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R.A.F. NARRATIVE.
(FIRST DRAFT)

THE R.A.F. IN THE BOMBING OFFENSIVE AGAINST GERMANY.

VOLUME V

THE FULL OFFENSIVE FEBRUARY 1943 TO FEBRUARY 1944

AIR HISTORICAL BRANCH (I)
AIR MINISTRY.

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G.225497/DEW/9/49.

SECRET

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CHRONOLOGY OF PRINCIPAL EVENTS

1943

February

2	Capitulation of German Forces at Stalingrad.
4	Casablanca Directive issued to Bomber Command - priority U-boat bases and yards.
25	Bomber Command commenced "round the clock" bombing.

March

3	Knaben Molybdenum mines attacked by 9 Mosquitoes of Bomber Command, with great success.
5/6	"The Battle of the Ruhr" began (ended July) - 442 bombers on Essen, first large-scale use of Oboe marking technique.

April

1	C.O.S.S.A.C. appointed in the person of General Morgan, to prepare plans for Overlord.
27/28	160 aircraft laid mines in Frisian and nearer coastal areas.
28/29	226 aircraft laid mines in Danish and Baltic coastal areas.

May

7	Tunis and Bizerta captured.
12	Trident Conference began (ended 27th) in Washington.
13	North African campaign ended.
16/17	Operation Chastise, raid on the Ruhr Dams by 19 Lancasters of No.617 Squadron - V.C. awarded to Wg. Cdr. Gibson, the leader of the raid.
23/24	826 aircraft despatched against Dortmund - largest scale raid since the thousand-bomber raids of 1942.

June

1	Tactical Air Force formed under Command of Air Marshal D'Albiac, No.2 Group transferred to it.
10	Pointblank Directive issued - priority German fighter industry.
11	Operation Corkscrew completed - Pantellaria occupied after intensive bombing. First capitulation due entirely to bombardment.
13	Lampedusa surrendered after intensive bombing.
20/21	First "Shuttle" Raid - Friederichshaven, landing in North Africa. "Leader" controlled bombing. Serrate operations began against controlled enemy fighters by British fighter aircraft.

July

9/10 Operation Husky - Allied landing in Sicily.

10 June shipping losses announced as lowest since United States entered the war.

19 Rome bombed by 700 U.S. aircraft from North Africa.

24/25 "Battle of Hamburg" began (until Aug.2nd/3rd) - 791 aircraft despatched. First use of Window, to confuse enemy fighter control.

25 Mussolini resigned - Badoglio formed government.

30/31 End of Battle of the Ruhr, March/July - Remschied.

August

1 Operation Tidal Wave - Attack on Ploesti oil refineries by U.S. aircraft from North Africa.

7/8 "Master Bomber" employed, on Turin, for first time.

17 Sicilian campaign ended.

17/18 Peenemunde research station (V-Weapons) attacked by 571 aircraft. Master Bomber employed for first time on full-scale operation in Germany.

20 Combined Chiefs of Staff appointed Air Marshal Leigh-Mallory Allied Air Commander for Overlord.

24 Quadrant Conference (Quebec) - Joint statement issued on talks, 14th/24th August.

27 Watton V-weapon launching site attacked by 224 U.S. aircraft.

September

3 British and Canadian landing in Southern Italy. Italian Armistice signed.

8 Italian Armistice announced.

8/9 Starkey exercise climax - gun positions at Boulogne bombed.

First United States night bombing sorties - Five Fortresses joined in Bomber Command attack.

9 Avalanche - Salerno landing by American and British forces.

Radar became official name for R.D.F. or Radiolocation (radio detection and ranging)

14 Brimstone - Allied landing in Sardinia.

15 Mussolini resumed power.

15/16 First 12,000 lb. H.C. (Tallboy) bombs dropped by Bomber Command, on Dortmund-Ems canal.

CHRONOLOGY OF PRINCIPAL EVENTS (Contd.)

September

22/23	First "Spoof" raid - Oldenburg, main target Hanover.
23/24	First use of Oboe aircraft to mark the route of the main force.
26/27	First operational trial of Mark II Oboe, Aachen.
27	First operational use of H2S by U.S.A.A.F., - Emden.

October

1	Naples captured
2/3	117 aircraft laid mines along whole enemy coastline.
4/5	First operational trial of Gee-H, - Aachen.
7/8	First operational trial of Oboe Repeater, - Emden.
	First operational use of Airborne Cigar (A.B.C.), for jamming VHF/RT.
8/9	Last bombing operation by Wellingtons of Bomber Command - Hanover.
13	Italy declared war on Germany.
20	First operational trial of Oboe by U.S.A.A.F., - Duren.
22/23	Corona first used against German night fighters.

November

1	Oboe released for use in precision attacks, independent of Main Force operations.
3	4,000 tons of bombs dropped on Germany by American and British aircraft in 16 hours.
3/4	First blind-bombing by G.H. Lancasters, Dusseldorf.
5	First successful U.S.A.A.F. attack by Oboe - Gelsenkirchen.
15	Formation of Allied Expeditionary Air Force under command of Air Marshal Leigh-Mallory.
	Fighter Command became Air Defence of Great Britain.
	Woodbridge emergency runway opened.
18/19	"Battle of Berlin" began - 444 aircraft despatched - 15 attacks in next three months, with two final ones, one American and one British of about 300 aircraft each, in March, 1944.
21	Sextant Conference began (ended December) between Churchill, Roosevelt and Chiang Kai Shek at Cairo.
28	Eureka Conference began at Teheran (ended 3rd December) between Churchill, Roosevelt and Stalin.

/December

CHRONOLOGY OF PRINCIPAL EVENTS (Contd.)

December

3	No.100 (Radio Counter-measures) Group formed.
10	Mediterranean Allied Air Forces formed, comprising M.A.C and N.W.A.A.F.
16/17	Mosquitoes and Beaufighters operated as "Intruders" for first time under Bomber Command.
23	General Eisenhower appointed Supreme Commander, Allied Expeditionary Forces in the United Kingdom.
	Air Chief Marshal Tedder Deputy Supreme Commander.

1944

January

1	General Spaatz appointed to command U.S. Strategic Air Forces in Europe (U.S.S.A.F.E.)
22	Shingle, 5th Army landing at Anzio and Nettuno
28	Air Ministry Interim Directive issued - New priorities in single and twin-engined fighter airframe and component and ball bearing plants.
30	C.O.S. Directive - Revision of Priorities.

February

9	Overlord bombing of French railway system began.
11	Anzio position "very tense" (Roosevelt)
12/13	No.617 Squadron failed to cut railway into Italy at Antheor Viaduct.
15/16	Heaviest attack on Berlin by Bomber Command - 891 aircraft despatched.
24/25	Attack on Schweinfurt by Bomber Command - 734 aircraft despatched.

LIST OF SOURCES

(With abbreviations used, in alphabetical order)

A.B.C.1.	Conclusions of the American/British Conference, Jan., 1941. Full title :- B.U.S./J(41)(30) dated 27th March, 1941.
A.D.I.(K) Reports	Assistant Directorate of Intelligence Reports from German prisoners, etc.
A.F.S. No.S.105	A.F.S. Memo. No.S.105; - a loose paper on the Attack on the Dams, circulated by A.I.3(c).
A.H.B.	Air Ministry Air Historical Branch folders, narratives, library files, etc.
A.H.B.6.	Air Ministry Air Historical Branch Translations of German documents.
A.T.H./D.O.	Personal files of the Air Officer Commanding-in-Chief, Bomber Command, (Air Chief Marshal Sir Arthur Harris).
The Bomber's Baedeker.	Guide to the economic importance of German Towns and Cities; published by the Enemy Branch of the Foreign Office and the M.E.W.
B.B.S.U.	British Bombing Survey Unit reports.
B.C./M.S. B.C./S.	Bomber Command Most Secret and Secret files.
B.C./O.R.B.	Bomber Command Operations Record Book.
B.C./O.R.B. Apps.	Bomber Command Operations Record Book Appendices.
B.C.O.O.	Bomber Command Operational Orders.
B.C.O.I.	Bomber Command Operational Instructions.
B.D.U.	Bomber Development Unit.
Bureau Scientifique de l'Armee.	Paper compiled by the French Ministre de Guerre on the Effects of Allied Bombing on French Territory. (1944).
C.A.S.	Chief of the Air Staff folders, etc.
C.C.S.	Combined Chiefs of Staff papers.
C.B.O. Report	Report on the Combined Bomber Offensive.
C.M.S./.C.S.S.	Air Ministry Most Secret and Secret files.
C.O.S.	Chiefs of Staff papers.
C.W.E/E/35, etc.	Reference numbers to target forces.
D.B. Ops.	Directorate of Bombing Operations, folders.
D. of O./L.M.	Director of Organisation, loose minutes.
D.O.	Defence Committee, minutes and papers.
E.R.P.	Expansion and Re-equipment Policy Committee.
Folders/C.A.S. /S. of S. /S.6.	Chief of Air Staff etc. Branch folders. (D.C.A.S., D.B. Ops., etc. folders referred to under A.H.B. shelf list).
Fuehrer Conferences.	A.H.B.6 translations; extracts from reports of the Fuehrer conferences.
Harris Despatch.	Despatch on War Operations. 23rd February, 1942, to May 8th, 1945; by Air Chief Marshal Sir Arthur T. Harris, Air Officer Commanding-in-Chief, Bomber Command.
J.P.	Joint Planning Committee, Minutes and Papers.
J.S.M.	Joint Staff Meetings.
M.E.W.	Ministry of Economic Warfare; folders, papers, etc.
M.H.S.	Ministry of Home Security.
O.R.S.	Operational Research Section, Bomber Command.
R.E./H.	Research and Experiments Department of the Ministry of Home Security.
Signals:- A.X.	Cypher signals from Air Ministry.
F.A.N.	" " " Combined Chiefs of Staff.
"Frozen"	" " " Cairo Conference.
Speer Papers	Interrogations of Albert Speer, Reichsminister for Armaments and Munitions.

/"Thunderbolt"

"Thunderbolt"	Report on the Air Ministry exercise "Thunderbolt", August, 1947.
Trnaslations.	A.F.S. Memo. No.S105 (see above), A.H.B.6., AI/12 (U.S.A.F.E.), Loose paper translations held by A.H.B.
U.S.P.	6 papers compiled by an ad hoc committee for the U.S. planners,
U.S.S.B.S.	United States Strategic Bombing Survey reports.
Wagenfuehr.	Paper by Doctor Rolf Wagenfuehr, member of Speer's ministry.
W.M. } W.P. }	War Cabinet minutes and papers.
W.R.	War Room Monthly Summary of Bomber Command Operations. War Room Manual of Bomber Command Operations.
W.W.1.	Washington War Conference, 23rd December, 1941 to 14th January, 1942.
Zone Hand Book No.V.	Supplement to the German Basic Handbook, published June, 1944.

Other sources of a special nature are referred to in the margin. References are also made to other volumes, Parts or Sections of the Narrative.

INTRODUCTION

C.O.S.(41)505
Annex "Y"

'It is upon bombing, on a scale undreamt of in the last war, that we found the new weapon on which we must principally depend for the destruction of German economic life and morale. To achieve this object within a reasonable time, the bombing offensive must be on the heaviest possible scale, and we set no limit to the size of the force required, save those imposed by operational difficulties in the United Kingdom. After meeting the needs of security, therefore, we give to the heavy bomber first priority in production, for only the heavy bomber can produce the conditions under which other offensive forces can be employed.'

These were the views of the Chiefs of Staff in July, 1941. How were they realised? In the preceding volumes we have seen the slow growth of Bomber Command, the many setbacks to its expansion, yet the continual increase in the weight of bombs dropped upon Germany. The period we now enter ushers in the peak of offensive power attained by Bomber Command. In spite of all the difficulties encountered, an effective force is at last available. The method of employing this force has now to be considered.

D.B.Ops.
16D/1 (II/
70/272(D))

The overall policy governing bombing operations throughout this period was laid down in the Casablanca Directive, and reiterated in the Pointblank Directive in June and at the Quebec conference in August. It was defined as -

'the progressive destruction and dislocation of the German military, industrial and economic system, and the undermining of the morale of the German people to a point where their capacity for armed resistance is fatally weakened.'(1)

The Bomber Command offensive was throughout more in accord with the general aim than with any category of target laid down. This general aim was interpreted by Bomber Command as the destruction of every German town of over 50,000 inhabitants which had any military or economic importance.

After reviewing general strategy and bombing policy, this narrative considers the tactical factors which complicated operations, and drastically altered their intended application. It then proceeds in a series of chapters devoted to the outstanding operations or campaigns of the period, interspersed with chronological records of the day to day work of the bomber forces. Further policy discussions occur in connection with specific operations or phases.

The actual composition, organisation and technical equipment of Bomber Command in 1943 are, in this volume, relegated to an annex. With the full maturity of the Command such considerations diminished in importance.

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(1) See Appendix 1.

'In war, every single bombing operation is merely one item in a complex campaign, and, to be successful, has to fit in to a general plan of operations which may cover the whole theatre of war and extend over a period of days, weeks, or even months. Weather, phases of the moon, length of darkness, enemy fighter strength and tactics, enemy defence organisation for guns, lights, radar, and fighter control; ever-changing techniques of navigation, target-marking, and bombing, - all these factors, and more, affect the selection and the type and location of targets.'

Marshal of the R.A.F., Lord Tedder,
Chief of the Air Staff,
in the Lees-Knowles Lectures at
Cambridge in February/March, 1947.

CHAPTER I

STRATEGIC BACKGROUND

Early Planning

A.B.C. - 1
27.3.41.
C.O.S.(42)80
Annex 1 -
W.W.1(Final)

When America entered the war in December, 1941, British plans for the defeat of Germany began to take more definite shape. The basic concept of Anglo-American strategy, already defined by the British Chiefs of Staff at the Washington Discussions in January, 1941, were laid down at the Washington War Conference in December, 1941/January, 1942. This basic strategy was to concentrate on the defeat of Germany first, since the defeat of Italy and Japan would then follow. This involved action to:-

(a) secure the main centres of war industry

(b) maintain essential communications

(c) wear down German resistance by air bombardment, blockade, subversive activities and assistance to Russia

(d) develop offensive action against Germany.

Whilst action was taken on (a), (b) and (c), plans for (d) began to take shape. The British plan for Round-up, the final assault on the Continent, prepared in late 1941, was taken up by the Americans.

Anglo-American agreement on this strategy was not obtained without a struggle. A strong section of American opinion, led by Admiral King and General McArthur, was in favour of attacking Japan first. General Marshall and General Arnold, however, were backed up in their stand for a "Germany first" policy by President Roosevelt. This alignment of American opinion continued to manifest itself in later planning. It meant that the British Chiefs of Staff had to be careful how they discouraged the over-optimism of the American Staff regarding European operations, in order to avoid playing into the hands of the "Pacific" advocates.(1)

(2) The Marshall Plan

J.P.(42)383(5)
9.4.42.

In April, 1942, General Marshall brought to England proposals for a "Super Round-up" in 1943, preceded by Sledgehammer, a smaller operation to establish a bridgehead on the Continent in 1942. This marked an important step in Anglo-American planning, as it showed that the American Government had accepted the British view that the defeat of Germany must come first, and were acting upon it. The Marshall Plan was also the basis of future planning for a Continental offensive.

C.O.S.(42)103
(O)

The outcome of the Marshall Plan was to be the "conversion of the United Kingdom from a defensive to an offensive footing". A cross-channel attack was the shortest way to Germany itself. It was also the easiest area in which to achieve air superiority, and to concentrate the United States forces. It was estimated that the very large forces necessary, assessed at 5,800 combat aircraft and 48 divisions, could be assembled in the United Kingdom by the spring of 1943.

/The

(1) Further information on this early planning can be found in the previous volume of this narrative, and in the R.A.F. Narrative The Liberation of N.W. Europe.

D.O.(42)101st
14.4.42.

