadron was engaged on 'Intruder'.

25th December 1941

No. 9 Group

| <u>Squadron</u> | <u>Sector</u> | <u>Airfield</u> | <u>Type</u> |
|-----------------|---------------|-----------------|--|
| No. 256 | Woodvale | Squires Gate | Defiant I & 4 Hurricanes I |
| No. 456 (RAAF) | Valley | Valley | Beaufighter II (1 Flt operational) |
| No. 96 | Atcham | Wrexham | Defiant I & 4 Hurricane IIc |
| No. 68 | Atcham | High Ercall | Beaufighter I |
| No.1456* | Honiley | Honiley | Havoc(Turbinlite) (Non-operational) |

No. 10 Group

| | | | |
|---------------------------|-------------------|-------------------|----------------------------------|
| No. 125 (Newfoundland) | Fairwood | Fairwood | Defiant I |
| No. 87 | Common Colerne | Common Colerne | Hurricane IIc (4 a/c in Sallies) |
| No.1454 Flt | Colerne | Colerne | Havoc (Turbinlite) |
| No. 600 | Portreath | Predannack | Beaufighter II |
| No.1457 Flt | Portreath | Predannack | Havoc (Turbinlite) |
| No. 307 (Polish) | Exeter | Exeter | Beaufighter II |
| No. 604 | Middle Wallop | Middle Wallop | Beaufighter I |
| No.1458 Flt | Middle Wallop | Middle Wallop | Havoc (Turbinlite) |

No. 11 Group

| <u>Squadron</u> | <u>Sector</u> | <u>Airfield</u> | <u>Type</u> |
|-----------------|---------------|-----------------|---------------------------------|
| No. 219 | Tangmere | Tangmere | Beaufighter I |
| No.1455 Flt | Tangmere | Tangmere | Havoc (Turbinlite) |
| No. 264 | Biggin Hill | West Malling | Defiant II |
| No. 29 | Biggin Hill | West Malling | Beaufighter I |
| No.1452 Flt | Biggin Hill | West Malling | Havoc (Turbinlite) |
| No.1451 Flt | North Weald | Hunsdon | Havoc (Turbinlite) |
| No. 85 | North Weald | Hunsdon | Havoc II |
| No. 418 (RCAF)* | Debden | Debden | Boston III (Non-operational) |
| No. 157* | Debden | Castle Camps | Mosquito (Non-operational) |

No. 12 Group

| | | | |
|----------------|------------|---------------|---|
| No. 255 | Coltishall | Coltishall | Beaufighter II |
| No. 25 | Wittering | Wittering | Beaufighter I |
| No. 141 | Wittering | Wittering | Defiant II (1 Flt at Coltishall, including 4 Hurricanes IIc) |
| No.1453 | Wittering | Wittering | Havoc (Turbinlite) |
| No. 409 (RCAF) | Digby | Coleby Grange | Beaufighter II |
| No.1459 | Kirton | Hibaldstow | Havoc (Turbinlite) |

No. 13 Group

| | | | |
|--------------|-----------|------------|---|
| No. 406 | Ouston | Acklington | Beaufighter II |
| No.1460 Flt* | Ouston | Acklington | Havoc (Turbinlite) (Non-operational) |
| No. 410 | Turnhouse | Drem | Defiant I (1 Flt at Ouston Beaufighter I) |
| No. 141 | Ayr | Ayr | Beaufighter I |

No. 14 Group

Nil

No. 82 Group (Northern Ireland)

| | | | |
|---------|--------------|--------------|---|
| No. 153 | Ballyhalbert | Ballyhalbert | Defiant I (re-equipping with Beaufighter I) |
|---------|--------------|--------------|---|

Notes: * Non-operational

Aircraft of FIU (Beaufighter etc) available for operations if required.

No. 23 (Havoc) Squadron engaged on 'Intruder'.

Hurricanes from various squadrons were flying by night with Havocs (Turbinlite).

Including No. 23 (Intruder) Squadron and squadrons which had formed but were not yet operational total number of night squadrons amounted to 25. The target earlier decided upon had therefore been reached. The 10 Havoc (Turbinlite) Flights were also available as planned.

FUNCTION OF NIGHT OPERATIONS STAFF AT
HEADQUARTERS, FIGHTER COMMAND

| | |
|----------------------------|---|
| Air Commodore (Ops 3) | (1) General policy of night operations and their future development. (2) Direction of current operations (through Staff Officer). (3) Direction of FIU Operations and trials. (4) Co-ordination of dispositions and requirements. |
| Group Captain (Ops 3) | (1) Study of enemy night operations. (2) Planning and organisation for offensive schemes and experimental operations. (3) Co-ordination of all methods of defence by night (including guns, searchlights and balloons). (4) Disposition of Night Squadrons. (5) Development and lay-out of methods for obtaining information regarding enemy movements. |
| Wing Commander (Ops 3a) | (1) Development of Night Interception technique. (2) Provision of night interception instruments. (3) Provision of trained specialist personnel in liaison with training branch. (4) Radio navigation policy, development and use. |
| Wing Commander (Ops 3b) | (1) Aerodromes and landing grounds. (2) Requirements and equipment for night flying. (3) Study of human factors effecting night efficiency. (4) Records and analysis of enemy bombing, interceptions and combats. (5) Meteorological requirements. |
| Flight Lieutenant (Ops 3c) | Development of special technical devices. |

FIGHTER COMMAND OPERATIONAL

INSTRUCTION NO. 66

(FC/S22042/Ops2 5th February 1941)

Tactical Control over AA, Guns, Searchlights and Balloons

1. The following principles are laid down for the exercise by Fighter Group Commanders of tactical control over AA guns, searchlights and Balloons in their Group areas. This tactical control is necessary in order to ensure that action by all forms of defence against enemy air attack are properly co-ordinated, and the principles have been agreed in consultation with the General Officer commanding-in-Chief, AA Command, and the Air Officer Commanding Balloon Command, as set out hereunder.

AA Guns

2. In addition to their responsibility for the control of AA fire against unseen targets, as laid down in Fighter Command Operation Instruction No. 50, Fighter Group Commanders may arrange at any time for any AA guns in their Group areas to withhold fire on enemy or unidentified aircraft if they consider the tactical or weather conditions make this action desirable. Such control should be given to the effect on public morale and the desirability of maintaining an offensive defence.

Searchlights

3. Fighter Group Commanders have complete tactical control over the operations of searchlights in their Group areas. This control includes the issue of the instructions on the operational procedure to be adopted by searchlights, provided that the terms of such instructions receive the prior approval of Fighter Command Headquarters.

Guns and Searchlights

4. (i) The exercise of tactical control within the above limits should be based on close co-operation with the AA formation commander concerned. The final responsibility for any resulting decision, however, will rest with the RAF Group Commander.
- (ii) Tactical control will not include authority to re-allocate any guns or searchlights, but Air Officers Commanding may submit their recommendations in this respect to these Headquarters.
- (iii) Copies of any policy instructions issued to AA defences within Group areas, as a result of this decentralisation of tactical control, should be forwarded to these Headquarters with a view to the necessary central co-ordination.
- (iv) Whilst local initiative is to be welcomed, and tactical control is decentralised to Groups, a certain community of principle is necessary throughout the defences as a whole, since frequent moves of unit demand a standardised training. This matter of principle must be settled between commands. Groups should therefore refer such matters to Command before taking action. They will be kept informed of policy by instructions and conferences.