The Defence Committee agreed in general with the Marshall proposals, but stressed the need of not neglecting the Indian Ocean area. Germany and Japan must not be allowed to link up. The British Staffs were also doubtful as to the operation proposed for 1942 - Sledgehammer. The shipping position would not allow the build-up of adequate American forces by the summer, so British forces would have to undertake this operation. The British view was that a bridgehead could not be maintained unless the Russians had first weakened the enemy to a critical degree.

C.O.S.(42)111(0)
25.4.42.

After agreement on the main essentials of the plan, a Combined Committee was appointed to carry out a preliminary survey of its implications. The action decided on consisted of:-

(a) offensive preparations all along the British coasts, including the provision of accommodation, airfields, harbour facilities and other long-term needs

(b) Large-scale raiding operations in 1942

(c) an active air offensive by fighters and bombers.

(d) planning for Sledgehammer, 1942

(e) planning for Round-up, 1943

U.S.P.(42)1-6

C.O.S.(42)118/0))
Annex 1.

Six papers covering the Administrative preparations were compiled, and a London Committee was formed to co-operate with the Washington Committee on Bolero, the code-name for the movement of United States forces to the United Kingdom.

Further examination convinced the British Chiefs of Staff that Sledgehammer was impracticable. Pressure from Russia and the United States in May, however, compelled another re-examination. In June the Prime Minister laid down two principles:-

C.O.S.(42)51st(0)4
8.6.42.

(a) "no substantial landing in France unless we are going to stay,

and

(b) no substantial landing in France unless the Germans are demoralized by another failure against Russia".

W.M.(42)73rd.

These were agreed by the War Cabinet on 11th June.

(3) Torch

The Prime Minister visited Washington in June, 1942, and agreed with the President that, failing Sledgehammer, landings should be made in 1942 in French North Africa instead. A plan for this, Gymnast, had long been prepared by the British. This was now expanded under the code-name Torch into a combined Anglo-American operation. With the final abandonment of Sledgehammer in July, Torch was accepted as the main objective for 1942. The Prime Minister stressed, however, that Round-up was to remain the most important objective of Allied strategy.

C.C.S.23rd.
22.7.42.
W.M.(42)101
31.7.42.

Planning for Torch now took first place, whilst the Bolero build-up continued. In September, however, General Eisenhower proposed a re-distribution of United States forces, which would leave very small forces in the United Kingdom. The British had believed Torch and Bolero to

/be compatible

be compatible, so that this proposal came as a shock to them. Only 150,000 ground troops were now to be in the United Kingdom by April, 1943. It was intended to give priority to Sickle, the build-up of the U.S.A.A.F. in the United Kingdom.

The launching of Torch on 8th November, 1942, therefore caused the abandonment of Round-up in the spring of 1943. The shipping situation did not allow the planned Bolero build-up to be achieved. Planning for the invasion of Europe once more became a long-term project, and a new review of future Allied Strategy was undertaken by the Chiefs of Staff at the end of 1942.

(4) Strategy for 1943

C.O.S.(42)345(O) 30.10.42.

The first version of this review of Future Strategy was considered by the Defence Committee in November. Its emphasis was on the best means of aiding Russia in 1943. No invasion was considered practicable until Germany's military power was undermined "by the destruction of the German industrial and economic war machine". The best weapon for this purpose was the heavy bomber, backed up by blockade and other measures. As economy in the use of shipping was a paramount consideration, the building-up of a great Anglo-American force of heavy bombers was recommended on the highest priority. "Our attrition of Germany has hitherto comprised bombing, blockade, raids and subversive action. All these can be intensified. Bombing is susceptible of the greatest development and holds out the most promising prospects".

It was therefore proposed:-

(i) to expand the Allied bomber force to 4,000 - 6,000 heavy bombers by April, 1944;

(ii) to tighten the blockade;

(iii) to stretch the enemy forces by amphibious operations;

(iv) to increase sabotage in Europe;

(v) to make plans and preparations - not to conflict with the above - for re-entry to the Continent "in the event of a break in German morale and powers of resistance".

D.O.(42)17th

The Prime Minister made three important criticisms upon this paper:-

(i) It nowhere stated that the creation of this enormous bomber force would involve the move to the United Kingdom of some 1¼ million American ground personnel. This would rule out other large-scale operations.

(ii) It took little account of the effect on Russia of a failure to open land operations against Germany in 1943 on a scale to bring substantial relief to the Russian front. During his visit to Moscow in August he had promised operation Roundup for 1943.

(iii) Its arguments would encourage the "Japan first" elements in America.

/Field Marshal

Field Marshal Smuts complained that the paper did not show how it was proposed to defeat Germany in the field, and the C.I.G.S. explained that "shortage of personnel shipping was exercising a strangle-hold on our strategy."

C.O.S.(42)399(0) 18.11.42.

The Prime Minister requested that the paper should be re-drafted with a change of emphasis. He put in a Minute on "Strategy in 1943" incorporating his views.

C.O.S.(42)412(0) 24.11.42.

A short two-page version of the Future Strategy paper was submitted later in November, with more emphasis on the build-up for invasion. A few sentences illustrate its tenor:-

> "Europe may be likened to a powerful fortress, which can be assaulted only after adequate artillery preparation. To make the assault before the time is ripe would be suicide for ourselves and of no assistance to Russia. Our aim must be to intensify the preliminary bombardment, for which purpose Anglo-American air forces will take the place of artillery".

C.O.S.(42)421(0) 29.11.42. C.O.S.(42)423(0) 30.11.42.

The Prime Minister still thought that plans for attack in July 1943, should be made, and that it would be better to bring over extra army divisions instead of the U.S.A.A.F., of whose capacities he was doubtful. The C.O.S. were convinced, however, that Roundup could not be staged by July, 1943. They pointed out that the Combined Chiefs of Staff had agreed on the impracticability of Roundup in 1943 in addition to Torch as long ago as July 1942, when the Torch operation was approved.

C.C.S.94.

C.O.S.(42)429(0)

The Prime Minister in a note to the C.O.S. on 3rd December, once more urged a target date for Roundup in 1943. He pointed out that the Russian success at Stalingrad, the success of Torch and the advance of the Eighth Army in Egypt had changed the situation since July. It was now proposed to employ only 13 divisions for Torch in 1943, in place of the 48 divisions envisaged for Roundup, and mentioned to the Russians. With the weakening of German forces in France forced upon them by reverses elsewhere, he suggested that 35 divisions would be adequate to make the assault, and that these could be assembled by August or September, 1943.

C.C.S.135 in C.O.S.(42)475(0) 25.12.42.

The United States Chiefs of Staff submitted their revised conception of basic strategy to the Combined Chiefs of Staff on 23rd December, 1942. This showed that they were still thinking in terms of a land offensive from the United Kingdom in 1943. They proposed to consolidate and hold the North African area, but to exploit it only by air attack. The British C.O.S. did not agree with this.

C.O.S.(42)452(0) (Final) and C.O.S.(42)466(0) (Final)

They advocated exploiting the success of Torch as vigorously as possible. The final versions of the two C.O.S. papers on "Future Strategy" and "American British strategy in 1943", were approved by the Defence Committee and cabled to the Joint Staff Mission at Washington on 31st December, 1942.

If the aim was a maximum Bolero, the British C.O.S. calculated that not more than 25 divisions could be assembled in the United Kingdom by August, 1943. Such a build-up would reduce the bomber offensive and mean the abandonment of further projected operations in the Mediterranean, such as Husky, the attack upon Sicily. Even so, the force built up would not be adequate to overcome German resistance. On the other hand, if Torch were followed up immediately, there was a good chance of knocking Italy out of the war, Axis air strength in the Mediterranean would be fully engaged and the bomber force

/in the

in the United Kingdom could be built up. The Bolero build-up, although slower, should reach 21 divisions by August. This should suffice to take advantage of any opportunity which might occur for re-entering France. This policy should afford earlier and greater relief to Russia than a concentration upon Bolero to the exclusion of other offensive operations.

(5) Symbol

C.O.S.(43)33(0)

The Casablanca Conference in the second half of January was an important milestone in Anglo-American relations. The differences which had manifested themselves in the previous months as to future strategy were there discussed and eliminated. All the principal military leaders of both countries accompanied the President and Prime Minister to the Conference. In the series of meetings which took place a comprehensive survey was made of the future course of the war.

C.C.S.170/2
23.1.43.

The decisions reached were incorporated in a final report by the Combined Chiefs of Staff, which was approved by the President and the Prime Minister.

The main points were:-

C.C.S.65th/1 in
C.O.S.(43)30(0)
27.1.43.

(i) Security of sea communications. It was agreed that intensified bombing of U-boat operating bases and constructional yards should be carried out, and that escort craft should be re-organised and long distance air cover provided.

C.C.S.63rd/1

(ii) Continuance of supply convoys to Russia, provided the losses entailed did not become prohibitive.

C.C.S.66th/2

(iii) Husky was agreed on - the attack of Sicily, with the July moon as target date, unless it could be brought forward to June. General Eisenhower was to command, with General Alexander as deputy, Admiral Cunningham and Air Chief Marshal Tedder being naval and air commanders.

C.C.S.65th/2

C.C.S.68th/1

C.C.S.68th/2

(iv) In the United Kingdom the American bomber force was to operate under the strategical direction of the Chief of the Air Staff. A directive to the two bomber forces was agreed upon.(1) The Bolero build-up in the United Kingdom was calculated to be four divisions by mid-August, and three more per month until the end of the year - a total of 15 by 31st December. A combined Staff was to be established immediately, under a British Chief of Staff, to plan for a return to the Continent, the Supreme Commander being appointed later.

C.C.S.67th/1

(v) Operations in the Pacific and Far East were agreed upon, including Anakim, the reconquest of Burma, the target date for which was provisionally fixed for 15th November, 1943.

C.C.S.62nd/1

(vi) The Axis oil situation was considered to be so restricted as to make the bombing of the sources of supply highly advantageous.

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(1) See next Chapter, and Appendix 1.

CHAPTER 2

BOMBING POLICY

(1) Planning the Combined Offensive

C.O.S.(42)141(O)

U.N.A.F.(42)3 in C.A.S.858 (A.H.B./ID3/858)

W.W.1(Final)

The previous volume of this narrative has described how the Anglo-American bomber forces were built up in 1942, in preparation for the full offensive in 1943. Following the Marshall Plan in April 1942 (see Chapter 1), a new schedule for the allocation of American aircraft was worked out. This was embodied in the Arnold/Towers/Portal Agreement in June, by which the quotas previously promised to the Royal Air Force were drastically reduced. The American desire was that "every appropriate United States aircraft should be manned by United States crews". The President had said in January that it would greatly encourage the American people to hear that their bombers were in action against Germany. It had been decided that there would be no difficulty in providing the aerodromes and accommodation required in the United Kingdom by September 1942. With the further increase anticipated by April 1943 airplane but not personnel accommodation would be available. The chief limiting factor was labour, so the Americans were requested to assist in this respect.

C.S.12569 Encl.5B.

A.C.A.S.(Ops) Folder J2.

General Spaatz left Washington on 10th June, 1942 to assume command of the United States Eighth Air Force, whose headquarters (code name Widewing), were at Bushy Park. The Eighth Bomber Command headquarters (Pinetree) were already established at High Wycombe under General Eaker. In July General Eaker proposed that the co-ordination of the U.S. and British Bomber Commands should be secured by his continuing to attend the operational conferences at Headquarters Bomber Command. A close liaison should be maintained between the two commands. In addition a Committee for the co-ordination of Combined Air Operations was formed on 20th August at Air Ministry with A.C.A.S. (Ops) in the chair. Meetings were held during the Autumn and Winter of 1942. The United States bomber force carried out its first operation on 17th August, 1942. (1)

C.O.S.(42)345 (O) 30.10.42.

When the Torch operation in North West Africa was finally decided on in preference to any immediate action across the Channel, the bomber offensive took on increased importance. In September priority was given to Sickle (the movement of the U.S.A.A.F.) in preference to the other parts of Bolero, (the build-up of American forces in the United Kingdom). The bomber force was once more the principal means of offensive action against Germany from the United Kingdom. The Air Staff planned to build-up an Allied force of 4,000 to 6,000 bombers by April 1944, and this proposal was embodied in the "Future Strategy" Paper submitted by the Chiefs of Staff in October 1942.

Ibid. Part II/28

This Paper laid great emphasis on the part to be played by bomber forces:-

> "The creation in the shortest possible time of a great Anglo-American force of heavy bombers will require high priority, qualified only by the necessity of providing adequate air forces for the maintainence of sea communications and for such military operations as it is decided to undertake".

/The

(1) The official U.S. Air History "The A.A.F. in World War II" Volume II contains an account of the build-up of the American bomber forces.

D.O.42(20th)5
AHB/
I.D.4/376
Encl. 11A
C.O.S.(42)423(O)
30.11.42.

J.S.M.611
31.12.42.

The Prime Minister expressed serious doubts as to the prospects of American day bombing attacks upon Germany. He was in favour of the United States VIII Bomber Command being converted into a night bombing force. The Air Staff feared that such an attitude would cause the Americans to divert their air power to the Pacific, and believed that there was a good chance of successfully operating by day. They considered that the best value would be obtained from the limited shipping available by using it for American air forces in the first instance. The United States Chiefs of Staff had also come to the conclusion by December, 1942 that "an integrated air offensive on the largest practicable scale" must be one of the primary objectives of the United Nations in 1943.

(2) The Purpose of Bombing

In the discussions on general strategy during 1942, several assessments had been produced to show the effects anticipated from the bombing offensive. A brief examination of these will show the opinions held at the time as to the efficacy of bombing, and the best use of bomber resources.

D.O.(42)47
20.5.42.

The Singleton Report was produced for the Defence Committee in May, 1942, as an impartial assessment of the value of bombing. Mr. Justice Singleton concluded that the enemy war effort might be hindered or hampered:-

(a) By damage to factories, etc., engaged on war work, public utility services and communications.

(b) By the hold up of fighter aircraft on defence work.

(c) By keeping occupied a large number of men and guns on anti-aircraft work, searchlights and A.R.P.

(d) By the lowering of morale.

His final conclusion was:-

"If Russia can hold Germany on land I doubt whether Germany will stand twelve or eighteen months' continuous, intensified and increasing bombing, affecting, as it must, her war production, her power of resistance, her industries and her will to resist (by which I mean morale)"

C.O.S.(42)379(O)
3.11.42.

On 5th October the Chiefs of Staff Committee requested the C.A.S. to prepare an appreciation of the effect of a heavy bomber force rising to a peak of 4,000 to 6,000 heavy bombers by 1944. This was a contribution to the preparation of the Future Strategy Paper. In this estimate the results to be expected were based on an analysis of German bombing of the United Kingdom during the year ending 30th June, 1941. In this period 55,000 tons of bombs were dropped, 41,000 people were killed and 45,000 injured seriously. A million people were rendered homeless. As bombing technique had vastly improved since then, an estimate based on these figures was considered very conservative.

/During the

During the period of development of the Allied bomber force contemplated, the scale of attack should be 25,000 tons per month by June, 1943, rising to 50,000 tons by December and 65,000 tons by June, 1944. By the end of 1944 1¼ million tons should be dropped on Germany. Six million houses should be destroyed, 900,000 people killed and a million seriously injured, and 25 million rendered homeless.

The effect of this on the German war machine was considered. Fifty-eight towns had been selected as the most important to the German war economy. They comprised nearly one-third of the total urban population of Germany, and, it was estimated, more than one-third of total German industry. By the concentrated attack envisaged these towns could be converted into a liability to the German war machine instead of an asset. As it was believed that the German economy was stretched to the limit, the conclusion was reached that the loss of this one-third would be borne mainly by the war potential, and would be more than it could stand. Although it was realised that every effort would be made to improve the German defences, it was believed that the weight and method of Allied attack would more than counter such improvement.

C.O.S.(42)478(O)

The C.I.G.S. criticised this paper on a number of grounds, but chiefly because the build-up of such a force would preclude the simultaneous build-up of an army organised for offensive operations. The Future Strategy paper contains a synthesis of the views of the Chiefs of Staff:-

C.O.S.(42)345(O) (Final) Part II/32/ 30.10.42.

"The aim of the bomber offensive is the progressive destruction and dislocation of the enemy's war industrial and economic system, and the undermining of his morale to a point where his capacity for armed resistance is fatally weakened".

This was the overall bombing concept which held its place in both the Casablanca and Pointblank directives of 1943.

The priority chosen for the attack of specific German industries depended primarily upon assessments made by the Ministry of Economic Warfare.

M.E.W. Intelligence Weekly Report No.45 24.12.42.

"Its survey of the Economic Position in German Europe" issued in December, 1942 summarised these assessments:-

"On balance Germany's production of weapons and munitions has doubtless fallen, since, in the munitions industries, a labour force, working under greater handicaps has had to divert increased effort to civil purposes. Since aircraft production, Naval ship building and motor-vehicle production have been maintained or increased, the reduction must have fallen on the sector which includes tanks, guns and ammunition. Rail transport runs to schedule, only because important traffic is not carried. Germany's war economy is being continually adjusted, with considerable skill, to the limitations imposed on it by two steadily increasing threats - shortage of materials and shortage of men.

"Oil shortage has begun to affect military as well as industrial efficiency; and the shortage of metals, especially copper, nickel and chrome, has made necessary adjustments expensive in effort, if not always in efficiency. The addition of another 700,000 foreign workers since the spring has no more than offset the further drain of men into the Forces, whilst dilution

/and

and fatigue must have further reduced industrial efficiency. The increased scale of air attack has accentuated every unfavourable factor, wearing down workers, destroying plant and stocks and creating at the same time new demands for labour and materials for building and consumer goods."

The final assessment made by M.E.W. of the priorities for air attack among economic targets in 1943 is given in full in Appendix 2. The overriding priority accorded to U-boat targets in the Casablanca directive was due to Admiralty pressure and to the influence of the war at sea upon the whole range of economic supplies to both the Axis and the Allied powers.

(3) Night and Day Attack

Night bombing had originally been forced upon the British bomber force, to avoid annihilation in the days of overwhelming enemy superiority. Whilst this superiority continued the technique of night operations had been developed. After early attempts to bomb specific objectives, the method of area attack upon industrial centres was used, as the only economical method until more accurate bombing and navigational aids should be available. By this means those bombs which failed to hit a worthwhile industrial target should demolish workers' houses or public utilities, thus causing delays in production, and affecting the morale of the civil population. With the advent of improved bombing aids these arguments still held good, whilst a greater concentration could be achieved. Having specialised in night operations British aircraft were inadequately armed for daylight penetration. German fighters were now equipped with cannon, whose range was much superior to the .303 machine guns with which British bombers were equipped. This disparity was unimportant at night, where close range was essential to identify the target, but would have been fatal by day. It was considered, moreover, that with Pathfinder technique and the new radio aids, results at night should be equal to those on the average day. Few days would provide perfect visibility at adequate heights.

American policy was to attack specific targets in daylight. The aircraft were designed for it, the aircrews not trained for night work, and the Nordern bombsight was efficient only in clear daylight. The British Air Staff was very sceptical of the possibility of operating economically by daylight, and anxious that the Americans should prepare themselves for a change-over to night bombing.

AHB/
1D/12/142
Minute 10.10.42.

General Eisenhower took up this matter with the American air staff and reported that it was under intense study. At the 20th meeting of the Defence Committee in December 1942 the Prime Minister's opinion was:- "They might perhaps succeed in carrying out sporadic attacks in favourable conditions." The final draft of the "Future Strategy" paper also expressed some doubt:-

DO(42)20th/5.

C.O.S.(42)466(O) Final, Annex 1.

"In spite of the progress made during recent months by the United States Bomber Command in the bombing of targets in Occupied Territory, it is still an open question whether regular penetration of the defences of Germany by daylight will be practicable without prohibitive losses."

/To counter

AHB/
1D/12/142.

To counter these doubts regarding daylight operations General Eaker produced a paper in January 1943 on "the Case for Day Bombing". His principal points were:- day bombing is more accurate; a smaller force can destroy a given target; it is an ideal complement to the R.A.F. night bombing, keeping the German defences alert for the 24 hours; it prevents congestion in air space over the U.K.; the Americans would need a long period of training to change over; American bombers and equipment were designed for day work; German day fighters would be destroyed. In considering this paper Air Chief Marshal Tedder pointed out that "the real question is whether the American bombers can in fact penetrate into Germany without prohibitive losses." Only experience could prove this point, and after some months of doubt, the Americans proved it practicable by the summer of 1943.

The argument as to the relative merits of night area attack and daylight precision attack can be approached from many viewpoints. The final argument at the time was practicability. The effect expected from the attack on morale was examined after this type of operation had proved necessary. In this connection it is interesting to note the opinion of Dr. Goebbels, the German propaganda Minister, according to the "Goebbels Diaries" for 21st September, 1943:-

> "Speer claims that the production deficit in the armament industry is not too great after an enemy air raid. The fact that bombed cities undergo pretty bad dislocations of public life, as a result of which the workers often stay away from their workbenches for weeks, is far more aggravating. Thus, for instance, the Lanz works at Mannheim have been completely ready for production for a fortnight, yet only 60 per cent of the workers have thus far returned. This explains our large production deficit. That is also the reason why the English are more interested in destroying cities than in destroying the munitions industry. Destruction in the munitions industry can be more easily repaired than is the case with the disorganization caused in cities and especially in residential sections."

The question of morale bombing is discussed more fully in the preceding volume of this narrative. The effects of night area bombing are considered in the last chapter of this volume.

(4) The Casablanca Directive

S46368/IV
Encl.1A.

The Bombing Directive, which was agreed by the Combined Chiefs of Staff at Casablanca, had been drawn up by the British Air Staff in very broad terms, to cover the requirements of all the Services. In the priority of bombing objectives, submarine construction yards came first, owing to the critical losses being inflicted by U-boats at this time.(1) The German aircraft industry was placed second as it was thought to be in a vulnerable condition, and the establishment of air supremacy was a pre-requisite both to effective attack upon German industry, especially by the American Day Bomber Force, and to invasion. Transportation was placed third owing to its general effect in dislocating industry, and the effect upon it obtainable by area bombing.

/The

(1) See Chapter 4.

The oil situation was still considered to warrant the placing of oil targets next in priority, whilst any other targets in the enemy war industry were covered by the final item.

The full text of the Directive can be found in Appendix 1. Its substance was as follows:-

CCS/166/1/D
21.1.43.

The Primary Object of the bomber offensive was the progressive destruction and dislocation of the German military, industrial and economic system, and the undermining of the morale of the German people, to a point where their capacity for armed resistance would be fatally weakened.

Within that general concept, the primary objectives, subject to the exigencies of the weather and tactical feasibility, were laid down in the following order of priority:-

"(a) German submarine construction yards.

(b) The German aircraft industry.

(c) Transportation.

(d) Oil plants.

(e) Other targets in enemy war industry."

This order of priority might be varied from time to time according to developments in the strategical situation. Moreover, other objectives of great importance from the political or military point of view should be attacked. Examples of these were the submarine bases on the Biscay coast, and Berlin, to be attacked when conditions were suitable to reduce German morale or improve that of Russia.

Operations were also to be directed against Northern Italy, in co-ordination with operations in the Mediterranean; against the German fleet in harbour or at sea; and in daylight attacks upon suitable objectives in Germany and, subject to political limitations, in occupied territories. The purpose of these day raids was to destroy objectives unsuitable for night attack, to maintain continuous pressure on German morale, to impose losses on the German day fighter force and to contain German fighter strength away from the Russian and Mediterranean theatres of war. When the Allied armies should re-enter the Continent, all possible support was to be rendered to them.

This Directive was forwarded to the A.O.C. - in-C. of Bomber Command on 4th February, 1943. It replaced the directive of 14th February, 1942, and its principal provisions remained in force until the end of the war. The A.O.C. -in-C. pointed out that it was "a very broad Directive stating in general terms the future policy". He awaited the Air Ministry interpretation of it.(1)

CMS.330
Encl.106A.
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"Bombing Policy"
11.3.43.
II/ 70/272(C)

The C.A.S. commented on this, "What his directive really means is that he should obliterate Hamburg, Bremen and Kiel as quickly as possible and that when weather does not allow attacks on these cities he should go for others of the highest industrial value, with a preference for those which are important in the U-boat and aircraft industries. Berlin and the Biscay bases are extras."

/A detailed

(1) M.E.W. recommendations forwarded on the same day are given in Appendix 2.

A detailed study of operational policy was made by the British and American Staffs during the months following. This resulted in the Combined Bomber Offensive Plan, which was put into effect by the new directive in June, 1943. These discussions are dealt with in Chapter 9 below, along with the new strategical factors which had to be taken into consideration.

CHAPTER 3

OPERATIONAL PLANNING

(1) Planning Organisation

The Casablanca Directive laid down in very broad terms the primary objectives for Bomber Command and the American VIII Bomber Command. These were "subject to the exigencies of weather and of tactical feasibility". A number of agencies were available to advise on the actual choice of target, but the Command concerned was responsible for this choice. The tactical factors could not be assessed elsewhere.

The Ministry of Economic Warfare was the principal source of information concerning the current importance of any target. The "Bombers Baedeker", produced by this Ministry during 1942, provided a useful summary of all relevant information on every known target in Germany and other countries. The state of production and the supply position in each industry and at each plant were continually under review. There was a constant search for "bottlenecks", such as shortage of ball-bearings, by the specialists engaged on the study of each industry.

AHB/ ID4/376/108A

The information provided by M.E.W. was supplemented by the Air Intelligence Directorate from sources such as the British Intelligence Service, neutral observers reports and photographic reconnaissance. Advice on the effects of bombing and similar subjects could be obtained from the Ministry of Home Security. And the other Service Departments continually provided information and requests for attack upon objectives in which they were interested.

The Bomb Targets Committee, which met fortnightly at the Air Ministry under the chairmanship of the Director of Bomber Operations provided an opportunity for discussion. It was attended by representatives of the above sources of information, (except the M.H.S.) as well as of Bomber Command and the other home Commands. It was concerned principally with tactical objectives, their day-to-day priorities under existing directives being kept under review. The U.S.A.A.F. was also represented at these meetings.

AHB/ ID12/33

In April, 1943, General Arnold suggested that the time had come for setting up some form of permanent committee for the co-ordination of bombing operations between the Allies, and for the planning of future operations. To this end, a Combined Operational Planning Committee was appointed in June, composed of representatives of Bomber and Fighter Commands, the Eighth Air Force, VIII Bomber and VIII Fighter Commands, with a co-opted representative from the Air Ministry Directorate of Bomber Operations.

AHB/ ID4/376

Its purpose was to enable the air forces to co-ordinate individual plans; to prepare tactical plans for passing bomber forces through the enemy defensive system; and to study the execution of these plans. Since it was concerned principally with daylight tactical factors its connection with the British night bomber force was not of great importance. Being the only force operating by night, Bomber Command formulated and investigated its own tactical methods. The Combined Planning Committee was, in effect, merely an additional means of liaison with the Americans on any tactical questions which might be common to both.

C.S.19364

/The tactical

The tactical planning of Bomber Command night operations centred around the C.-in-C's daily conference at 0900 hours, in the Operations Room at Bomber Command. This conference was attended by the Commanding General of the VIII U.S. Bomber Command and Staff representatives from Operations, Intelligence and Sections of H.Q., B.C. Navigation. The Meteorological Officer forecasted the weather for the coming night at bases on the Continent. Intelligence advised the C. -in-C. in the choice of a target in an area suitable for bombing, and assisted the Navigation representative in suggesting a route to and from the target. The route was planned to spend minimum time over enemy territory, avoid gun defended areas and deceive the enemy's fighter defences. The C.-in-C. decided on the aiming point, the effort to be despatched against the main target and any subsidiary target, such as minelaying, and the proportion of incendiaries and H.E. bombs to be carried.

After discussion with the Groups, the operation order was passed to them. Orders were passed by them to the stations, where the detailed tactical plans were worked out, according to the Pathfinder technique decided upon. The Pathfinders would mark turning-points on the route, and would mark the target according to the weather conditions prevailing, with sky or ground markers.

(2) Factors Affecting Planning

The operations carried out during the first half of 1943, especially those by Bomber Command, do not always appear to conform to the priorities laid down in the Bombing Directives. It is necessary, therefore, to consider the tactical or other factors which affected the choice of targets. The principal ones were the weather in different parts of enemy territory, the radio aids available and their limitations, and the intelligence gained both of the effect of operations carried out, and of the importance of further targets.

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~~BC/S29949/Ops.~~
1(P).

Up to 1943 the weather had severely limited the choice of targets on any night. With the improvement in Pathfinder and bombing technique, principally due to the use of H2S and Oboe, weather over the target area became less important. This enabled operations to be carried out on a greater number of nights. It also helped to combat the growing menace of enemy night fighters. Since moonlight and clear conditions were not so necessary, it was possible to operate in conditions unfavourable to the enemy. The increasing loss rate meant, however, that frequent changes of tactics and targets had to be made. Strict fulfilment of the target priorities laid down could not be achieved without prohibitive losses.

See Annex.

The two new radar devices in use in this period were H2S and Oboe, which are described in the Annex.(1) H2S had been available in 1942, but was not released for use over Germany until January, 1943. Thereafter it was used as a navigational and bombing aid on targets beyond Oboe range, in particular the North German ports. Oboe had been tried out on a small scale before this period, but the small number of fitted aircraft had not allowed of its use for full-scale target marking. Numerous individual Oboe Mosquito attacks had been carried out for experience. From March, 1943, onwards, it was used to good effect in the Battle of the Ruhr.

/The

(1) See Annex, Chapter 5.

The operations during this period fall into three main categories; attack on U-boat bases, on the Ruhr and Rhineland, and on South German towns. In addition there were operations against Italy, Berlin, Czechoslavakia and other special targets, and an extensive minelaying campaign. The first main group was directly in line with the Directive. It also made use of Oboe against the French bases, and of H2S against those in Germany. The second group was a direct application of the use of Oboe in the most effective area - the Ruhr. The extreme value and anticipated short life of this device made its exploitation a matter of prime importance. The third group was mainly a tactical alternative, in line with the object of the Directive - "the undermining of the morale of the German people." The other attacks either had the same aim, as in the case of Berlin, or were due to special instructions or intelligence concerning the fleeting importance of a target, as in the case of Spezia, where the Italian fleet was located. The minelaying campaign was a steady contribution to the blockade of Germany, and a means by which new crews gained relatively safe operational experience.

In viewing the operations at this period, the following factors must therefore be borne in mind:-

(a) The C. in-C's fidelity to the morale plan of 1942.(1) This led to the choice of the largest target amongst those available. By this means, he argued, the greatest effect was obtained from every bomb.(2) Those which were inaccurate would not be wasted.

(b) The first consideration on any night was the weather. This usually limited the target area drastically, and affected the tactics which could be employed.

(c) The directive in force covered a large variety of targets, leaving the choice to the operational commander.

(d) The need to exploit Oboe before it was jammed was a major factor from February to July.

(e) The limitations of H2S were a major factor after this. A compact target, if possible against water and away from high ground, was required. The gradual improvement in the definition and operation of H2S extended its scope, until Berlin could be successfully tackled at the end of the year.

(3) Bombing Methods

With the introduction of H2S and Oboe as navigational and blind bombing aids, standard blind bombing techniques were developed. These, known as "Wanganui" and "Parramatta" were introduced on 29th December, 1942 and revised on 2nd February, 1943. They were employed on many of the attacks upon German industrial centres in this period.

/"Wanganui"

(1) See previous volume.

(2) See Bomber Offensive by Sir Arthur Harris, P.88.