Balloons

5. Fighter Group Commanders are authorised to close-haul by day or by night any balloon barrage or part of any barrage in their area to meet any emergency affecting seriously the safety or active operations of their fighter aircraft.

This over-riding fighter control for emergency should be used sparingly and should be exercised direct with the Barrage Control Officer concerned through the local Gun Operations Room.

All other applications for close-hauling balloons will be dealt with by Command Headquarters, vide Fighter Command Operation Instruction No. 51.

AA and Searchlight Training and Co-operation

6. Fighter Group Commanders will have no responsibility for the training of AA units.

Fighter Group Commanders are still responsible, however, for providing all possible air co-operation towards AA and searchlight training, and should arrange suitable local exercises for this purpose. It is intended to allot special AA co-operation units to each Fighter Group, expressly for this purpose but co-operation should be extended in every possible form.

FIGHTER COMMAND OPERATIONAL INSTRUCTION NO. 71

'Fighter Nights'

(FC/S.22178/Ops 3, 13th March 1941)

Intention

1. It is intended whenever large enemy concentrations attack any one of the targets named in Appendix 'A' to this Instruction, to provide when circumstances are favourable close fighter protection over the target area under attack.

Execution

2. The fighters will patrol over the target area to intercept and destroy any enemy aircraft sighted. They will not be directed to controlled to intercept specific raids.

3. When a heavy attack is being made or is considered likely to develop on any of the targets named, the appropriate Group Commander may at his discretion order "Fighter Night" patrols to be carried out over the target area.

4. This Operation will be ordered only when weather is favourable and when visibility and light are such that Sightings are likely to be made by the patrolling fighters.

5. Single engined fighters only will be used for these Operations to patrol over the target area in layers with a selected height interval between each aircraft. Decisions as to the height intervals to be employed and the duration of the patrols will rest with the Air Officer Commanding concerned. As many fighters as can be made available should be employed simultaneously over the target to the maximum number that can be effectively operated.

6. Whenever it is decided to order 'Fighter Night' Patrols, the Group concerned is to advise the Duty Air Commodore, Fighter Command, of the Zero hour at which patrols will be started and their duration. During the time patrols are over the target area no fighters other than those engaged in operations 'Fighter Nights' are to approach within twenty miles of the centre of the patrol area.

Procedure in Gun Defended Areas

7. When 'Fighter Night' patrols are employed over Gun Defended Areas, the guns will continue to fire at targets below the level of the lowest fighter patrol. This gunfire at lower level is intended:

- (i) To prevent enemy aircraft from operating below the fighter patrol.
- (ii) To induce low flying enemy aircraft to climb up into the zone of the fighters.
- (iii) To encourage the morale of the people in the target area who may otherwise misunderstand gun silence in the presence of hostile aircraft.

8. The Fighter Group concerned will in agreement with the appropriate AA formation order the maximum height to which guns may be permitted to fire. The height restriction so ordered will allow as a safety margin a gap of 2,000 feet between the level of the lowest fighter patrol and the maximum height to which the guns may fire.

9. In certain Gun Defended Areas, such as the London area, it will be necessary for the Fighter Group to arrange for Gun Silence or for height restriction on gun fire to be imposed along a selected lane by which the fighters enter and leave their patrol area.

APPENDIX 'A' TO FIGHTER COMMAND OPERATIONAL INSTRUCTION NO. 71

| | | | |
|-------------|--------|----------------|--------|
| LONDON | 805985 | DERBY | 814561 |
| SWANSEA | 110150 | HULL | 550500 |
| CARDIFF | 630980 | NOTTINGHAM | 030600 |
| BRISTOL | 030960 | SHEFFIELD | 850100 |
| GLOUCESTER | 280380 | GLASGOW | 090880 |
| PORTSMOUTH | 070200 | ROSYTH | 620500 |
| PLYMOUTH | 900770 | NEWCASTLE | 740840 |
| SOUTHAMPTON | 860320 | MIDDLESBOROUGH | 980400 |
| LIVERPOOL | 800100 | BELFAST | 340750 |
| MANCHESTER | 300180 | WOLVERHAMPTON | 370190 |
| COVENTRY | 790990 | BIRMINGHAM | 520070 |

FIGHTER COMMAND OPERATIONAL INSTRUCTION NO 72

R/T/ Control of Night Fighter Aircraft

(FC/S.19398/Ops. 3 13th March 1941)

Attention is drawn to the memorandum on Night Fighter organisation issued by this Headquarters under reference FC/S.22011/Ops. 3 dated 30th January 1941.

2. The object of this instruction is to bring into effect the details outlined in Appendix 'C' of the above mentioned memorandum and to introduce, in so far as our present equipment permits, standard organisation of all Night Fighter Squadrons in Fighter Command.

Use of R/T Frequencies by Night

3. The VHF channels in all night fighter aircraft are to be used for the following purposes, and are to be fitted with crystals of the corresponding frequencies.

Channel A - For local homing to the Night Fighter Aerodrome from which the fighters are operating and for ZZ landings (Sector Ops. 1 frequency).

Channel B - For control by the GCI operator (Sector Ops. 2 frequency).

Channel C - For emergency homing on Command Guard.

Channel D - For sector control and voice fixing (Sector Ops. 3 'fixer' frequency).

Where a GCI set is not yet available for any particular Squadron the crystal for sector control by another convenient sector may be used in Channel B. A more detailed explanation of the use of these channels is contained in the following paragraphs.

4. At the Night Fighter Aerodromes: The two D/F stations being supplied at Night Fighter Aerodromes will be used for homing aircraft to the aerodrome and for carrying out ZZ landings. These stations will come under the direct control of the Aerodrome Control Officer. The stations will normally operate on the same frequency as that fitted in Channel 'A' of the aircraft. A listening watch will, however, be kept at certain aerodromes as detailed in para. 9 of this Instruction on Command Guard frequency, and the Aerodrome Control Officer must be prepared to home aircraft from other aerodromes on this frequency using one of his D/F Stations.

5. Each Night Fighter Aerodrome will have two D/F Stations for homing purposes. These stations may consist of two mobile D/F tenders or one tender and a permanent homing station. Homing stations must be used for that purpose only (or for ZZ also if mobile) and will not be used as fixer stations also.

6. At the Sector Operations Room: The Sector Controller will use the main transmitting station and forward relays for controlling night fighters. Night fighters under the control of the Sector Controller will operate on Channel 'D'.

7. At night voice fixing will be used and the Fixer Stations will, therefore, have to listen out on the same frequency as that being used by the Sector Controller. Since this frequency will be the

same as that fitted in Channel 'D' of the aircraft and used for 'pip-squeak' in day fighters no change of frequency at DF Stations will be required at dusk and dawn.

8. At the GCI: VHF tender with two channels is supplied for the use of the GCI Controller. The GCI Controller will control night fighters on the frequency fitted in Channel 'B' of the aircraft. This will give the GCI Controller an independent frequency and so enable him to carry out his interceptions without interference. The second channel in the GCI Controller's tender may be used to operate night fighters from a second Sector in a similar manner.