"Wanganui" was used when cloud obscured the target. Sky-marker flares were placed at the release point at frequent intervals by H2S aircraft. The bombing aircraft had to approach the target on a given heading to release at the point marked. When Oboe Mosquitoes used this method it was known as "Musical Wanganui". There were at first insufficient Oboe Mosquitoes to maintain the marking throughout the raid, so backers-up were employed, using different coloured flares.

"Parramatta" was the method of using ground markers without visual identification of the target. It was used by H2S aircraft when cloud conditions permitted. "Musical Parramatta" was the version of it employed by Oboe Mosquitoes, with less continuous marking. Backers-up were used to fill in the intervals of Oboe with ground-markers of a different colour.

The "Newhaven" technique had been employed in 1942. It consisted of blind markers laid on the ground to guide the illumination of the target by bundles of flares. The illumination was then used by selected Pathfinder crews to identify the target visually. These crews laid ground-markers of a different colour at which the main force aircraft were ordered to aim.

In the "Illumination" method of attack, from which these later methods developed, Pathfinders laid sticks of flares over the target. It was then the responsibility of each main force crew to identify and bomb the target visually by the light of these flares. This method was abandoned with the success of the new radio marking methods, except on very rare occasions.

(4) Assessment of Results.

For the first year of the War the results of bombing were assessed from crews reports and intelligence sources. The former were naturally optimistic. A crew would search for their target, and bomb what they judged to be its position by inadequate evidence, often a glimpse of a river bend through a cloud. No radio aids or adequate flares were available. Intelligence reports were scrappy, inaccurate and a long time after the event.

With the gradual improvement in night photography, and in the provision of cameras, and above all with the large increase in photographic reconnaissance by day, the paucity of results obtained became obvious. Attack upon large area targets was the immediate answer.(1) In the autumn of 1941 the Operational Research Section of Bomber Command was set up, and began to assess results from all the evidence, and keep statistics illustrating the progress made.

By 1943 large numbers of night photographs were being taken, showing the actual release of the bombs. Plots were made of these, by which an assessment of the bomb concentration and of the area attacked could be made. Immediate lessons could be drawn from these plots, as to the advantages of different tactics. For example, it was found that later aircraft tended to undershoot on the markers, owing to the large area of earlier attack usually visible by then. This could be corrected either by varying the direction of approach of later waves, or by instructing the later marker aircraft to place their markers beyond the target.

/Daylight

(1) See Chapter 2 (3) above.

AHB/
ID/4/23A
Flag.27.

Daylight reconnaissance was almost invariably available within a few days of an attack. The interpretation of photographs in the light of known effects produced by enemy attacks in the United Kingdom gave a fair assessment of the attack. This assessment was used to judge what further attacks upon the target might be necessary. Owing to the extraordinary speed with which repairs were effected by the enemy, even this assessment was usually optimistic, as shown by post-war investigation.

CHAPTER 4 SECRET

THE ANTI U-BOAT CAMPAIGN

(1) Bomber Aid In The War At Sea

C.O.S.(43) 30(O) 27.1.43.

"Security of sea communications.....The combined Chiefs of Staff agreed that:-

(a) Intensified bombing of U-boat operating bases should be carried out;

(b) Intensified bombing of U-boat constructional yards should be carried out. "

This was the first point made in the final report of the Casablanca Conference to the President and Prime Minister.

Throughout the war the Admiralty had pressed for greater assistance from the Bomber Force in the war at sea. The Air Staff and Bomber Command usually opposed it, as a diversion from the proper role of the Strategic Bomber Force. This Admiralty pressure, and the critical state of sea communications resulted, however, in a very considerable diversion of bombing effort from the attack on Germany. This was expended in mine-laying, anti-submarine patrols, attacks upon shipping and attacks upon port facilities, shipyards, fuel depots and armament plants connected with naval construction. The full story of the war at sea is covered in another narrative.(1) It is briefly dealt with here to illustrate the reduction caused by it to the bomber offensive against other aspects of German war industry.

The Bomber Command attacks upon the objectives described in this chapter took place, with one exception, before 6th April, 1943. After that date Bomber Command concentrated on the attack of German industrial areas. Damage caused to submarine construction and other marine targets was incidental. The general account in later chapters includes such effects, which cannot be examined in isolation.

U.S.S.B.S. German Submarine Industry Report (Page 31).

During the whole of 1943, the U.S. VIII Air Force dropped a total of 20,362 (American) tons of bombs on submarine installations of various kinds, which represented 41.8% of the total dropped. For the first six months of the year the principle target system of the force was submarine construction and operating facilities. Of the total air effort, 63% of the VIII Air Force and 30% of the R.A.F. tonnage dropped during the first quarter of 1943 was on submarine facilities. In the second quarter of the year, 52% of the VIII Air Force and 30% of the R.A.F.

/tonnage

(1) A.H.B. Narrative, The R.A.F. in Maritime War.

tonnage were thus expended.(1) By June, 1943, the submarine had been substantially defeated at sea and the principle effort was shifted to other targets, with only 16% of the VIII Air Force tonnage directed against submarine activities.

..... In addition to these attacks, whenever weather conditions permitted, anti-submarine patrols were carried out daily by aircrews under training and mines were laid nightly by inexperienced squadron crews, occasionally supplemented by a heavier effort when weather conditions forbade attack upon Germany. The effect of all these measures, with those of the Admiralty and Coastal Command, was to increase the sinkings of U-boats from an average of fourteen per month (13%) to a figure of 37 U-boats sunk in May, 1943, or 30% of all those at sea.

Fuehrer Conference on Naval Affairs.

(2) U-Boat Bases in France.

The Admiralty began to press for bombing attack upon the U-boat bases in France in the autumn of 1942. On 12th October, the First Sea Lord submitted a memorandum to the Chiefs of Staff on the importance attached by the Admiralty to these bases. At the C.O.S. meeting on that day he stated that General Spaatz intended to attack them. This was confirmed bythe Chief of Air Staff. In spite of serious doubts as to the value of bombing the concrete pens, the Americans were anxious to use them as aiming points, to gain experience. They argued that some damage should be done to surrounding installations. Permission to attack these targets was given to them on 19th October.

C.O.S.(42) 147th(O) Minute 1.
AHB/ ID/12/142.
C.S.16536.

The question of bombing the Biscay ports by night was raised at the Anti-U-boat Committee meeting on 13th November by the Secretary of State for Air. The Prime Minister deprecated it at that time on political grounds and suggested that it should be brought up at the War Cabinet later. The matter was discussed again in December, when the Air Ministry and the Foreign Office were against it. On 23rd December the First Sea Lord pressed for heavy attack upon these ports, as the whole of the U-boat campaign was based on their availability. The Prime Minister told him to raise the matter with the War Cabinet.

/As a result

(1) The summary below shows how this effort was directed. All the R.A.F. attacks took place before 6th April. The full details can be found in the Diary of Operations at Appendix 10.

Major Attacks on U-Boat Yards Feb./June, 1943.

Target	No. of Attacks			Bomb Tonnage		
	British	U.S.	Total	British	U.S.	Total
France						
Lorient	5	3	8	3263	530	3793
St. Nazaire	4	4	8	2896	710	3606
Brest		3	3		224	224
La Pallice		1	1		88	88
Rennes		2	2		234	234
Bordeaux		1	1		92	92
Germany						
Wilhelmshaven	4	4	8	2002	875	2877
Hamburg	2		2	1315		1315
Kiel	1	3	4	1381	567	1948
Bremen	1	2	3	424	473	897
Heligoland		1	1		166	166
Flensburg		1	1		119	119
Emden		3	3		308	308

As a result of the serious menace caused by increased U-boat operations, the War Cabinet decided on 11th January, 1943 to permit area attack upon U-boat bases on the French coast. The ports of Lorient, St.Nazaire, Brest and La Pallice were to be attacked in turn .....

CMS 330/1 Encls.88a, 92a.

> "with the object of effectively devastating the whole area in which are located the submarines, their maintenance facilities and the services, power, water, light, communications etc., and other resources upon which their operations depend."

CMS 330/1 Encl.96a.

Five heavy night attacks by Bomber Command, and one day attack by the Eighth Air Force were carried out during that month upon Lorient, the first base chosen for attack. The Casablanca Directive of 21st January, quoted these bases as "objectives of great importance":-

> "Submarine operating bases on the Biscay Coast. If these can be put out of action, a great step forward will have been taken in the U-boat war which the C.C.S. have agreed to be a first charge on our resources. Day and night attacks have been inaugurated and should be continued so that an assessment of their effects can be made as soon as possible. If it is found that successful results can be achieved, these attacks should continue, whenever conditions are favourable, for as long and as often as is necessary."

D.O.(43)1st/1 23.2.43.

On 17th February, it was decided to discontinue them "for the present." On 24th February, however, the Defence Committee decision to carry out "two full scale blitz attacks" upon St. Nazaire within the next month was communicated to Bomber Command. Three were actually carried out between 28th February and 29th March. It was not until 6th April that Bomber Command was released from this unprofitable task. After that the attack was maintained by the American bomber force alone.

CMS330/1 Encl.104a.

Ibid. Encl.109a.

U-boats were housed in heavy reinforced concrete pens in the French ports, but it was hoped to disrupt operations by area attack. The best indication of the effect of these attacks can be obtained from the minutes of the 40th meeting of the German Central Planning Office, held on 4th May, 1943. Grand Admiral Doenitz said that:-

U.S.S.B.S. German Submarine Industry Report (Page 19).

> "the Anglo-Saxons' attempt to strike down the submarine war was undertaken with all the means available to them. You know that the towns of St.Nazaire and Lorient have been rubbed out as main submarine bases. No dog or cat is left in these towns. Nothing but the submarine shelters remain. The Todt organisation built them because of far-sighted orders of the Fuehrer, and the submarines are repaired in them. The enemy has shifted his fight ------- since he has realized that he cannot effectively achieve anything by the air raids".

Lorient - In accordance with the directive the campaign against Lorient was continued by four attacks in February, on the night of the 4th, 7th, 13th and 16th. A signal from the Air Ministry of 17th February ordered their discontinuance until further notice.

/The first

The first attack, on 4th/5th February, was made by 121 aircraft. Most of these were Wellingtons, as the main heavy force was sent to Turin. Weather conditions were excellent, and 213 tons of bombs were dropped visually with a good concentration. Weather conditions were equally good on the three succeeding attacks. On 7th/8th February, 302 aircraft attacked, and on the 13th/14th, 437, and on the 16th/17th, 363.

O.R.S. Final Night Raid Reports.

Photographic reconnaissance on 16th February, revealed a vast amount of damage and another reconnaissance on the 19th confirmed this. The last raid had merely completed the destruction of already damaged buildings. It was estimated that 95% of the buildings in the old town had lost their roofs. Hardly any buildings in the arsenal or commercial area had escaped damage. 75% of the barracks on the island of San Michele were demolished, and in the Keroman peninsular, the dock railway station, offices, cement stores, cold storage and other works were damaged, the only things entirely to escape being the submarine pens. This assessment of the damage caused can be compared with Grand Admiral Raeder's statement mentioned above. "No dog nor cat is left in these towns. Nothing but the submarine shelters remain." The French army report states that 3,500 out of about 4,500 houses in the town were completely destroyed by 16th February. Most of the others were uninhabitable.

Bureau Scientifique de l'Armée

C.B.O. Progress Report.

The United States Eighth Air Force carried on the attack on Lorient on 6th March, 16th April, and 17th May. On the first two occasions a force of about 60 aircraft dropped some 130 tons per attack. On 17th May, two separate objectives were attacked, 80 aircraft on the "submarine installations" at Lorient, whilst a further 38 aircraft attacked the Keroman submarine base. A further small night attack by Bomber Command was carried out on 2nd/3rd April.

O.M.S.330/1 Encl.104a D.O.(43)1st/1 23.2.43.

St. Nazaire - In accordance with instructions from the Defence Committee, Bomber Command turned to the attack of St. Nazaire on the night of 28th February. An attempt at marking by the aid of Oboe was not very successful, but the target was well illuminated by P.F.F. backers-up. The night was cloudless, and a good concentration of bombing was achieved, 413 aircraft attacking, and dropping 1129 tons of bombs. Reconnaissance revealed severe and widespread damage. On March 22nd/23rd, it was planned to send a force of 643 aircraft to St. Nazaire. Owing to deteriorating weather, however, only 357 selected crews were despatched. The target was ground-marked by Oboe-equipped Mosquitoes, and 284 of the aircraft attacked, achieving a very good concentration. On 28th/29th March, another Oboe groundmarking attack was carried out by 297 aircraft. Mosquitoes which carried out a nuisance raid after the main force had finished, reported that the whole town seemed ablaze. A further small attack was carried out on 2nd/3rd April, by 49 aircraft, a further 40 attacking Lorient at the same time.

The United States bomber force attacked St. Nazaire on 16th February. After a small attack by 25 aircraft on 1st May, further heavy daylight attacks were made on 29th May and 28th June. About 250 tons of bombs were dropped on each occasion.

/Photographic

O.R.S. Final Night Raid Reports.

Photographic reconnaissance after the British attack on the last night of February showed approximately half the old town and many industrial installations to have been destroyed. Further reconnaissance after the later raids revealed steady progress in devastating the area. The greatest damage was caused by the raids of 28th/29th March. Two floating docks and a dry dock received direct hits, the former being sunk. There was no evidence that direct damage had been caused to the submarine pens, but it was considered that the usefulness of St. Nazaire as a harbour for shipping and a base for submarines must have been reduced by the havoc caused to the shipyards and dock installations, communications and living facilities of the town.

Other French Ports - The submarine base at Brest was attacked three times in this period by the U.S. Eighth Air Force in February, March and April, and La Pallice and Rennes were attacked in May. The summary below shows the weight of attack devoted to these objectives.(1) Daylight attacks were also carried out by small formations of Venturas of No.2 Group upon ports in France. During February Dunkirk was attacked nine times, Boulogne twice, and Rennes once in this way. In April Brest and Cherbourg were attacked twice each and Dieppe once, and Cherbourg was again attacked three times during May. After that No.2 Group was transferred from Bomber Command to the 2nd Tactical Air Force. The scale of these attacks can be seen in Appendix 10.(2)

/(3) Wilhelmshaven and Kiel

(1)

Major Attacks on French Ports, Feb/June, 1943.

Date	Place	Air Force	Aircraft Attacking	Aircraft Missing	Bomb Tonnage
Feb. 4/5	Lorient	British	121	1	213
" 7/8	"	"	302	7	770
" 13/14	"	"	437	7	1169
" 16	St.Nazaire	U.S.	65	8	143
" 16/17	Lorient	British	363	2	1003
" 27	Brest	U.S.	60	-	138
" 28/ Mar. 1.	St.Nazaire	British	413	5	1129
Mar. 6	Lorient	U.S.	63	3	139
	Brest	"	15	-	40
" 22/23	St.Nazaire	British	284	1	915
" 28/29	"	"	297	2	680
Apl. 2/3	"	"	50	1	172
" "	Lorient	"	40	-	118
" 16	"	U.S.	59	1	131
	Brest	"	17	3	49
May 1	St.Nazaire	"	25	7	51
" 17	Lorient	"	118	6	261
May 29	(St.Nazaire	"	147	8	247
	(La Pallice	"	34	-	88
	(Rennes	"	57	6	114
June 28	St.Nazaire	"	158	8	269

(2) Tonnages used are English tons except where stated.

(3) Wilhelmshaven and Kiel

As a result of the high priority given to submarine construction yards in the Casablanca Directive, the two great German naval ports of Wilhelmshaven and Kiel were chosen for attack by both the British and American bomber forces. Kriegsmarine Werft at the former and Howaldtswerke at the latter were engaged in submarine construction. Four large scale attacks upon Wilhelmshaven were made by Bomber Command during February, 1943, followed by four daylight attacks by the U.S. Bomber force in February, March, May and June. Kiel was attacked by the British in April and by the Americans twice in May and once in June. The scale of these operations can be seen in Appendix 10.