Homing on Command Guard Frequencies

9. All night fighters are to have Command Guard Frequency fitted in Channel 'C' of the aircraft. Channel 'C' will, therefore, be used for emergency homing only and not for operational purposes, except as provided for in para. 17 of this Instruction. A listening watch on Command Guard frequency is to be introduced forthwith at the following Aerodromes:

| | | | | |
|----------|---------------|-----------|------------|------------|
| Cranage | Exeter | Tangmere | Coltishall | Catterick |
| Baginton | Charmy Down | Gravesend | Digby | Acklington |
| | Middle Wallop | Debden | | |
| | Pembrey | Abingdon | | |
| | | Manston | | |

The above detail of aerodromes on Command Guard listening watch is temporary only, pending the development of the full Regional scheme.

10. This listening watch will be kept from sunset to sunrise at all the above aerodromes irrespective of the local weather. It must be appreciated that even when the weather is not suitable for aircraft to operate from the aerodromes concerned the Regional Control system may be used for passing aircraft from one district to another.

11. When it is apparent that the weather covering the whole of the United Kingdom is such as to make the operation of night fighters impossible, Groups may consider it advisable to apply to Headquarters, Fighter Command, to close down on Command Guard. In this event the Duty Air Commodore at Headquarters, Fighter Command, must be satisfied that emergency homing will not be required during the night before giving the necessary permission.

12. The listening watch will be kept by an operator under the supervision of the Aerodrome Control Officer. The Aerodrome Control Officer will ensure that D/F station is standing by to open up on the Command Guard and to take over control of a high power transmitter if a homing is required.

13. On the back of their recognition cards all night fighter pilots are to write down a list of the aerodromes given in para. 9 above with their call signs and any details of lighting which may be useful. If a pilot becomes lost he will go into Channel 'C' and call the aerodrome which he judges is nearest to him. It is not anticipated that a pilot will be so far afield that he will be unable to judge to some extent which the nearest aerodrome is. In the worst event he may have to call two or three aerodromes before receiving a reply.

14. It is pointed out that the final night fighter Regional Control system when fully developed will be a larger organisation than that provided for in this Instruction, but cannot come into full operation until the necessary equipment and personnel are available.

Reinforcements of Night Fighters

15. Occasions may arise when it will be necessary to reinforce a sector with night fighters from another sector or another group. This may be occasioned by a heavy intensity of raids over a particular area with little or no enemy activity elsewhere. Alternatively the weather at the aerodrome in the sector where the enemy is operating may not be suitable to operate night fighters whereas the weather elsewhere is good. In either case it will be the duty of the Group Controller to provide reinforcing aircraft in the area where they are required. If these aircraft are available from within the Group, arrangements can be made direct by the Group Controller. If reinforcement is required from another group then the Group Controller is to communicate with the Duty Air Commodore at Headquarters, Fighter Command.

16. When aircraft from one sector are required to reinforce another sector or group the reinforcing aircraft may be required to operate:

- (a) Under the GCI control of the reinforced sector but not under the sector controller.
- (b) Under the sector controller of the reinforced sector but not under the GCI Controller.
- (c) Under both Sector and GCI Controller of the reinforced sector.

17. To meet the above conditions sufficient warning will normally be allowed to enable reinforcing aircraft to change crystals to the appropriate frequency of the sector being reinforced. If the reinforcement is limited to either (a) or (b) above, it will be sufficient to change the crystals in Channel 'B' of the reinforcing aircraft to the frequency of the GCI controller or of the Sector Controller, as appropriate, of the sector being reinforced.

18. If on the other hand aircraft are required for reinforcing purposes as in (c) above, then Channel 'D' frequency of the reinforcing aircraft will be replaced by the Sector Controller frequency of the sector being reinforced and the Channel 'B' of the reinforcing aircraft to the GCI frequency of the sector being reinforced. For this purpose arrangements are being made forthwith for the distribution of six crystals of the frequency of Channel 'B' and six crystals of the frequency Channel 'D' from each sector which operates night fighters to all other similar sectors within a range of 150 miles.

19. In an emergency where prior warning is not possible, the Command Guard frequency in Channel 'C' may be used in the first reinforcing aircraft under the control of either the sector or GCI of the station being reinforced. Subsequent aircraft will, however, have to fit the appropriate crystals before taking off to reinforce.

20. It is appreciated that when the Command Guard is used as an operational frequency as outlined in para. 19 above, the night fighter Regional Control organisation, now being introduced, will to some extent become restricted. The ground control and aircraft using this frequency for operational purposes must, therefore, be warned to cease communication should they hear aircraft in distress calling for assistance. Permission for the use of Command Guard Frequency for operational purposes is to be obtained from the Group Controller who will in turn inform the Duty Air Commodore at Headquarters, Fighter Command, of the circumstances resulting in the necessary use of Command Guard. Headquarters, Fighter Command will warn other Groups that Command Guard is being used for operational purposes so as to prevent any other Group from also trying to use this frequency for a similar purpose at the same time. For obvious reasons it is emphasised that the Command Guard Frequency is only to be used for operational purposes as

an emergency measure, and when the delay in changing crystals to the frequency of the sector being reinforced cannot be accepted.

21. When aircraft from one sector are required to reinforce another sector the Duty Signals Officer at the reinforcing sector will be responsible for communicating with the Night Fighter Aerodrome at which the reinforcing aircraft are located and for giving the necessary instructions. The organisation for the storing and immediate distribution of the necessary crystals is the responsibility of the Sector Signals Officer. The Squadron Signals Officer or NCO will be responsible for the immediate setting up of the requisite number of aircraft sets with the reinforcing crystals and for the installation of these sets in the aircraft.

FIGHTER COMMAND OPERATIONAL INSTRUCTION NO. 77

'Fighter Nights'

(FC/S.23725/Ops. 3 2nd May 1941)

During the past month considerable success has been achieved by 'Fighter Nights' patrols when conditions of moon and weather have been favourable. Under such conditions, fighters have been found capable of inflicting heavier losses on the enemy than AA fire during the same period. On the other hand, in conditions of darkness and low visibility, and in particular when the moon is below the horizon, it has been found that fighter pilots operating in 'Fighter Night' patrols seldom sight the enemy. In such circumstances it is clearly preferable to give complete freedom of action to the AA guns as, under these conditions, they have a better chance of bringing down enemy aircraft.

2. All previous Instructions issued concerning operations 'Fighter Nights' are hereby cancelled. The following revised Instructions are issued for the future conduct of Operations Fighter Nights.

Intention

3. It is intended, whenever a heavy and concentrated attack is made on a major objective in this country, and when conditions of light and weather are favourable, to employ close fighter protection over the area under attack.

4. 'Fighter Night' operations will be ordered only when:

(i) the moon is above the horizon;

(ii) visibility and light are such that Fighter patrols are likely to sight enemy aircraft;

(iii) the enemy attack is obviously concentrated on a clearly defined target which covers only a limited area.

Execution

5 The fighters will patrol over the actual target area to intercept and destroy any enemy aircraft sighted. They will not be directed or controlled to intercept specific raids.

6. When a heavy attack is being made or is considered likely to develop on an important concentrated objective, the Group Commander will at his discretion order 'Fighter Night' patrols to be carried out over the target area.

7. Single-engined fighters only will be used to patrol over the target area in layers, with a selected height interval between each aircraft. Decisions as to the height intervals to be employed and the duration of the patrols will rest with the Air Officer Commanding concerned. As many fighters as can be made available should be employed simultaneously over the target to the maximum number that can be effectively operated. It is considered that, whenever possible, at least 20 fighters should be employed simultaneously. It is preferable and more profitable to have one really strong patrol than several consecutive weak patrols.

8. Whenever it is decided to order 'Fighter Night' Patrols, the Group concerned is to advise the Duty Air Commodore, Fighter Command, of the Zero hour at which patrols will be started and their duration. During the time patrols are over the target area no fighters other than those engaged in operations 'Fighter Nights' are to approach within ten miles of the patrolled area.

Procedure in Gun Defended Areas

9. When 'Fighter Night' patrols are employed over Gun Defended Areas, the guns will continue to fire below the level of the lowest fighter patrol. This gunfire at lower level is intended:

- (i) to prevent enemy aircraft from operating below the fighter patrol;
- (ii) to induce low flying enemy aircraft to climb up into the zone of the fighters;
- (iii) to encourage the morale of the people in the target area, who may otherwise misunderstand gun silence in the presence of hostile aircraft.

10. The Fighter Group concerned will, in agreement with the appropriate AA formation, order the maximum height to which guns may be permitted to fire. The height restriction so ordered will allow, as a safety margin, a gap of 2,000 feet between the level of the lowest fighter patrol and the maximum height to which the guns may fire.

11. Searchlights inside the patrolled area will not expose and targets will not be engaged by them within the perimeter of the patrolled area. Searchlights outside the target area will engage enemy aircraft up to the limits of the patrolled area.

12. In certain Gun Defended Areas, such as the London area, it will be necessary for the Fighter Group to arrange for gun silence, or for height restriction on gunfire to be imposed along a selected lane by which fighters enter and leave their patrolled area.

FIGHTER COMMAND OPERATIONAL INSTRUCTION NO. 78

Free Balloon Barrage ('Albino')

(FC/S.22692/Ops. 2 3rd May 1941)

Intention

Special operational trials of the Free Balloon Barrage are to be carried out by No. 33 Balloon Group in the LIVERPOOL area, directed by HQ, Balloon Command and under the

operational control of HQ Fighter Command. These trials will be carried out when meteorological conditions are suitable and will consist of:

- (a) a preliminary release limited to 2000 units for practice purposes.
- (b) a full scale operation of up to 1000 units.

Technical Data

2. The original equipment has been modified and improved and the following performance is expected:

- (i) Free balloons should be controllable with accuracy between heights of 28000 ft. and 14500 ft. Adjustments to control height can be made during the process of release.
- (ii) Self-destruction should be ensured

- (a) after the expiration of a pre-determined period in flight.

- (b) if the balloon descends to a height of 12,000 feet after reaching its intended operational height.

Note: The above heights are all balloon heights; a parachute which opens on impact is suspended 2000 feet below the balloon. Aircraft should therefore be safe if they fly below 9000 feet except in the area of operation during the period of release, whilst balloons are still ascending after release.

Procedure for Releases

3. Releases will be effected simultaneously from No. 8 Balloon Centre, Fazackerley, Liverpool and No. 9 Balloon Centre, Warrington, over periods of up to four hours.

4. Releases will be limited to periods when, other conditions being suitable, the wind is from North West through North to N.N.E.

5. The practice release (up to 2000 units) will take place any night on or after 6th May, 1941. The full scale release may take place any night on or after 15th May, 1941.

Preliminary Daily Action

6. On and after 6th May, 1941, a special meteorological forecast will be issued to Headquarters Fighter and Balloon Commands at 0930 hours daily.

7. A preliminary decision to 'Stand-by for release that night' or to 'cancel release' will be made at Headquarters, Fighter Command.

8. If the decision is to 'Stand-by' this information will be passed without delay by Fighter Command to Headquarters, Balloon Command, and also to Fighter Groups, Air Ministry, Bomber, Coastal, Flying Training and Maintenance Commands, RANAS, Duty Air Commodore and other authorities concerned within Headquarters, Fighter Command.

9. In addition to this information, the authorities named will be advised of the 'prohibited area' in which friendly aircraft are prohibited from flying at any height because of the danger from balloons rising after release. Commands and Groups will realise that the balloons will drift downwind for a considerable distance after release and that in addition to this 'prohibited area', it will be dangerous for aircraft to fly to leeward of the point of release at heights in excess of 9000 feet.

10. If 'Stand-by' is ordered a further special meteorological forecast will be issued to headquarters Fighter and Balloon Commands at 1600 hours the same day. If conditions are regarded as favourable, 'Stand-by' will be confirmed to the authorities mentioned in para. 9: if conditions have become unfavourable the operation will be cancelled for the night and all concerned will be informed accordingly.

Orders for Release

11. The decision as to when releases are to take place will be taken by Headquarters, Fighter Command, based on the tactical situation. The executive order will be given by the Fighter Command staff concerned direct to Headquarters, Balloon Command.

12. Immediately release is ordered the authorities mentioned in para. 8 will be advised, as well as the Admiralty (Mines Dept.) War Office and Ministry of Home Security.

FIGHTER COMMAND OPERATIONAL INSTRUCTION NO. 84

Protection of Convoys Against Air Attack by Night

(FC/S.24310/Ops. 23rd July 1941)

1. The result of vigorous efforts by fighters in the protection of shipping by day and of improvements in the AA defence of the surface craft themselves has been to force the enemy to make a larger proportion of his attacks on shipping by night. These night attacks are quite frequently successful and are causing serious losses to shipping. It is necessary, therefore, to ensure that every available means for the defence of convoys at night is used to its fullest effect.

2. Experience has shown that fighter escort over convoys during hours of darkness is seldom successful in intercepting enemy aircraft, which as a rule make their attacks on the ships at low altitude. The presence of the fighters confuses the AA defences of the ships, which cannot easily distinguish between friends and enemy and are liable in consequence either to withhold their fire until too late or else to engage a friendly aircraft, and possibly give away the position of the convoy to the enemy.

3. It has therefore been decided that, except in special circumstances mentioned in para. 7 (v) below, fighter patrols are to be withdrawn from the vicinity of the convoys during periods of darkness, and the convoys left to rely on their own anti-aircraft fire and other devices for their defence.

4. Fighter Groups are to continue, however, to endeavour by every means practicable to intercept the enemy bomber on his way to or from the convoy area at night. It is recognised that catseye night fighters have little chance, except on clear and moonlight nights, of intercepting and engaging enemy aircraft out to sea. Under good conditions, however, and when guided by AA fire or under GCI control they have a fair prospect of making successful interceptions, and they should be so employed whenever conditions appear favourable.

5. Similarly, the use of AI night fighters for the interception of these anti-shipping raiders is to develop wherever experience proves that results are obtainable. Experience indicates that enemy bombers often approach the shipping areas at heights at which AI is still effective and may be engaged successfully by these means.

6. Control by GCI or CHL (fitted PPI) Stations out to seaward will, as they are developed, materially assist in the interception of anti-shipping raiders or minelayers.

7. In future, therefore, the policy for the use of fighters in the protection of shipping at night will be as follows:

(i) Dusk patrols and escorts are to remain in the close vicinity of the convoy until the light is insufficient:

(a) For the fighter escort to have a reasonable chance of intercepting a low flying aircraft, or

(b) For the surface escort and merchant seamen gunners to distinguish friendly and enemy aircraft.