Wilhelmshaven - The first of the night attacks on Wilhelmshaven was carried out in blind bombing conditions on 11th February, with the aid of H2S. Sky markers were used, 138 aircraft claiming to have bombed by their indication. The next attacks were made on the nights of the 18th and 19th in clear weather conditions, and the last of the February attacks on the 24th, when blind bombing was again necessary. The American bomber force attacked Wilhelmshaven by day on 26th February, with a force of 64 aircraft. They made further attacks on 22nd March, 21st May, and 11th June. On the latter occasion the size of the force reached 168 aircraft.

The effect of these raids cannot be accurately assessed, as post war investigations do not show when damage occurred. Photographic cover showed that the Mariensiel Ammunition Depot was hit on 11th/12th February, as reported by crews on the raid. This is said to have resulted in 120 acres of buildings and storehouses being completely wrecked, and was certainly the most notable damage achieved in these raids. The second operation, on 18th/19th February, was displaced to the west of the target, and the bombing was mostly in open country, resulting in negligible damage. This was due to the inaccuracy of the H2S marking, and the provision of an effective smoke-haze by the enemy. The attack on the following night was scattered, due to failure of most of the P.F.F. markers, and conditions of cloud and haze. Apparently little damage was done once more. P.R.U. cover of these three raids showed considerable damage to the commercial Harbour, where the Deutsche works and shipyard, several oil tanks, some harbour works and other buildings were damaged. This was mainly attributed to the first raid on 11th/12th February.

O.R.S. Final Night Raid Reports.

The British attack on 24th/25th February, and the American one of the 26th were covered by the same P.R.U. sortie. The night attack was made through cloud, but most of the damage seemed to be in the centre of the town, with hits on dockyard buildings, quays and railway tracks.

Kiel - On 4th/5th April, Bomber Command carried out their only heavy attack upon Kiel during this period. There was ten-tenths of cloud over the target, so "blind bombing" had to be carried out, 507 aircraft claimed to have bombed on the markers. As ground-markers were used, the cloud obscured and diffused their glow, resulting in very scattered bombing. Little damage to the target could be observed by photographic reconnaissance.

German documents show that the alarm lasted from 22.32 to 0018 hours. "Four large flares, changing into red, white and green, fell in numerous stars".

A.H.B.6.
Translation.

55 H.E. bombs, of which 6 did not explode, 2,000 stick incendiaries, 240 phosphorous-rubber and 50 other incendiaries, and 11 fragmentation bombs were reported. Considerable material damage was caused to buildings, with a large fire in the Kolbe naval dockyard, and the destruction of a stretch of the Kiel - Hamburg main line, which took 10 hours to repair. 25 people were killed and 54 wounded, 10 of them severely.(1)

Ibid.

American daylight attacks were made on Kiel on 14th and 19th May, and on 13th June. The first of these, by 126 aircraft, was reported by the Germans as 50 to 60. The weather was sunny and clear. 505 H.E. bombs and 5/6,000 incendiaries were reported. Wharves, a hospital, the eastern Fire-Station, and other buildings were badly damaged. A passenger ship, Stadt Kiel, was sunk and 2 motor-ships burned out. Damage was caused to the electricity, telephone, gas, water, tramway and railway systems. 325 people were killed and 762 wounded. This was by far the worst of this series of attacks. On May 19th about 120 aircraft were reported, but only 103 took part. Gas, water, electricity and telephone systems in the Elmeschenhagen district were affected, but no industrial installations were damaged. German casualties were 22 only. The third attack, on 13th June, was by 44 aircraft, whilst the main force of 102 was directed against Bremen. The Germans reported 73 H.E. bombs, but little damage. There were 66 casualties.(2) 50% losses were suffered by the American formation in this raid. It was intended as a diversion, and the enemy devoted his major fighter effort to it. The formation leader, who was missing, was inexperienced, and carried on to the target in spite of the over-success of his diversionary object.

S.6706
encl.56A.

(1) German statistics such as these are tabulated in Appendix 18, and are, therefore, only briefly referred to in the following pages.

(2)

Major Attacks on Wilhelmshaven and Kiel, Feb/June, 1943.

Date	Air Force	Aircraft Attacking	Aircraft Missing	Bomb Tonnage
Wilhelmshaven				
Feb. 11/12	British	140	3	432
" 18/19	"	185	4	596
" 19/20	"	311	11	781
" 24/25	"	105	Nil	193
" 26		65	1	147
Mar. 22	American	84	3	200
May 21	"	77	7	172
June 11	"	168	8	332
Kiel				
April 4/5	British	519	13	1381
May 14	American	126	8	267
" 19	"	103	6	211
June 13	"	44	22	89

The formation became scattered and fell an early prey to fighters. The main formation was able to maintain its cohesion, and lost only four aircraft.

(4) Hamburg and other German Ports

In addition to the two big naval ports of Wilhelmshaven and Kiel dealt with above, a number of attacks in this period were aimed at other German ports, in order to reduce the submarine construction industry therein. Of these ports Hamburg was by far the most important, containing the construction yards of Blohm and Voss, Howaldtswerke, Deutsche Werft and Stuelcker Sohn, as well as numerous firms making submarine parts. Bremen and Stettin were also attacked by the British, with a small attack on Rostock at the same time as Stettin, and Bremen, Heligoland, Flensburg and Emden by the Americans.

Hamburg - Hamburg is dealt with in greater detail in a later chapter, as the attacks upon it in July and August were by far the most important in 1943.(1) There were two attacks in February and March, however, which must be recorded as a part of the contribution of Bomber Command to the anti-U-boat campaign. The first attack, on 3rd/4th February, was made in conditions of heavy cloud and icing. Only 142 out of the force of 263 aircraft which set out succeeded in attacking the target. Five of the 11 H2S aircraft reached the target and dropped skymarker flares to guide the bombing. The attack appeared to be rather scattered. German reports show 85 H.E. bombs and some 12,000 incendiaries in the Harburg and harbour areas.

U.S.S.B.S. area Report No.1 Table 6.

The second attack, on 3rd/4th March, was on a larger scale, 417 aircraft being detailed. On this occasion, however, the German decoy at the village of Wedal was highly successful in diverting the attack. Weather conditions were excellent, but some of the H2S dropped their markers at Wedal, 10 miles west of the aiming point, Altona railway station. Almost the whole of the main force bombed on these markers instead of those at Altona. German records show that only 33 H.E. bombs and 3000 incendiaries dropped in the Hamburg area at Bilbrok, Altona, Wilhelmsburg and the outskirts on the Elbe.

Bremen and Vegesack - The shipbuilding firms of Deschimag at Bremen, and Bremer - Vulkan at Vegesack, 10 miles downstream, were engaged in submarine construction. Consequently Bomber Command made one night raid on Bremen, and the Eighth Air Force attacked each place once by day, during this period.

The night attack was on 21st/22nd February, 1943. 143 heavy aircraft, 130 of which were Lancasters, took part. The target was covered in cloud, but the red Target Indicators showed through, and a good concentration of bombing was claimed. 129 aircraft reported successful attacks, but German records show no appreciable damage on this occasion.

The American daylight raid on Vegesack took place on 18th March, when 97 aircraft dropped 239 tons of bombs. Considerable damage was caused to buildings in the Bremer Vulkan works, but the U-boat programme was hardly affected. On 13th June, 102 American bombers attacked the Deschimag works at Bremen. Once more there is no record of any damage caused.

O.R.S. Report Bremen. App.III

/Stettin and Rostock

(1) See Chapter II.

AHB/IIH/241/3/823
~~BO/S.29949~~

Stettin and Rostock - On 20th/21st April, a highly concentrated attack was carried out on Stettin, whilst a small force visited Rostock. 326 of the aircraft directed against Stettin reported successful attacks. The weather was clear, and target indicators were placed extremely accurately, the whole attack being carried out almost exactly according to plan. 100 acres of the industrial area on the south of the city were reported to have been devastated. A diversionary raid by 11 Mosquitoes on Berlin prevented assistance being sent from there to the fire services, which were inadequate. Three shipyards and the naval base were reported as damaged.

O.R.S. Final Night Report.

A force of 86 Stirlings was sent to Rostock at the same time. The target was the Heinkel works there, but owing to the effectiveness of its smoke-screen, the town was attacked instead. Day reconnaissance later showed the damage to be in the centre of the built up area and the docks. 4½ acres in the Neptun Werft submarine yards were reported as devastated, including a boiler house, a factory building and some sheds.

Heligoland, Flensburg, and Emden - In Mid-May the Eighth Air Force began a series of attacks upon submarine bases in Germany. After the attack on Kiel on 14th May mentioned above, Heligoland was chosen for the second attack on 15th May. 76 aircraft attacked the submarine base there.

On 19th May Flensburg, on the Kiel canal, was attacked by 55 aircraft whilst the main force went to Kiel. 120 tons of bombs were dropped on the submarine building yard of the Flensburger Schiffau A.G. On 21st May the Nordseewerke shipyard at Emden was attacked by 45 aircraft.(1)

(5) Anti-Submarine Patrols.

Anti submarine patrols were carried out by Bomber Command aircraft almost every day during the first half of 1943. The area patrolled was the Bay of Biscay, and two detachments were at first employed on this duty. A detachment of No.10 O.T.U. had been stationed at St.Eval in Cornwall since 15th July, 1942. They carried out patrols in Whitley aircraft as a part of their training course. No.405 R.C.A.F. Squadron was detached to Beaulieu, under the control of Coastal Command, on 25th October, 1942, to join in this task in Halifax aircraft. This squadron ceased patrols at the beginning of March, 1943, and resumed duty with No.6 Group of Bomber Command.

/During

(1)

Major Attacks on the above German Ports, Feb/June, 1943.

Place	Date	Air Force	Aircraft Attacking	Aircraft Missing	Bomb Tonnage
Hamburg	Feb.3/4	British	142	16	393
"	Mar.3/4	"	354	10	922
Bremen	Feb.21/22	"	129	Nil	424
" (Vegesack)	Mar.18	American	97	2	239
Bremen	June 13	"	102	4	232
Stettin	Apl.20/21	British	326	22	847
Rostock	" " "	"	77	8	133
Heligoland	May 15	American	76	5	166
Flensburg	" 19	"	55	Nil	120
Emden	" 21	"	45	7	101

B.C.O.R.B. App.A541.

During February No.405 Squadron operated every day except four, with an average of four sorties per day. No.10 O.T.U. also missed only four days. Although several sightings occurred, only one attack was made by each detachment. That of No.10 O.T.U. was made on one of two surfaced U-boats on 4th February, from 150 feet. Debris was observed 10 minutes afterwards over an area of 260 square feet. One aircraft was lost by each detachment during the month.

In March, the average sorties were seven, and operations were carried out on all but five days of the month. Five sightings and four attacks were made on 22nd March, 21 250 lb. depth charges being dropped. Three other attacks were made during the month, and two aircraft were missing. In April only three days were missed, but the average sorties dropped to six. Seven sightings and three attacks were made, for the loss of one aircraft.

May showed a big increase in the number of attacks - 19 in the 25 days on which patrols took place. On 15th May, four out of the eight sorties despatched sighted five U-boats and attacked four of them with depth charges and machine-guns. Five aircraft were lost during the month.

Patrols were carried out on 26 days in June, the daily average being 6.5 sorties. Seven attacks were made during the month for the loss of three aircraft. On 14th June, 13 U-boats were sighted and three of them attacked.

B.C.O.R.B. July, 1943.

These patrols were continued until 19th July, after which the detachment was recalled from St.Eval to its parent O.T.U. Tributes were paid to its work by the First Sea Lord and the A.O.C.-in-C. Coastal Command.

For the period February-July the total number of sightings was 51, with attacks upon 38 of them. 996 sorties were despatched, for the loss of 16 aircraft missing, and a number more crashed or damaged on return. One of the missing aircraft in July shot down a J.U.88 after an engagement with five of them. A fuller account of these anti-submarine patrols can be found in the Coastal Command Narrative.(1)

(6) Mine-Laying

S.1636/2 Encl.185A.

As a means of giving new crews operational experience, or when bad weather precluded attack upon Germany, mine-laying continued to be an important commitment of Bomber Command. With the development of radio aids, which made the weather factor of less importance, the mine-laying effort tended to decrease. In early 1943, Bomber Command were expending about 1,000 mines per month, whilst Coastal Command were provisioning at the rate of 1,000 per week. By the beginning of March, a reserve of 3,500 had been built up, and the Admiralty were complaining of the failure of Bomber Command to maintain their earlier effort. It was decided at a meeting on 5th March, 1943, that 1,600 mines per month should be provisioned, to allow a surplus for occasional large scale operations. Owing to the build-up of stocks continuing, this was reduced to 1.200 per month in September, 1943.

Ibid. Encls. 198A & 199A.

/Mine

(1) The R.A.F. in Maritime War.

Mine laying was aimed at enemy shipping in general. It is dealt with here in connection with the U-boat campaign, as this was the principal preoccupation at sea in early 1943. The mine laying campaign from the air is dealt with at length in another narrative, including that of Bomber and Coastal Commands and the Fleet Air Arm.(1) A summary of the Bomber Command effort is included here for the period February 1943 to February 1944.

Ibid. Encl. 159A.

The mines in use during this period were "A" Marks I to IV of 1,500 lb. weight with parachute attachments, and Mark V of 1,000 lbs. They had to be dropped from below 3,000 feet, at a speed not exceeding 200 m.p.h. Three other types were under development, type "G" of 2,000 lbs., later called "A" Mark VI, for high level dropping, with a land detonator in case it should strike land, type "H" of 500 lbs.,(2) and type "J" of 2,000 lbs.

There were several occasions in February when the weather was unfit for bombing, and a larger scale of mine laying than usual was undertaken. On 6th/7th February, 72 aircraft were despatched to the Friesian and French Atlantic coast areas. On the night of the 18th, 89 aircraft were ordered to lay mines, whilst the main attack was upon Wilhelmshaven; and on the 27th 91 were detailed, as the weather precluded bombing. On both these nights the same areas were sown. The average sorties in February were 30, for 18 nights on which operations took place.

B.C.O.O.No. 170 12.6.43.

In March an operation order was issued, "to increase the dislocation to enemy shipping by extensive and repeated mine laying". However, during 20 nights operations in March, the average sorties were only 26.

S.1636/2 Encl.188A.

In April the average rose to 49 for only 14 days operations, owing to two large scale efforts after 27th April. These two operations were undertaken as a result of an Admiralty request, and in conformity with the operation order already issued. The Admiralty wished to make use of a new type of firing unit, employing an acoustic and magnetic fuse, to defeat the enemy's current sweeping methods. In order to cause the maximum confusion, it was essential to lay a large quantity of mines within a short period of time, in a similar manner to that adopted for the acoustic mine in 1942.(3) 458 mines were laid on 27th/28th April and 593 on 28th/29th April. The weather conditions over Germany were unsuitable for bombing on these nights, but were satisfactory for mining in the areas required. The mine laying was carried out at a low level underneath cloud layers. On the first night, the nearer and easier areas were dealt with; on the second night the Kiel and Baltic areas, heavier casualties resulting. For the two operations the casualties were 24 aircraft, compared with 18 for approximately the same effort spread over the previous month.

/Small scale

(1) See narrative The R.A.F. in Maritime War.

(2) For use against inland waterways.

(3) Operation Bobbery.

Small scale mine laying was continued in May, with one large scale operation only, on 21st/22nd May, by 104 aircraft. The average number of aircraft despatched to lay mines in May was 32, in 12 nights' operations. In June, the average sorties were 25 per day, as there were no large scale operations. Mining took place on 17 nights.

B.C.O.O. No.170 12/6/43.

Operation Order No.170 issued in March was revised and reissued to provide for future large scale mining. No such operations took place until September, however.

In 16 nights' operations in July, an average of 20 aircraft were employed, and an average of 58 mines were laid. August saw a slightly higher average in both respects - 32 aircraft and 65 mines. The highest aggregate of mining sorties were despatched since April. In the second half of the month, operations were on a fairly large scale on several nights. On the 15th/16th, 40 aircraft were sent to mine the French Ports and 23 to the area of the Friesian Islands. On the 22nd and the three succeeding nights more than 40 aircraft were despatched and again on the 27th/28th.