(ii) The responsibility for deciding when to leave the convoy will rest with the pilot of the escorting aircraft. In this connection, it is important that no indication should be given to the enemy of the departure of the fighters, and no form of R/T communication or W/T (from ships) should be made. Local arrangements, if desired, may be made between Naval and Fighter Authorities to enable the fighter pilot to indicate by visual means to the escort vessel that he is leaving.

(iii) Escort, when applicable, will be resumed in the morning sufficiently early to ensure that the fighters are over the convoy by first light.

(iv) Fighters are to keep clear of convoys during hours of darkness, but subject to this will still continue to pursue the coastal raider by every means in their power.

(v) On bright moonlight nights the policy will remain the same, unless a particular Naval Authority considers that the convoy would be better protected by retaining the fighter escort, in which case special request to the Fighter Group concerned will be made.

(vi) In view of the foregoing, convoys will be permitted to open close range barrage fire at any aircraft heard approaching during the hours of darkness, without waiting to identify it. In addition, subject to current Admiralty and Air Ministry orders, ships in convoy will fly balloons by night with lethal devices cocked in the following areas:

(a) Between Cape Wrath and Rattray Head up to 1,500 feet.

(b) Between Rattray Head and the Thames (inclusive) up to 1,000 feet.

(vii) In view of (vi) and to avoid distracting the defences by noise and by RDF indications, fighters carrying out normal interceptions must be kept well away from the convoy. If it is found essential to pass over the convoy, they should do so at a height of not less than about 7,000 feet, unless actually engaged with an enemy aircraft.

8. It is important that Groups operating aircraft over the sea at night should keep themselves fully acquainted with the operations of the Coastal Group in the area concerned. Coastal Command policy is to keep their aircraft clear of convoys at night, but the block patrols carried out by them over the sea are, to some extent, adjusted each night to cover the most important convoys. Coastal aircraft may, therefore, be met in the neighbourhood of convoys at night, and fighters employed on interception should be given all available information as to their movements.

FIGHTER COMMAND OPERATIONAL INSTRUCTION NO. 90

Night Interception with Fighters aided by AA Searchlights

(FC/S.26110/Ops. 3 3rd November 1941)

COMPOSITION

This instruction is written in three parts as follows:

- Part I General
- “ II Instructions to Pilots
- “ III Control and Plotting Procedure

PART I – GENERAL

INFORMATION

1. New Layout

Orders have recently been given for a new deployment of AA Searchlights to confirm with conclusions reached from extensive trials held to evolve the technique of searchlight aided interceptions.

2. Co-operation

In future, it is intended that there shall be far closer co-operation at night between fighters and searchlights. To this end, single twin engined aircraft will be employed at night to reinforce the specially equipped night fighters who will work independently of searchlights, whilst under GCI or CHL control.

3. The System of Belts

The layout of searchlights has been altered from an even carpet of clusters at 10,400 yards spacing to a series of zones or belts consisting of single lights. In general, the object of the siting of these belts has been to ensure that an enemy aircraft flying to attack a target inland must first cross a belt where he will be engaged by fighters.

4. 'Indicator' Zone

To give the fighter sufficient indication that an enemy raider is approaching and will be engaged by searchlights, lights are spaced 10,000 yards apart in a belt approximately 12 miles deep. This is known as the 'Indicator' Zone. The searchlights in the zone will be of the 90 cm type and eventually will be equipped with SLC. (For details of SLC see Appendix 'A').

5. 'Killer' Belt

Contiguous to the 'Indicator' Zone is another belt known as the 'Killer' Belt. This belt is between 16 and 20 miles deep with searchlights disposed 6,000 yards apart. The majority of these searchlights will be of the 150 cm. type and eventually all will be equipped with SLC. The function of the lights in this belt is to illuminate the enemy aircraft selected for interception until it is shot down or passes out of the belt.

6. Fighter Boxes

Within the 'Killer' Belt are a number of fighters orbiting beacons. The beacons will take the form of a searchlight beam exposed vertically, the beacon being sited midway between the front and rear edge of the 'Killer' Belt. Both the 'Indicator' Zones and 'Killer' Belts are partitioned from front to rear to form 'boxes' 14 miles in width with the orbit beacon midway between the sides.

7. Assumptions

The dimensions of each 'box' i.e. 32 miles deep, 14 miles wide with the 'Indicator' Zone comprising the first 12 miles of its depth, were based originally on theoretical calculations and confirmed by practical tests. Given accurate illumination, and assuming that the fighter has a command of speed of not less than 20% over the enemy aircraft, the fighter should close with the enemy aircraft before it can pass out of the 'Killer' Belt.

8. Gun Defended Areas

Lights have been disposed in the Gun Defended Areas to harass enemy bombers within these areas; to act as indicators of incoming raiders in Coastal Gun Defended Areas; and when the occasion demands to take on the illumination of an enemy who is being hotly pursued by one of our fighters.

9. Extent of Chase by Fighter

Once the raider has left the 'Killer' Belt the fighter, unless in hot pursuit, should return to his orbit beacon to await a fresh indication or vector. It is not intended that the fighter, unless he has AI contact, shall go beyond the rear boundary of the 'Killer' Belt unless he is so close behind the enemy aircraft that decisive attack is imminent. Enemy aircraft which succeed in passing through the first 'Killer' Belt will provide targets for fighters in successive belts (similarly spaced), or for guns in the Gun Defended Areas.

10. Non Lighted Areas

Certain areas have perforce been left without searchlights because resources and topographical factors do not permit deployment everywhere.

INTENTION

11. To effect interceptions with fighters aided by AA Searchlights without interfering with night fighters operating independently of searchlights.

EXECUTION

See Parts II and III

PART II – INSTRUCTIONS TO PILOTS

12. Initiation of Action

On receipt of warning of the approach of hostile or unidentified aircraft action is initiated in the appropriate Sector Operations Room. There the raids to be engaged by searchlights will be selected. The rules governing the selection of raids are set out in Appendix 'B'.

13. Orbiting (Cancelled by Amendment June/1942)

Fighters will be sent up to orbit beacons on orders from the Sector Controller on warning of enemy approach. The fighter pilot will report to this parent Sector Controller when he is 'on orbit'. The fighter will carry out a left hand orbit of the beacon at approximately 5 miles radius from it. Normally one fighter will be assigned to each 'box'. The orbit beacon will be sited in the centre of the 'Killer' portion of the 'box'.

14. Use of Coloured Beacons

Each orbit beacon site will be provided with two searchlights side by side, one to act as the orbit beacon, the second will be provided with a coloured Screen. The coloured beacon will be exposed:

- (a) After the fighter has been sent up to orbit.
- (b) When the fighter is returning to his orbit point after a chase (para. 24).

In all cases it will be doused once the fighter has reported 'on orbit' or identified himself to the orbit searchlight detachment (para. 21). The orbit beacon will then be left exposed alone. Coloured beacons in adjoining 'boxes' will be of a different colour.

15. Preliminary Warning

A fighter on orbit who is likely to be assigned a raid will, by way of warning, be given the code word 'TRADE' by the Controller on VHF. The code word will be followed by the height of the raid as then known. The fighter will at once start to climb or lose height as befits the case till he is 2000 feet above the raid height. Add instructions for procedure when more than one fighter is orbiting.

16. Action by Fighter told to Intercept

When the Controller decides to assign to a certain fighter a raid selected for interception he will give the fighter the code word 'SMACK' meaning 'attack' followed by the height of the raid as known at that moment. On receipt of this code word the fighter will at once turn in towards the orbit and fly towards it as quickly as possible.