After August the effort fell steadily until the end of the year. In September, an average of 31 aircraft were employed on 13 nights. In October, the average was 33 for only 11 nights. This includes the despatch of 89 aircraft on the night of 2nd/3rd September and of 117 on 2nd/3rd October. On the latter occasion, nearly 300 mines were laid in the Baltic and Lorient areas. On 7th/8th October, 80 aircraft were despatched, but bad weather limited operations later. In the words of the No.3 Group summary October "began in a blaze of glory and finished in a haze of fog", as far as gardening was concerned.

There were no major mining operations in November or December. An average of 27 aircraft were despatched on the 13 nights of mining in November, and of 26 in 10 nights in December. The latter was the lowest month of the year both for total sorties, successful sorties and the number of mines laid.

AHB/ II/70/107.

By the beginning of 1944, plans were under discussion for special mining operations in preparation for Overlord. The proposals were to continue normal scale mine laying until about ten days prior to D-Day, but in special areas. Heavy mining operations should then be carried out using the new Mark VI mine, of which 3,000 should be laid within 20 days. The Mark VI mine was actually released for operational use on the last day of February.

AHB/ II/69/172 B.C.O.R.B. Air Staff 4/1/44.

Meanwhile, the technique of high level mine laying had been developed. A paper on the subject had been drafted by the Directorate of Bomber Operations in June, 1943. After discussions with the Admiralty, instructions were issued by Bomber Command to the Bomber Development Unit on 19th September, 1943, to carry out trials.

AHB/ II/69/171 BDU/S136/Arm. 23.12.43.

The directive stated that heights up to 15,000 ft. were required; the ballistics of the mine were to be determined; aiming at markers and timed runs from visible land marks were to be investigated; the accuracy of target marking by H2S was to be determined. The type of mine used was the standard one in use, "A" Mark I to IV of 1,500 lbs. The ballistics were found to be consistent, with a T.V. of 275 f/s. The average error for inexperienced crews was assessed at 800 yards maximum.

/As a result

B.C.O.I. No.76.

As a result of these trials, an operation instruction was issued for "high level mine laying by H2S", and the first operations were carried out on 4th and 6th January, by six Lancasters and six Halifaxes respectively off Brest. This method was adopted for future operations. It thus became possible to lay mines in the enemy's most heavily defended harbours and swept channels, at a very low cost.

The effort devoted to mining increased rapidly during January and February 1944. The January average for 11 nights operations was 34 sorties. In February the average rose to 51 sorties for 13 nights operations. High level mine laying by 115 aircraft was used as a diversion for the main attack by 734 aircraft om Schweinfurt on 24th/25th February. The areas mined were Kiel Harbour and the Kattegat by 110 heavy aircraft, and Lorient by five Wellingtons. On 25th/26th February, mine laying was again used as a diversion for the main attack on Augsburg, the areas being St.Nazaire, The Sound and Kiel.(1)

B.B.S.U. Sea Communications Report, page 16.

The results of mine laying were always hard to assess, owing to the time lag and other methods of attack. Numerous reports were received of enemy vessels sunk in the areas mined, however. It was believed in Bomber Command that damage to enemy shipping was to the tune of approximately 50 tons per mine laid during 1943. The final post-war assessment of enemy shipping losses is not yet complete. The Enemy Shipping Losses Assessment Committee estimated that 842 vessels, or 34.1% of all those assessed as sunk and and damaged in European waters, north of Dover during the war, were the results of mines laid by Bomber Command. It was estimated that 22 sorties were required per ship sunk at a cost of 0.55 aircraft lost. Total German losses for 1943 and the first two months of 1944 in the North Sea and the Baltic were reported by the Reichskommissar for Shipping, Karl Kaufmann, as 129 ships of 346,725 B.R.T.

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(1) The mine laying operations carried out can be seen in Appendix 10. The summary below shows the effort devoted to this task month by month:-

Mine Laying Operations, Feb.1943 to Feb.1944.

Month	Detailed	Successful	Missing	Mines Laid
Feb.1943	540	419	10	1165
March	511	398	17	1161
April	691	562	33	1887
May	378	320	8	1095
June	426	373	7	1177
July	313	274	6	927
August	484	401	10	974
September	397	342	2	1188
October	368	317	4	1067
November	352	319	8	963
December	256	203	5	894
Jan.1944	373	322	3	1096
Feb.	661	566	8	1737

CHAPTER 5

OBOE AND THE BATTLE OF THE RUHR (March/July 1943)

(1) The Problem of the Ruhr

The area of the Ruhr, in which was centred the German heavy engineering industries, had always been an objective of prime importance to the bomber force. The primary objectives of the Casablanca Directive, submarine and aircraft construction, were amongst its activities. It was also regarded as the most vulnerable area for the prosecution of the overall concept of the Directive - "the progressive destruction and dislocation of the German military, industrial and economic system, "since it was the most highly industrialized area in Germany.

The Ruhr had always presented a problem of special complexity from the operational point of view. Its very heavy defences made it expensive to attack, and the industrial haze by which it was almost invariably covered made it difficult to pick out an aiming point within it. For these reasons the frequent attacks made upon this area up to 1943 had been relatively ineffective.

The introduction of Gee as a navigational aid in early 1942 had led to optimistic hopes of achieving a high degree of accuracy in attack upon the Ruhr. These hopes had been disappointed, as its accuracy in the Ruhr was found to be considerably less than had been achieved in trials over the United Kingdom. At that extreme range and in the face of the Ruhr defences and the consequent necessity for avoiding action, it was found that the bombing error was too great. A number of large-scale raids were carried out in the spring of 1942, mainly against Essen. The effect was scattered, the town of Duisburg being the only one to receive serious damage.

With the introduction of Oboe in 1943 the attempt was renewed. The method of using Oboe and an account of the campaign against the Ruhr, from March to July 1943, will be found in the sections following. Individual towns are considered consecutively. The reasons for the choice of a certain place on any particular night were invariably tactical, the weather or disposition of enemy defences. The main effort of the Command during this period was directed against the Ruhr, and every suitable night was exploited, with the minimum essential diversions to other areas in order to keep the enemy defences dispersed.

The effects are described from photographic reconnaissance and from German records. A general assessment of the long-term effect is reserved for the last chapter of this Volume.

/The table

The table below shows the effort devoted to this campaign by Bomber Command.(1) A full list of operations during the period can be found in Appendix 10.

(2) The use of Oboe

See Chapter 4, (3) on Oboe.

The outstanding feature of Bomber Command operations in the early months of 1943, was the new bombing technique resulting from the use of Oboe. This device, first employed in December 1942, so changed the situation that night attacks on targets within its range became to a large extent independent of weather conditions over the target area. This relative freedom from meteorological limitations made possible a great expansion in the number of sorties carried out. In conjunction with the expansion of first line strength and the greatly increased proportion of heavy bombers in the force, this raised the tonnage of bombs dropped on Germany very considerably. The 1942 total was 37,197 tons, whilst that for 1943 was 136,433 tons.

Only a few Mosquito aircraft of No.109 Squadron were equipped with Oboe during January, 1943. This limited the period during which marking could be maintained, so that only small raids of about 60 aircraft could be carried out. During February, further experience in the use of Oboe was obtained by the despatch of one or two Oboe equipped Mosquitoes on most nights to carry out blind-bombing harassing raids on important Ruhr targets. Bochum and Ruhrort were thus attacked on 4th/5th February, by one Mosquito apiece, Dusseldorf by two on the 6th/7th, Essen and Hamborn on the 7th/8th. A full list of these attacks is in the Diary of Operations at Appendix 10.

Despatch by A.C.M. Harris.

The first large-scale attack in which Oboe was used as a marking device was against Essen on 5th/6th March, when 442 aircraft were despatched. The details of this attack are discussed below. It is relevant here, however, to

/describe the

(1)

Weight of Attack upon Ruhr - Rhineland, Feb/July, 1943.

(Large-Scale Attacks Only)

Place	Period	Aircraft Despatched	Aircraft Missing	Bomb Tonnage
Essen	Mar/July	2775	119	7440
Cologne	Feb/July	2592	100	7481
Duisburg	Mar/May	2089	84	5157
Dusseldorf	May/June	1542	65	4139
Dortmund	May	1422	69	3818
Wuppertal	May/June	1349	67	3641
Bochum	Mar/June	1102	61	2801
Gelsenkirchen	June/July	895	42	2737
Krefeld	June	705	44	2068
Mulheim	June	557	35	1643
Remscheid	July	273	15	778
Oberhausen	June	203	17	645

describe the plan of attack on this raid, which was typical of that used on major Oboe raids. Eight Oboe equipped Mosquitoes were followed by 22 heavy marker aircraft of the P.F.F. Group. From a pin-point at Egmont, on the Dutch coast, the main force of 412 aircraft flew direct to a point 15 miles north of the target. This turning point was marked by P.F.F. heavy aircraft with yellow route markers. The aiming point was marked by the Oboe Mosquitoes dropping red target indicators at intervals of three and seven minutes alternately. P.F.F. heavy aircraft backed up with green target indicators, dropped at intervals of one to two minutes throughout the attack. The red T.I.'s were given as the primary point of aim if they could be seen.

At a meeting held by the C.A.S. on March 11th, 1943, it was decided:

BC/S.27462/I
Encl.95B.
(A.H.B./IIH/241/3/930A-B)

"That Oboe should only be used by the R.A.F. over enemy territory on the occasion of heavy raids. Its use in light-scale and individual harrassing attacks should be discontinued."

Signal
AX 117

Bomber Command were instructed to use Oboe over enemy territory only for or in the vicinity of heavy raids. In spite of protests from No.8 (P.F.F.) Group, who wanted to carry out training operations, this restriction was maintained until November. The Air Staff wished to minimise the risk of Oboe equipment falling into enemy hands, whilst it was being fully exploited for target marking.(1)

(3) Essen

O.R.S.Report
No.S.235.

Krupps armament works at Essen covered about two square miles in the middle of the town, with a subsidiary plant on the outskirts covering another one-third of a square mile. This series of plants comprised the most important target in the war industry of Germany. They included blast furnaces, steel works, pressing, forging and rolling mills, and machine shops for the manufacture of guns of every size, tanks, locomotives and a variety of parts for aircraft and naval vessels, including submarines.

Ibid.
No.S.233

Essen was the largest town in the Ruhr, with a population of 670,000 in September, 1939, of which a large number were employed by Krupps. In addition the mining industry employed about 16% of the working population. Essen had been bombed more continuously than any other town in Germany up to 1943. The first attack was on the night of 24th/25th May, 1940 and the first 4,000 lb., bomb was dropped on it a year later. Up to March, 1943, the difficulty of visual identification due to the almost invariable haze which overshadowed it, caused the attacks upon Essen to be very largely abortive.

The attack was renewed with more promise of success with the introduction of Oboe. After experimental raids by Oboe-equipped Mosquitoes in early 1943, the first really successful attack was carried out on 5th/6th March, 1943. The new technique introduced on this attack has been described above. A thousand tons of bombs were dropped, with a very good concentration upon the target.

The summary below shows the weight of attack devoted to Essen during the "Battle of the Ruhr" from March to July

/1943, and

(1) See chapter 14 (1) for the Development of Oboe during 1943.

1943, and the proportion of the 54 major productive shops in Krupps works which were hit in each raid.(1)

In addition to the damage to Krupps' shown, the town's large gasometer was destroyed on the first big raid. The supply was not renewed for 25 days to the town centre. The electric power station was immobilised by failure of its water supply. The chief factories were supplied again next day, the town centre was at 50% four weeks later.

O.R.S. Report No.S.233 Appendix II

After this first larger scale operation, single Oboe Mosquitoes carried on the attack on the nights of 8th, 9th and 10th March. The heavy raid on the 12th/13th was nearly as effective as the first, and was especially effective in the Borbeck area, in which the subsidiary Krupps works were situated. The No.4 Foundry was totally destroyed, gas water and electricity supplies at Borbeck were effected. 10% of the buildings of the Stolberger zinc firm were destroyed or seriously damaged. 70% of the Goldschmidt Chemical Works were destroyed in the first two attacks.

The next operations against Essen, on 3rd/4th April and 30th April/1st May, were not quite so heavy, and the damage was not as severe, as can be seen from the table. The workshop making chemical apparatus was destroyed in the latter raid. Skymarking was used on both these raids, although it was possible to use groundmarkers in addition on the first. The skymarking was not maintained to the end of the second raid, resulting in some dispersal of effort.

/There were

(1)

Major Attacks on Krupps, Essen, March/July 1943.

446/ IIH/85 ~~A.M.W.R. Summary~~

O.R.S.Report No.S.235 Appendix 3.

		March		April		May	July
Date		5/6	12/13	3/4	30/1	27/28	25/26
Sorties	Despatched	422	457	348	305	518	705
	Attacking	366	384	317	251	493	627
	Missing	14	23	21	12	23	26
Tonnage of bombs Dropped	H.E.	509.4	524.8	513	422.5	762.3	1082.8
	Incendiary	543.5	564.8	470.2	416.8	680.4	949.6
	Total	1052.9	1089.6	983.2	839.3	1442.7	2032.4
Number of H.E. Plotted		70	125	20	30	75	350
No. of Major Shops Hit	Destroyed	-	1	-	1	1	6
	Heavy Damage	4	2	4	3	-	15
	Medium Damage	13	11	11	6	10	14
	Light Damage	18	15	16	10	15	7
	Total	35	29	31	20	26	42

NOTE The figures for bomb tonnage given in Appendix I of the O.R.S. Report on Krupps are incorrect, as the tonnage carried by the sorties despatched has been taken. The corrected figures in the above table are from the A.M.W.R. Monthly Summary of Bomber Command Operations. They differ from those given in the O.R.S. Final Night Raid Reports, as the latter omit the bomb-loads of aircraft missing.

There were further serious breaks in the gas, water and electricity supplies to the town resulting from the heavy raid on 27th/28th May. No.1 Foundry at Krupps was destroyed completely. The final raid of this series, on 25th/26th July, was by far the heaviest of them. Gas supplies to the whole town and works area were interrupted for two to three weeks, water supplies for a few days. Lack of water and breaks in cables caused interruption of electricity supplies to 8 - 10% of Essen for three to four weeks. At Krupps the Chemical Apparatus workshop was again destroyed, in addition to the wheel casting, shell, tool and spring makers workshops, and the press forge. Widespread lesser damage was caused, as seen from the table, and a considerable amount of damage to workers houses in the town.

(4) Cologne

Cologne, victim of the first "thousand bomber" raid in 1942, was a main centre of trade, traffic and political activity in the Rhine province. Situated just outside the Ruhr, it was an important inland port, with numerous industries, mainly in the suburbs. With these suburbs, its population in 1940 was 912,000. The first attacks upon it in this period were in February, 1943, as a geographical alternative to the raids on French and German U-boat bases. After that it was not seriously molested until the closing stages of the Battle of the Ruhr, receiving two attacks in June and two in July.

O.R.S. Final Night Raid Reports.

On 2nd/3rd February 161 aircraft were despatched. H2S was used to mark the target, but the marking was scattered. On 14th/15th February, an attack was made through ten-tenths cloud with the aid of H2S skymarking. 217 aircraft attacked, but the result could not be assessed. The third and final raid of the month was on 26th/27th February. Oboe was used in addition to H2S, but only one Oboe aircraft marked the target. 382 aircraft attacked on this occasion. P.R.U. photographs covering these three raids showed a considerable increase in the general damage suffered by this target, but specific results were difficult to determine.

A.H.B.6. Translations

German police reports on these raids are available. These show that on 2nd/3rd February many districts of the city were affected, although the main points of concentration were the northern and western districts. Over 1600 houses were destroyed or damaged, but little else, although 15 land mines, 42 H.E. and over 7000 incendiaries were recorded. The second attack was also scattered and mainly on residential areas. 1500 people had to be evacuated, about 2,000 houses being affected. 70 industrial plants were damaged, whilst 5 large fires and some 580 smaller ones are recorded. The attack of 26th/27th February mainly affected residential areas in the centre, southern and western districts. 6,322 people had to be evacuated, over 2,700 houses being destroyed or damaged. Several public buildings, railways, roads and water-mains were damaged. Four small works were destroyed, and 53 factories damaged. There were 67 large fires, and over 300 smaller ones.

Single Oboe aircraft attacked Cologne on a number of nights in March, but it was not until June that further heavy-scale raids took place. Two-hundred-and-twelve aircraft took part in the first of the new series on 16th/17th June. H2S Skymarking was used, and the attack was again scattered. Three-hundred-and-sixty casualties

/were recorded

were recorded by the police, over 12,000 houses being destroyed or damaged, as well as 16 industrial plants, 11 railway installations and 3 Wehrmacht buildings.

The two heaviest raids in this period were those of 28th/29th June, and 3rd/4th July, in each of which over 600 aircraft were employed. The first of these was a skymarking attack directed against the area west of the river. It caused very extensive damage, rendering homeless 230,000 people. Casualties were 8,460. Forty-three factories were totally destroyed, as well as a railway station. A further 42 factories, 7 railway stations, the Kalk-Nord goods yard, water, gas and electric installations were damaged. In the attack of 3rd/4th July, there were 2,598 casualties and 72,000 people rendered homeless. Twenty factories were destroyed and some 30 damaged, with proportionate effects on other installations. There was serious damage in the harbour and dock areas. This raid was aimed at the east bank of the Rhine, accurate groundmarkers being laid by Oboe aircraft.

Two hundred and eighty eight aircraft took part in a further attack on 8th/9th July. This was a well-concentrated attack. Photographic reconnaissance showed fresh damage, and police reports confirm it.(1) It was estimated from photographs that about 80 factories were damaged between 16th June and 9th July. Seventy-six thousand houses, or 75% of the built-up area was estimated to have been destroyed by the latter date. No further heavy raids were made on Cologne during 1943.

(5) Other Ruhr Towns

The Bomber's Baedeker

The other towns attacked during the course of the Battle of the Ruhr can be seen in the table in Section (1) above. The most important of them, after Essen and Cologne, were Duisburg, at the mouth of the River Ruhr, the greatest inland waterway harbour in Europe, containing important heavy industries; and Dusseldorf, the leading commercial city of Western Germany. With a population of 559,000 in 1940, Dusseldorf was Germany's third largest inland port. It was as important as Essen and Duisburg in the production of armaments, the Administrative headquarters of nearly all the heavy industries of the Ruhr being located there. Other Ruhr towns which received a heavy scale of attack during this period were Dortmund, Wuppertal and Bochum, whilst others such as Gelsenkirchen and Krefeld were attacked on one or more occasions in the closing stages of the campaign.

Duisburg and Bochum - The Ruhr campaign proper opened with the early March 1943 attacks upon Essen already dealt with. At the end of March Duisburg and Bochum were each attacked once; 455 aircraft despatched against the former on 26th/27th March, 157 against the latter on 29th/30th March. This attack was simultaneous with a larger-scale raid on Berlin. In April Duisburg was attacked three times, on the 8th/9th, the 9th/10th and 26th/27th. No appreciable success was claimed in any of these attacks except the last two, owing to bad weather conditions and faults in the Oboe marking. Some damage was observed after the last two, that of 26th/27th April being made in clear weather conditions with fairly accurate groundmarking.

/Four

(1) See Appendix 18.

Four Mosquitoes of No.2 Group were despatched some hours after the main attack to carry out a nuisance raid, and found many fires burning. The damage revealed by photographic reconnaissance was not extensive, however, owing to the scattered lay-out of the town.

There was a further heavy attack on Duisburg by 572 aircraft on 12th/13th May, and on Bochum by 442 aircraft the following night. Very extensive damage was revealed by day reconnaissance photographs after both these raids. They were both made in good weather conditions, with accurate ground-marking. Decoys led astray the later attackers at Bochum, however. Two further heavy attacks were made upon Bochum during 1943 - on 12th/13th June, and 29th/30th September. Both were successful, inflicting heavy damage, although a part of the effort was diverted by an error in marking and a strong wind, during the first of these raids.

A detailed study of the effects of these raids upon Bochum has been made from German records. No similar information is yet available for Duisburg. The Bochum report gives the following statistics, which are compared with the weight and number of bombs dropped:-

Date (1943)	Weight of Bombs tons			Number of H.E. Bombs.		Houses Destroyed or Seriously Damaged.
	H.E.	Incend.	Total.	Dropped.	Recorded by Police.	
May 13th/14	567	489	1056	989	684	1298
June 12th/13th	878	718	1596	1306	786	1630
Sept. 29th/30th	641	702	1343	838	594	2129

In specific damage: The Gas supply was little affected in the first raid, in the second the supply to the inner town was cut for four days, and in the third the whole area suffered a 100% cut for five days, all but 20% being restored in nine days. Fifty per cent of the supply of water was cut for eight days in the first and third raids, to the south and central area in the former, the north and north-west in the latter; the central town was cut for a few hours in the second. The electricity supply to the whole town was cut in all raids, due to damage to cables and other equipment. Two days were required to restore a part supply, but the damage was never fully rectified. Damage to the vast Bochumer Verein Steel and Armament works was about 5% in the first two attacks, production being about 60% of normal until August; in the September attack damage was about 12% and production ceased completely for a time, being less than 30% of normal for October, and taking six months to recover.

Dortmund and Dusseldorf - In May and early June two heavy attacks each were delivered against Dortmund and Dusseldorf. The former was the target for 596 aircraft on 4th/5th May, and 836 on 23rd/24th May, the latter for 759 on 25th/26 May, and 783 on 11th/12th June. The attack on the Moehne Dam on 17th May had an important short term effect upon Dortmund owing to the flooding of pumping stations causing shortage of water, especially for industrial use.(1)

(1) See Chapter 6.

Detailed studies from German records are available, showing the effect of these raids upon the two towns. These can be compared with the post raid assessments from photographic reconnaissance.

O.R.S. Final Night Raid Reports.

The attacks on Dortmund in May were considered to have caused very severe damage. Day reconnaissance photographs showed the greatest concentration on the first raid to have been in the centre and north, and in the dock area to the northwest. Most of the damage was caused by fire. Twenty-eight factories were seen to have been hit, as well as many warehouses and about 1,100 residential or commercial buildings. The second raid was especially severe in the north and north-east, but it was considered that "no district and few industries escaped unscathed." Some 2,000 residential and commercial buildings were assessed as hit.

O.R.S. Report on Dortmund

The post-war analysis of German records shows that two-thirds of the Hoesch Steel works were damaged (48 buildings were claimed from photographic evidence). The Moehne dam attack had the most serious effect in lowering production, which was reduced to 10 to 15% of normal during June, recovering full production in about six months. The other big steel works in the town were at a standstill for a short time also. Effects on the town are shown in tabular form below:-

Date	Bomb Tonnage.	Casualties.	Houses.	Damage to Gas.	Water.	Electricity.
May 4/5	1256	1431	30%	15%	15-20%	20%
May 23/24	1921	2378	30%	25%	30%	50%

(It took from a few days to some weeks to restore supplies)

O.R.S. Final Night Raid Report.

The attack on Dusseldorf at the end of May was very scattered, owing to heavy cloud which unexpectedly obscured the ground-markers and the target. The June raid made up for this, as a very heavy concentration was achieved. Photographic assessment showed that two-thirds of the town centre was devastated, including many important industrial plants. A further successful attack was carried out 3rd/4th November, 1943.(1)

O.R.S. Report on Dusseldorf

German records show that the June attack and the November one were the only ones which seriously affected Dusseldorf during 1943. On 11th/12th June 50% of the gas network was put out of action for 17 days, and 20% of the water system for some 16 hours. Two electric transformer stations were badly damaged, and 10 small transformer stations destroyed. Some 30,000 dwelling units were destroyed and a further 20,000 heavily damaged.

U.S.S.B.S. Survey on Wuppertal

O.R.S. Final Night Raid Report.

Wuppertal - The assault upon another Ruhr town was begun on 29th/30th May with an attack upon the Barmen side of Wuppertal by a force of 719 aircraft. A further 630 aircraft were despatched against the Elberfeld section of the town on 24th/25th June. These were the only two really heavy raids upon Wuppertal up to 1945, and caused over 80% of the casualties incurred there throughout the war.

/The first

(1) See Chapter 14.

The first attack was considered to be "the best concentration yet achieved by the Pathfinder Force". Immense damage was caused, affecting 113 industrial concerns, including five out of the six priority factories. The second attack caused even greater havoc in the Elberfeld district, 239 industrial concerns being affected. It was claimed from P.R.U. evidence that 80% of the business and residential property in Wuppertal was destroyed in the two raids.

U.S.S.B.S. Area Study No.2.

The United States Strategic Bombing Survey Area Studies show that the police reported 2,371 killed in the first attack and 1,848 in the second. Approximately 130,000 people were rendered homeless in the May raid and 112,000 in that of June. The P.R.U. estimate of homeless due to the first raid was 118,000. The damage to buildings was caused chiefly by fire. Incendiary bombs started conflagrations that covered eight square kilometres. These area raids put an abrupt stop to expanding production. Industry required nine months to regain its former level. Domestic and industrial gas supplies were completely cut off for two months following these raids, and were only 41% of the pre-raid consumption for six months. Water and electricity supplies were adequate for the reduced needs following the raids. 6,830 buildings were totally destroyed, of which 5,430 were residential, 1118 commercial and industrial and 144 utility services. An additional 7,993 buildings were heavily damaged.

Oberhausen, Krefeld and Mulheim - The next Ruhr towns to be attacked were Oberhausen, Krefeld and Mulheim, all important steel producers. They were attacked once each in June, on the 14th/15th, 21st/22nd and 22nd/23rd, respectively.

O.R.S. Final Raid Reports.

About 200 aircraft were despatched against Oberhausen, a well-timed attack being carried out with the aid of skymarkers: Reconnaissance showed that damage was well concentrated. The important iron and steel works, boiler works and other factories were severely damaged, and about 1700 houses destroyed. German reports show 900 destroyed and 2,000 severely damaged.

O.R.S. Survey Krefeld.

The raid on Krefeld was made by 705 aircraft in good weather with the aid of ground-markers. Reconnaissance showed that more than half the town was destroyed, mainly by fire which was hardly checked in its spread through the northern part of the town. German records show that 40% of the houses in the town were destroyed or heavily damaged, a total of 7,600. There were 5536 casualties, and the whole town was without gas, water or electricity, which were restored in six weeks. There was little effect on the iron and steel works, which were situated outside the town, but the textile firms were very heavily damaged.

Five hundred and fifty seven aircraft were despatched against Mulheim, making a very successful attack with the aid of Oboe ground-marking. Day reconnaissance showed very heavy damage, including the three important iron and steel works in the northern part of the town. It was estimated that nearly one-fifth of the houses in the town were destroyed.

/Gelsenkirchen

Gelsenkirchen - Two heavy raids were carried out against Gelsenkirchen, the important synthetic oil centre. The first was on 25th/26th June, the second on 9th/10th July. The 473 aircraft employed on the first attack were frustrated by cloud and bad timing by the Oboe skymarkers. No reconnaissance cover was obtained before the next attack, but the attack was not considered successful. German records show four industrial targets hit.(1) The second attack, by 422 aircraft, suffered from the same defects, as well as an error of 10 miles by one of the Oboe skymarking Mosquitoes. The damage was seen to be very scattered and unimportant. German records show 84 casualties, about 1000 houses more or less damaged, and six major industrial plants affected, the majority only for a few days.

Remscheid

The concentrated campaign against the Ruhr ended in July, although there were four further isolated attacks before the end of the year. The last town to be dealt with in July was Remscheid, an important centre of the machine tool trade. On 30th/31st July 273 aircraft were despatched, and carried out a highly successful ground marking attack. Reconnaissance next day showed uncontrollable fires sweeping the area, and the whole centre of the town gutted with about 50 factories damaged. The German report shows that 100 industrial targets were affected, including two steel works. One of the 590 fires started covered an area of 12 square kilometres.(1)

A.H.B.6.
Translation

The attacks on Bochum and Dusseldorf, in September and November respectively, have already been mentioned. The only other heavy operations against the Ruhr in 1943 were an attack on the area of Munchen Gladback and Rheydt in August, and on Hagen in October. Both of these are dealt with later, under the months concerned.(2)

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(1) See Appendix 18 for German damage reports.

(2) See Chapters 10 (5) and 14 (3).

CHAPTER 6

OPERATION CHASTISE - THE DAMS RAID

(1) The Ruhr Dams

Highball & Upkeep appreciation & Progress Reports 8 and 13. (A.H.B/ID/12/357)

Some twelve dams in the catchment area of the River Ruhr controlled the flow of the river, conserving water for the dry season, and providing hydro-electric power. The most important of these were the Möhne and Sorpe. The former, with a capacity of 134 million tons of water, contained 50% of the total known reservoir capacity in the area. The latter, of 72 million tons capacity, made up a further 25% of the total. Others were the Lister, Schwelme and Ennepe Dams. The Eder reservoir had a capacity of 202 million tons. This dam controlled the level of the Weser river, and protected Kassel and its neighbourhood from flooding.

The walls of these dams, apart from the Sorpe, were of masonry. That of the Möhne dam was 25 feet thick at the top, 112 feet at the bottom. The Eder was 19 feet at the top and 115 at the base. The Sorpe dam was of different construction, an earth bank with a concrete core.

The probable economic and moral effects of the destruction of these dams were examined by the Ministry of Economic Warfare and the Scientific Advisers to the Minister of Production in March, 1943. The effects were listed under the following headings:-

(a) Möhne and Sorpe

(i) Inundation - The effect would depend on the level of water, size of the breach and rate of egress. Assuming the reservoirs to be full the rate of discharge might be 2,500 cubic metres per second, or some 30 times the average rate of flow of the Ruhr river. This might destroy the dams and power stations lower down the valley. The whole volume of water must eventually reach the Ruhr watercourse and extensive inundations would be inevitable. Important railways in the valleys would be damaged.

(ii) Water supply - Immediate dislocation of the water supply system was anticipated from the scouring of the valley, involving many filter beds and stirring up sediment. The long-term effect might not be felt for some months, however, and would depend on rainfall, reconstruction work and other unpredictable factors.

(iii) Electricity Supply - Destruction or damage to many of the hydro-electric power-stations in the Ruhr valley would probably follow. The resulting fall in water level would also affect any which remained intact. The loss of power resulting would probably be of only secondary importance, as these stations formed a negligible proportion of the total power supply of the Ruhr area. Most of it was supplied by thermal power stations.

(iv) Navigation - The fluctuations in water level resulting would impede the navigability of the lower Ruhr. This effect would not be important, as little traffic was involved.

/(v) Moral Effect

(v) Moral Effect - The physical destruction could not fail to be visible to millions of people. Owing to the precarious state of water supplies in the Ruhr over many years, the population should be susceptible to alarmist rumours concerning the effects.

(b) Eder

(i) Inundation - The rate of discharge should be sufficient to destroy the four power stations below the dam. No large industrial area would be affected until the water reached Kassel, some 50 kilometres below. Low-lying districts in this city should be inundated, but most of the effect would be felt in sparsely-populated agricultural districts higher up the valley.

(ii) Navigation - In view of alternative supplies, destruction of the Eder dam would be unlikely to affect the navigability of the lower Weser or Mittelland canal unless the summer were exceptionally dry.

(iii) Electric Power - The loss of the Eder power stations would be felt, but not seriously

(iv) Moral Effect - The number of people who would be aware of the damage done and affected by it would be much less than in the case of the Ruhr dams.