17. Beacons and Indicators or Pointers

The searchlight detachment manning the orbit beacon should now hear the fighter in close vicinity of the beam. They will receive the code word 'SMACK', wait 30 seconds and then depress the orbit beacon to an angle of 20 above the horizontal and on the bearing of the approaching raid. The fighter will follow the pointer and in the distance he should see one or more searchlights in the 'Indicator' Zone engaging (not necessarily illuminating) the enemy aircraft which has been selected for him. The orbit beacon will be doused at the end of one minute, or if one or more fighters are still orbiting it will be elevated to the vertical again to act as a beacon to the fighters still orbiting.

N.B. This system of making use of the orbit beacon as a pointer for one minute is a safeguard against a fighter leaving his orbit point in an attempt to effect an interception on a raider not intended for him.

18. Effecting Contact

The fighter will then fly towards the enemy aircraft by constantly directing his aircraft toward the intersection of the searchlight beams. Add procedure when fighter is equipped with AI.

Assuming that the fighter has a command of speed over the enemy aircraft of at least 20% the enemy aircraft will be overtaken before it passes out of the 'Killer' Belt, no matter how much the enemy alters course.

19. Illuminated Area round Target

For some time prior to being overtaken, the enemy aircraft should be steadily illuminated by the SLC controlled searchlights in the 'Killer' Belt. A number of beams, not usually more than six, will be exposed at one time and the area of illumination round the enemy aircraft will be of the order of 100 yards diameter.

20. Dousing of Searchlights

Should a fighter require all searchlights engaging a target to be doused, this may be achieved as follows:

(a) By flashing a succession of dots on the downward recognition lights.

Note: To ensure response it is essential that the glass or talc screen of the light be kept spotlessly clean and that the aircraft be kept on an even keel. If any turn must be effected the fighter should turn away from the searchlight. A turn towards the searchlight only results in the searchlight crew being unable to see the light owing to the bank.

(b) By firing a two star cartridge of the colours of the day from a Verey pistol or other device.

Note: This obviously should not be resorted to except in an emergency as it gives information away to the enemy.

(c) By request on R/T to the SOR.

Note: This signal cannot produce instantaneous dousing. Approx. 30 secs. lag.

21. Identification

Should the fighter wish to identify himself to the searchlight crews he will flash the letter of the day in Morse on the downward recognition light. As an acknowledgement the coloured beacon will be doused, or, if it is not already showing, it will be exposed to show the pilot that he is on his own correct orbit point. It will douse again once he is 'on orbit' (para. 14).

22. Extent of Latitude to Pilots

It has been found that if the method of interception outlined in this instruction is followed, the interception will be effected in a short time. Long stern chases cause complications in the ground control of searchlights and are to be avoided. A fighter therefore, having failed to achieve an interception by the time he reaches the rear boundary of the 'Killer' Belt will not cross the boundary (marked as in para. 23) unless the enemy aircraft is well illuminated and the fighter is so close behind him that a decisive attack is imminent. Unless AI contact has been made.

23. Marking of Belt Boundary

The fighter will be warned unless in AI contact of the fact that he has arrived at the rear boundary of the 'Killer' Belt by the searchlights in this belt, (once they have handed the target over to the lights in the adjoining zone, either Indicator or GDA), exposing their beams as nearly horizontal as possible and in the same direction and parallel to the course taken by the target.

24. Termination of Interception

The fighter having destroyed, lost or broken off from a raid will inform his parent Sector and ask for a vector back to his orbit beacon. The orbit beacon and the coloured beacon will at once be ordered to expose and the fighter will report to Sector when back 'on orbit'. The fighter will identify himself to his orbit beacon and the coloured beacon only will then douse (para. 21).

25. Action in the event of failure of Communication

Should communication fail between Searchlight Battery Headquarters and the Sector Operations Room, the fighter will be so informed by the Controller. In these circumstances, the Searchlight Battery Commander selects the targets for engagement and the pilot will not receive the code word 'Smack' from the Controller. The fighter will continue to orbit the beacon and await its signal to attack. When he sees the orbit beacon depress he should fly to intercept in the normal manner, but will inform the Controller as he is leaving the beacon to attack.

26. Action in the event of High Density Raids

Raids may become so dense that the Sector Controller is unable to select raids or to exercise adequate control. There are two methods of dealing with such an eventuality depending on the weather conditions especially the visibility prevailing at the time.

Method I – Dark Nights

On dark nights when Catseye Fighters are not likely to make interceptions without the aid of searchlights it is desirable to maintain as great a measure of control over fighters and searchlights as possible. The Sector Controller will give the code word 'Crackers'. On receipt of this, all orbit beacons will depress to 500 pointing to the front of each 'box' and will remain so exposed until further orders. With the orbit beam pointing thus the

boundaries of the 'entrance' are 35° right and left of the beam. Meanwhile the fighters, having also received the code word 'Crackers' will take this as a signal to attack any enemy aircraft being engaged by searchlight beams within their 'box', which will be 7 miles on each side of the depressed orbit beam. Searchlights will be engaging raids in the normal manner at intervals of 5 minutes. The fighters will return to the neighbourhood of their orbit beacon after interception, or on reaching the rear boundary of the 'Killer' Belt which will be marked by the depression of searchlights as in para. 23 above.

Method II – Bright Nights

On nights brightened by the moon or the 'Northern Lights' better results may be obtained by releasing catseye fighters from controlled searchlight interceptions. The action on these occasions will be ordered by the code words 'Free Lance' which will be authorised by the Group Commander only. On receipt of this order, the orbit beacons will revolve through 3 complete circles (the projector being at an elevation of 70° from the horizontal), and will then douse. The fighters will also be given the code words 'Free Lance' followed by information of the enemy's movements and, if possible of his target¹. They will then be at liberty to go forward to meet the incoming stream of enemy aircraft to follow these to the target area without restriction. The searchlights similarly will have restrictions removed and will be at liberty to engage as many enemy targets as possible, always adhering to the normal three beam rule.

27. Signal Security

Subject to the code words, vector instructions and 'orbit' reports referred to above, V.H.F. will be used as seldom as possible.

PART III

Control and Plotting Procedure

28. Equipment

When searchlights are exposed, enemy aircraft in the vicinity of the beams will expect to be attacked. To make the full use of this moral factor therefore it is desirable always to expose searchlights to engage targets whether or not fighters or guns are available to engage. Searchlights therefore will always be ordered to engage enemy aircraft whenever practicable.

29. Types of Night Interception

There are two main types of night interception:

- (a) Interception by GCI/AI night fighters.
- (b) Interception by fighters aided by AA searchlights.

30. Simultaneous Operation

As the number of interceptions which can be effected by AI fighters at any moment is limited, both types of interception must be operated simultaneously, and not one to the exclusion

¹ The Group Commander in whose area the target (GDA) is situated will use his discretion as to whether guns are to cease fire or have a height limit imposed as in a 'Fighter Night'.

of the other. Controllers must ensure that raids selected for each kind of interception are suitable for that type, and so far as can be foreseen will not interfere with each other, e.g. if one raid is making landfall and another is still some 20 miles out at sea; the former should be allotted to searchlight aided fighters and the latter to GCI/AI.

31. Non-Interference with GCI/AI Fighters

The presence of searchlight beams may be a hindrance to pilots of GCI/AI fighters, and searchlights will not be ordered to engage a raid selected for the GCI/AI method of interception unless the pilot for some reason or other is unable to obtain a visual and calls for the aid of searchlights.

32. Nomenclature of Raid Pilots

For plotting purposes a fighter is assumed to be a satellite of its raid. Raids allotted to fighters working with GCI will be plotted and known as 'Dark' raids. All raids engaged by searchlights, whether fighters are co-operating or not, will be plotted and known as 'Bullseye' raids. The selection of raids as 'Dark' or 'Bullseye' is to be communicated to the appropriate Royal Observer Corps Centre.

33. No overlap of 'Dark' and 'Bullseye' Raids

Every care must be taken that GCI/AI or 'Dark' interception is not hindered or rendered abortive by searchlights inadvertently illuminating either the enemy aircraft or the fighter following it. To this end searchlights will not be ordered to engage a raid the plot of which is seen to be within a semi-circle of 5 miles radius ahead of the plot of a 'Dark' raid, such semi-circle moving with the raid and having its diameter at right angle to the raid track. This restricted area for searchlights is to allow for the fact that owing to inaccuracies or time-lag in plotting, the fighter and its prey may be anywhere within the area covered by the semi-circle.

34. Responsibility for Selection of and calling off of Raids for engagement by Searchlight

It is the responsibility of the Sector Searchlight Commander or in his absence a senior searchlight officer deputed by him, to select raids for engagement by searchlights. It is the responsibility of the RAF Sector Controller to ensure that raids selected do not hamper other means of directing fighter interceptions or provide a possible source of assistance to the enemy's operations. For this reason the Sector Controller has authority at any time to stop the Sector Searchlight Commander engaging further raids or to end an engagement already started.

35. Rules for the Selection of Raids

These are set out in full in Appendix 'B'.

36. Allotment of Raid to appropriate Fighter

To operate in the most economical manner it is essential to allot the selected raid to the appropriate fighter. Only by careful scrutiny of the plots can this be achieved and if it is achieved the interception will be effected in the shortest possible time and the fighter will be set free to deal with the next selected raid.

37. Responsibility for Allotment of Fighters

The Controller, in conjunction with the Sector Searchlight Commander, will be responsible for warning, allotting and calling off the appropriate fighter.

38. Assignment and Allotment – Distinction

The Controller may assign two fighters to a raid but should control them so that only one actually attacks. When the Controller decides to call off one of the fighters the assignment of this fighter is cancelled and the raid is said to be 'allotted' to the other fighter.

39. The Rubicon

In order to prevent two fighters attacking one target it is necessary for the Controller to have some arbitrary point in the Indicator Zone so that when the enemy passes beyond this point he can judge that it is time to call off one fighter. This point will be on a line known as the RUBICON. The Rubicon is a line two miles outside and parallel to the outer edge of the 'Killer' Belt.

40. General Rules for Assigning Fighters to Targets

(a) The Controller will, if possible, give early warning to the fighters which in his opinion are likely to be told to intercept. This early warning should be given if possible before the raid is within twelve miles of the Indicator Zone.

(b) The Controller will assign targets and simultaneously give the order to attack as the track of the selected raid crosses the front line of indicators into a box.

Note: Since the width of the Indicator Zone varies ably the front boundary of the box does not necessarily coincide with the line of outer lights of the zone.

(c) Never more than two fighters should be assigned to one raid and one must be called off as the raid track crosses the Rubicon, or in certain cases, the axis of a 'box'.

41. Plotting of Raids Selected for Interception to cover adjoining Sectors

To comply with the provisions of Appendix 'B' it is essential that plots of searchlights, GCI or CHL selected raids are clearly displayed in the Sector Operations Room. It is also essential that neighbouring Sectors have these raids similarly displayed before the raids actually enter the Sectors. This is particularly important as the present Searchlight Battery lay-out is such that in some cases Sectors are controlling Batteries within neighbouring Sector boundaries.

42. Main or Observer Corps Table

On this table all information arriving at the Sector is displayed.

43. Night Fighter Plotting Table

In addition to the main table a special subsidiary table known as the Night Fighter Plotting Table is necessary. This table with a map showing the Sector and neighbouring Sectors, and fitted with an appropriate number of jacks, is placed in each Sector Operations Room so that it can be seen clearly by the Controller, Sector Searchlight Command and AALO.

In addition this table will be marked with the boundaries of searchlight 'belts' and 'boxes', the position of orbit beacons and the Rubicon line (see para. 39).

44. Display of 'Dark' Raids

When a raid is selected from the information on the main table as being suitable for interception by a GCI or CHL Night Fighter, the Fighter and the raid it is pursuing will be shown by dressing a plaque (black with letters showing stations viz. HUN – SOP – etc.) with figures showing the pilots' individual call sign and the height at which he is flying, together with a standard 'visual counter' showing the direction in which he is going.

The plaque on the night fighter plotting table will be moved accordingly to plots received from the appropriate GCI or CHL Station.

The Royal Observer Corps plots of the 'Dark' raid will continue to be plotted on the main table.

45. Display of 'Searchlight' or 'Bullseye' Raid

When a raid is selected from information on the main table as suitable for interception by a searchlight aided fighter the display will be a plaque (yellow with a black 'S' dressed with pilots call sign and height) placed on the raid block of the raid identified as the one the fighter is pursuing. It should be noted that fighters working with searchlights will be plotted as being 'on orbit' unless and until the Controller orders them to leave their orbit beacon to attack.

This plaque on the night fighter plotting table will be moved according to plots received from Searchlight Battery Operations Rooms via the Army Plotting Room or Army 'D' Board.

The Royal Observer Corps plots of the 'Bullseye' raid will continue to be plotted on the main table.

46. Production of Traces

(a) Where an Army Plotting Room is provided the track of selected raids will be produced on the Army Plotting Table, and drawn by the Recorder on a $\frac{1}{4}$ - 1 mile trace.

(b) Where no Army Plotting Room or Table is available, the plots will be recorded by the telephonists at the Army 'D' Board who will maintain communication with the Searchlight Batteries concerned. The tracks will be drawn on a similar trace. In both cases the plots will be telephoned by one of the AALO's to a plotter stationed at the Night Fighter Plotting Table who will move the 'Bullseye' plaque as each plot is received. The traces are for analysis and record purposes.

47. Exercise of Control

The relative position of the 'Dark' and 'Bullseye' plaques on the Night Fighter Plotting Table will enable the Controller to exercise the control envisaged in paras. 31, 33 and 34.

48. Information to and from Neighbouring Sectors

Arrangements are made for Liaison Lines from neighbouring Sectors to be permanently through to operators on the Night Fighter Plotting Table. These arrangements do not pertain to No. 11 Group where information is passed through the Group Operations Room.

The function of these operators is to tell the positions of the sector's fighters, and the raids which they are following, to the neighbouring sectors and receive equivalent information from the latter. This information they plot on the Night Fighter Plotting Table.

Once a raid has been designated 'Dark' or 'Bullseye' this fact will be communicated immediately to the appropriate Royal Observer Corps Centres (para. 32).

49. Termination of Raids

When a fighter destroys, loses or breaks away from a raid, he will inform his parent Sector (see para. 24). The Sector Controller will be responsible for notifying immediately to the appropriate Observer Centre that the 'Dark' or 'Bullseye' designation is to be withdrawn.

50. Control in the event of failure of Communications

Should communications fail between Sector Operations Room and one (or more) Battery Headquarters the appropriate fighter(s) will be informed and conform to para. 25. Plots from the Royal Observer Corps will still be available to the Controller but plots from Searchlight Battery Headquarters will not come in and control will consequently be decentralised to the Battery Commanders. They will order engagement of raids entering the Indicator Zone into their Battery Areas at intervals of five minutes or in addition they may take over and continue to engage all searchlight engaged raids entering their Battery Areas from adjacent Battery Areas.

51. Control in the Event of High Density Raids

If the target density becomes so great that precise selection of targets at the Sector Operations Room becomes difficult, the Sector Controller will order 'Crackers', or on the authority of the Group Commander 'Free Lance' in accordance with para. 26 above. These orders will be passed by the Sector Searchlight Commander to such Batteries as may be affected. Fighters will likewise be informed and take action as in para. 26. In the case of 'Crackers' Batteries will order the orbit beacons to be depressed to 50° and to remain exposed until further orders. Battery Commanders will act as in para. 50 above. Plots of all raids so engaged will be passed via the Army Plotting Room for plotting on the Night Fighter Plotting Table in the Sector Operations Room. On the occasion of 'Free Lance' the Batteries will order their orbit beacons to revolve three times clockwise at 70° elevation and then douse. Searchlights will be engaging as many raids as possible and no plots will be passed to the Sector Operations Room.

52. Searchlights in Gun Defended Areas

As mentioned in para. 8 these searchlights have three roles.

(i) to assist in the defence of the Gun Defended Area, in which case they will be controlled by the Gun Operations Room.

(ii) to act as 'Indicators' to a contiguous 'Killer' Belt, in which case they will be controlled by the Sector Operations Room.

(iii) to take over the engagement of an illuminated target of which a fighter is in hot pursuit.

The decision as to which role shall be adopted shall rest with the Sector Command who will be advised by the Anti-Aircraft Defence Commander (AADC) after consultation with the Sector Searchlight Commander (SSC).

These searchlights may be doused at the request of the Controller to the AADC at the Gun Operations Room.

APPENDIX 'A' TO FIGHTER COMMAND OPERATIONAL INSTRUCTION NO. 90

NOTES ON THE CAPABILITIES OF AA SEARCHLIGHTS WITH PARTICULAR REFERENCE TO SLC

1. Value of Searchlights

AA Searchlights are of value

- (a) against low flying aircraft (below 8,000 feet) by illuminating the aircraft and so providing an easily found target for fighter attack. No other form of control at present in use can deal with such raids at night.
- (b) against high flying aircraft, to provide a means of guiding fighters to the target and enabling non AI aircraft to see and engage the enemy.
- (c) to illuminate, and allow AA guns to engage, a seen target.
- (d) to obscure targets by dazzle effect on bombers.
- (e) for moral effect, rendering the enemy aircraft conspicuous, even if no fighters or guns are immediately available to engage it.

(This Instruction deals with (a), (b) and (e) above).

2. General Description of SLC

SLC commonly called 'Elsie' is a radio locating device to searchlights. It works on similar principles to those of RDF and GCI.

3. Data appropriate to Searchlights with SLC

(a) Heights at which searchlights can illuminate

Given good atmospheric conditions searchlights can illuminate a doped aircraft up to 25,000 feet the aircraft being visible from the ground. Under average weather conditions an illuminated target cannot be seen from the ground above 15,000 feet.

(b) Distance beams can be seen by aircraft

On dark nights a fighter pilot can see an intersection of 3 beams up to 25 miles away.

(c) Range

SLC provided it is given an indication of where to search, can follow the target from 15,000 yards range downwards, and from 10,000 yards range downwards, the searchlights can illuminate it sufficiently for the fighter to see. If no plot is available to assist SLC to pick up, then it will not start to function until it hears the target.

(d) Accuracy

With SLC equipped searchlights this is plus/minus $1\frac{1}{2}^\circ$ at all angles of elevation above 20° .

(e) Intensity

90 cm. projector beam candle power is 210 million c.p.
150 cm. " " " " " 510 million c.p.

(f) Divergence

The spread of the beam of a 150 cm. projector has a divergence or spread of $1\frac{1}{2}^\circ$. At 10,000 feet with the beam vertical the horizontal area of illumination is a circle of 88 yards diameter at 20,000 feet it is 176 yards and so on. As the beam is depressed from the vertical the area becomes elliptical in shape.

(g) Discrimination

SLC equipped searchlights can discriminate between two aircraft until they close to within 700 yards of each other. Steps are being taken to overcome this by equipping all SLC searchlights with the means of changing over rapidly to visual control.

4. Advantages of SLC over other means of locating and directing searchlights.

- (a) Not dependent on sound.
- (b) No need for air speed to be set on instrument.
- (c) Can recognise friendly fighters provided they show IFF Mark IIG.
- (d) Not dependent on visual direction from the ground.
- (e) Since searchlight beams will penetrate thin cloud 300' thick on SLC controlled beam can illuminate and follow a target in conditions of 10/10 cloud.

5. Disadvantages

- (a) Liable to interference by other SLC's wireless masts, etc. within 5,000 yards.
- (b) Fairly difficult to site.
- (c) Requires careful alignment and handling.
- (d) Cannot be used to engage target below 30° elevation or 4,000 feet high or within the first 6,000 feet of slant range. Targets such as these can be adequately dealt with by visual control.

APPENDIX 'B' TO FIGHTER COMMAND OPERATIONAL INSTRUCTION NO. 90

RULES FOR THE SELECTION OF RAIDS FOR INTERCEPTION BY FIGHTERS AIDED BY AA SEARCHLIGHTS

1. 'X' RAIDS

Searchlights provide a useful means of establishing the identity of aircraft and lights in the 'Indicator' Zone have a definite role as challengers of doubtful raids. The SSC may therefore select an 'X' raid to be challenged. If it is confirmed as a hostile he will then take action to effect an interception in the same way as he would if he had selected a raid definitely plotted as hostile.

2. Early Selection

The time lag between the origin of the raid track at the CH Station and the first indication of its position on the S.O.R. plotting table may be as much as four minutes representing an average distance of 12 miles. Selections of raids, therefore, should, as far as possible, be made from those whose indicated position is at least 15 miles from the coast.

3. Prevention of Confusion

Raids will be selected when they are at distances of not less than approximately 15 miles apart. When a series of raids are seen to be approaching the coast at the same point the SSC should select raids following each other at intervals of approximately 15 miles.

4. Preference for Low Raids

Whenever possible raids shown by the RDF as flying comparatively low will be given preference in selection.

5. Preference for Incoming Raids

Incoming raids generally will be preferred for selection to outgoing raids. An incoming bomber is primarily concerned with finding his objective and is likely, therefore, to maintain a more steady course, speed and height, especially as evasive action with a heavily laden aircraft is more difficult.

6. Allotment to correct Fighter

A successful interception depends largely on the selected raid being assigned to the appropriately positioned fighter. This may sometimes prove difficult, owing to the raid changing course.

7. Converging Raids

When selected raids are seen to be converging and are within 10 miles of each other, the Searchlight Sector Commander will draw the attention of the Controller to this fact, and the Controller will decide according to the apparent likelihood of interference which, if either, of the two interceptions should be abandoned.