(2) Development of Upkeep

The breaching of the Ruhr dams had been considered since before the outbreak of hostilities. No existing weapon could be expected to achieve the desired result, however. Suggestions for the use of a large number of mines or of torpedoes had been examined and rejected. A suggestion for the use of a special high capacity gliding torpedo had been made in early 1941 but had not been considered practicable. Another suggestion at that time was made by Mr. B. N. Wallis, of Vickers Armstrong. This was the use of a 10 ton deep penetration bomb. Mr. Wallis calculated that the dam could be sheared vertically by an earthshock from beneath it.(1) This project was deferred after detailed consideration by a scientific committee. The reasons were the time necessary for developing the bomb and an aircraft capable of carrying it, and the doubt as to the effect obtainable. The belief was still maintained that a larger number of small bombs was more effective than very large ones. Targets suitable for the latter were also extremely limited in number.

The heavy gravity type of dam, of which the Möhne was the most important example, was considered practically invulnerable. Mr. Wallis, however, continued his calculations and experiments. By 1943 he had invented a spherical, spinning bomb. This, if released at a low height above water, after a backward spin had been imparted to it, should, on hitting the water, progress straight forward in a series of diminishing bounces for some 2,000 yards.(1) If it hit the side of a ship or a dam it should roll down this surface until detonated by a hydrostatic fuse at a pre-chosen depth. It would not be effective against an earth bank such as that of the Sorpe Dam.

/This spherical

(1) See Air Ministry Air Historical Branch Monograph on Armament for details of the development of these weapons.

This spherical bomb was designed in two sizes. One weighing 950lbs. for the attack of ships, with the code-name Highball; the other of 11,000lbs. with a charge weight of 7,500lbs. and a diameter of 84". This was for the attack of dams, and was given the code-name Upkeep. The operation was given the code-name Chastise. It was calculated that the Upkeep weapon should be dropped from 250 feet at a speed of about 250 m.p.h. It must not be dropped so close as to bounce over the dam nor so far as to lose its forward velocity before striking the dam.

Numerous dropping trials had to be carried out to determine the actual conditions of release. It was eventually found that a height of 60 feet and a speed of 210 to 220 m.p.h. were necessary. During the course of the trials the shape of the Upkeep weapon was changed from a sphere to a cylinder. With this, 250 yards travel was obtained after contact with the water. The Highball weapon remained a sphere.

At the suggestion of the Admiralty an ad hoc committee was appointed on 11th March, 1943, "to co-ordinate the plans and preparations for operation Highball and to report progress fortnightly to the Chiefs of Staff". The A.C.A.S. (Ops) was chairman, with a representative each from the Admiralty and the Ministry of Aircraft Production. The subject of the Upkeep weapon was included in the committee's terms of reference. A number of meetings were also held by A.C.A.S.(Ops) on the subject of Upkeep with Mr. Wallis, representatives of Bomber Command, and other interested parties. Every priority was accorded to the project, so that advantage could be taken of the May moonlight period 14th/26th May, when the water-level was expected to be at maximum.

(3) The Planning of Chastise

C.S.8586 in Folder "Highball and Upkeep Executive action".

Details of the preparation for an attack on the dams (operation Chastise), were given to Bomber Command on 19th March, 1943. It was suggested that the training of aircrew and preparation of aircraft should proceed concurrently with the planning of the operation and delivery of the aircraft and weapons.

C.O.S.(43)174 (O) 3.4.43.

A special squadron, No.617, was formed in No.5, the Lancaster Group, on 23rd March to carry out the operation. Picked crews were selected from the Group, under the command of Wing Commander Guy Gibson. The squadron was located at Scampton and equipped with Lancaster III G aircraft modified to carry the weapon, and equipped with V.H.F./R.T.

Folders "Highball and Upkeep Meetings" and "Appreciation and Progress Reports".

The squadron commander and other crews assisted Mr. Wallis and the Vickers test pilot, Captain J. Summers, at the trials. These were carried out at Reculver in Kent, using Manston aerodrome. To give the accurate height which was essential, a "Spotlight Altimeter" was devised. This consisted of two converging lights placed at the wing-tips, focussing at a point on the water exactly 60 feet below the aircraft. These were fitted to squadron aircraft under the guidance of the R.A.E. Training routes were planned over the British Isles. These simulated all the principal landmarks on the actual route, using lakes and reservoirs for the targets. All crews carried out intensive training in low level navigation over these routes.

/The optimum

The optimum depth for detonation of the charge was found to be 30 feet below sill level for the Möhne Dam. The prospects of effective damage fell off rapidly at greater depth owing to rapid thickening towards the base of the dam. Tests confirmed that the hydrostatic fuse was accurate to within one or two feet. The water-level should be not more than five feet below maximum to obtain the full effect. Photographic reconnaissance showed the level at six feet below on 19th February and two feet below on 4th/5th April. It was therefore decided that the operation should be carried out during the May moon period, in case of withdrawals before June, causing a fall in level.

These points were decided at a meeting in A.C.A.S. (Ops) office on 5th May, 1943. The A.O.C. of No.5 Group stated at this meeting that training with practice bombs from 150 feet was well advanced, 20 aircraft were available in the squadron, ready to start training at 60 feet with the spot-light altimeter. By 15th May successful drops had been made by squadron pilots using the cylinder, including one filled with H.E. to prove the functioning of the live bomb.

The Highball version of the weapon was not yet fully developed. It had originally been planned to use both weapons simultaneously in order not to prejudice the security of either. Owing to this delay, however, and to the modification of Upkeep to a cylindrical shape, which rendered its connection with Highball less obvious, it was decided by the C.O.S. to launch the Chastise operation immediately. A signal was despatched on 15th May, 1943 to Bomber Command in the following terms:-

A.M. Signal A.X.457.

"Operation Chastise. Immediate attack of targets X, Y and Z approved. Execute at first suitable opportunity."

C.M.S.33 16.5.43.

The letters X, Y and Z had been allotted to the targets Möhne, Eder and Sorpe dams respectively for security reasons. For the same reason a "cover plan" had been devised, describing the weapon as a large mine, which had to be dropped with extreme accuracy close to the target. This false account gained considerable credence.

(4) The Attack on the Dams

No.5 Group O.O. No.B.976/ 15.4.43.

On the night of 16th May, 1943, nineteen Lancasters Mark III G took off from Scampton. They flew at low level, following carefully planned routes to avoid areas of concentrated flak. The first wave of nine aircraft, led by Wing Commander Gibson, went to the Möhne Dam; the second wave, of five aircraft, to the Sorpe Dam; the third wave, also of five aircraft, was despatched 2½ hours after the first two. Zero hour, 2248 hours B.D.S.T. was the time at which the first wave was to be at 03°00' East.

O.R.S. Final Night Raid Reports.

Eight of the first wave reached the Möhne Dam in perfect visibility, the ninth being shot down en route. The first five attacked in turn, the fourth and fifth attacks causing breaches to appear, covering about 30 yards, through which the water flooded. The leader controlled the attack, flying alongside each aircraft in turn to divert the defences. He directed the remaining three of the first wave to the Eder Dam, and reported the breaching by signal to Group Headquarters. The A.O.C. in C. was there, and on receipt of the news informed the Chief of the Air Staff, who was in Washington with the Prime Minister, over the transatlantic telephone.

/The remaining

The remaining three aircraft attacked the Eder Dam in turn, under the leader's control. The first caused a breach, but the second reported an overshoot and was brought down. It was believed that the detonation of its own bomb on the parapet was responsible for bringing it down. The third caused a large hole, and a torrent of water poured through the breaches. A wall of water 30 feet high was seen to sweep down the valley.

Of the second wave, two turned back, one because it hit the sea and lost its bomb, the other through enemy action. Two others were missing on the way to the target. The only one to arrive attacked the Sorpe Dam, causing the earth to crumble on the crown of the dam. A special method of attack had been devised for this dam. The aircraft approached along the length of the dam, aiming at the earth bank itself. Of the third wave, one was shot down on the way, one attacked the Sorpe Dam, causing further crumbling, and another the Schwelme Dam, without apparent result. The other two were detailed to attack the Lister Dam. One was missing and the other could not find the dam owing to gathering mist.

O.R.S. Final Night Raid Report.

The aircraft which attacked the Schwelme Dam passed over the Möhne valley shortly before dawn, and reported that villages were already inundated, "some showing only church steeples". Photographs taken the next day showed a breach measuring about 230 feet at the top and 130 feet at the base. Water was pouring through, the main power station at the foot of the dam had disappeared, part of the village of Guenne had been swept away and villages lower down were flooded. Serious flooding of the Eder valley was also recorded by photographic reconnaissance on that day.

Interpretation Report No.K.8. 85A.

Further P.R.U. sorties on 18th May showed that the Möhne reservoir was almost empty and that the breach extended to the foundations. The Eder dam was also photographed, showing a breach 180 feet wide at the top and 100 feet at the base. The lake was almost drained, the country was flooded, bridges, roads and railways destroyed. The lower part of Kassel was under water. Reconnaissance of the Sorpe dam showed two distinct cavities, exposing the concrete core of the dam over 200 feet. The dam was still intact, however, and repairs had been put in hand by the following day. It had not been expected to achieve more than a leakage here, as Upkeep was not a suitable weapon.

(5) Effects of the Raid

P.R.U. photographs taken later in the month and in July revealed further damage. The railway viaduct near Herdecke, between Dortmund and Hagen, was fractured. The total area inundated by the breaching of the Möhne dam was estimated at 32 square miles; that due to the breach of the Eder dam was estimated at 27 square miles. By 17th July, road and rail bridges had been replaced or repaired along the Eder valley and preparations were in hand for the reconstruction of the dam.

A.H.B.6. Translation No.VII/36.

German reports from the Regierungspräsident, Arnsberg to the Ministers of Labour and of Home Affairs dated 22nd June and 24th June, 1943, respectively, give details of the local effects of the Möhne attack. A breach 76 metres wide and 21 to 23 metres deep was made at about 00.45 hours on 17th May. "An immense floodwave poured through the Dam into the Möhne and Ruhr valleys.

/The main

The main wave, carrying about 6,000 cubic metres of water at a height of eight metres (up to Neheim), reached a speed of more than six metres per second". The main power station below the dam was carried away. The small power station was damaged beyond repair. All road and rail bridges in the Möhne valley were destroyed. In the Ruhr valley two bridges at Neheim, about six miles away, were washed away, not even the piles remaining. Six bridges further down the Ruhr valley were destroyed, and many more damaged. Railway embankments were undermined, and several roads washed away. Numbers of power stations and water works in the Ruhr valley were destroyed or damaged, as well as industrial installations. "In many cases materials, buildings and machinery have been swept away". Two steel works some 30 miles downstream, near Hagen, whose smelting ovens and rolling mills were working at full pressure at the time, received very heavy damage. About 500 houses were destroyed or damaged, and over 1,200 people dead or missing.

The German report goes on to say:-

"The effects of the attack were felt far into the Dusseldorf district. Damage to the water supply system is of the most far-reaching importance. The Möhne dam is the backbone of this system, serving the whole Rhine-Westphalia industrial area, which is inhabited by about 4½ million people. "With the loss of the Möhne Dam, the available reservoir space has been halved. The result will be that the additional supply of water to the Ruhr will have to be curtailed. The quality of the water will be adversely affected and consumption, unless supplies can be got from other sources such as the Lippe, will have to be cut down, even for industrial consumers."

O.R.S. Post-War Report No. S.238.

The water supply to the town of Dortmund was cut short for a week, owing to the flooding of the pumps. If a duplicate system of steam pumps had not been available, the period would have been much longer. The production loss in the town was equivalent to more than the week of actual shortage. The coal mines lost several weeks work. The German report of 22nd June, says that the waterworks along the Ruhr - Gelsenkirchen, Hamm, Dortmund, Hagen, Witten and Bochum - had already been re-opened, after flood damage had been repaired. They could supply, quantitively, the most urgent needs of the area. As the quality was uncertain, chlorination had been ordered, and the population told to boil all water before use. The waterworks supplying the towns of Soest and Gelsenkirchen were still out of action.

Ibid No.S.242.

The breach of the Eder Dam flooded the gasworks at Kassel and deprived the town of gas for some days. Two of the town's six pumping stations were also flooded, but the water supply was maintained. The electricity supply was also unaffected. The whole area of the Eder valley up to about 16 miles from the dam was flooded.

Translation AFS No.S. 105 Reports to OKH Berlin.

A German report from 1Xth Army Corps, Kassel, dated June 3rd, 1943, gives details. The dam was struck in the middle, at about two o'clock, causing a hole 70 metres across and 20 deep. The reservoir had a capacity of 202 million cubic metres of water, some 120 of which escaped. Communities below were reached so quickly that the people could only save themselves.

/Shortly

"Shortly after four o'clock the flood wave had reached Fritzlar (about 16km below the dam) and, at about eleven o'clock, had reached Kassel (40km below), continuing with unbroken force through the Fulda valley".

51 people were killed, as well as some thousands of livestock. 1055 houses and 15 bridges were destroyed and many damaged. Several sawmills and sections of railway track were destroyed, and high tension pylons were bent over for considerable distances.

A report from the VIth Army Corps gives the story of the attack on the Sorpe dam. In the first attack, at 00.50 hours, a bomb was dropped by an aircraft flying along the dam at about the tenth attempt. It struck 12.5 metres below the crown on the water side, about four to five metres below water level. The crater was eight metres wide and four and a half metres deep. Water spilled over the dam, and the road pavement was hurled over the dam, as far as the engine room.

The second bomb was released at 03.15 hours, at the fifth attempt, and fell 30 metres from the first, slightly nearer the surface of the water. The clay packing sealing off the concrete core was loosened over a length of 25 metres. A small escape of water took place until the water level had sunk by 0.45 metres.

CHAPTER 7

OTHER OPERATIONS - FEBRUARY TO MAY, 1943

(1) Tactical Flexibility

The necessity for the bomber force to undertake a variety of disconnected tasks, often diversions from its principal role, has repeatedly been emphasised.(1) During the first four to five months of this period the main roles of the Command were first, the War at Sea, and second, the Ruhr Campaign. Both of these have been dealt with. In addition, for political or tactical reasons, a considerable effort was expended upon the attack of targets such as Berlin, Munich and Nuremburg and certain towns in Italy.

The reasons for attacking Berlin were always mainly political. Although it was the most important industrial city in Germany, its importance as capital and headquarters of the Nazi movement far out-weighed this consideration. Its extreme range, vast size and scattered nature made it an unprofitable target. Attempts were made, however, in March to make use of H2S in attacking definite areas within it. It was found that H2S definition was too poor to achieve this, and so the attempt was abandoned until the late summer when the nights were long enough once more.(2) The improvements incorporated in H2S in the interval, and the experience gained in its use, then enabled success to be achieved.

In the same way, attacks upon Munich and Nuremburg were influenced by political considerations. These two towns were shrines and strongholds of the Nazi system. In addition they, with the other important towns of Southern Germany - Stuttgart, Mannheim and Frankfurt -served as geographical alternative targets. Either on account of the weather, or in order to disperse the enemy defences, it was necessary sometimes to operate in that area. These towns also provided experience in the use of H2S.

Another distant target attacked was Pilsen in Czechoslovakia. The Skoda armament works there were of vital importance to German war industry. Attacks upon it were complementary to the campaign against the war industries of the Ruhr.

There were few attacks upon Italy during these months. Turin and Milan were attacked in February. Concentration upon the primary objective of the Ruhr prevented further diversions to the subsidiary task of demoralising Italian industry. A few heavy operations against the naval port of Spezia were carried out at the request of the Admiralty. It was hoped to drive the Italian warships sheltering there to sea, where they could be attacked by Allied submarines.

(2) February - Italy and Nuremburg

D.B. Ops. Folder Directives IV. Encl.39A. Ibid. Encl.40A.

Conditions for the attack of Italian targets had been laid down on 17th January, 1943. Such attacks were not to prejudice the offensive against Germany. Targets in Italy were limited to Genoa, Milan and Turin, but consideration was to be given to the possibility of attacking Spezia. On 29th January, Spezia was added to the target list.

/The first

(1) See Chapters 3 and 4, also previous Volumes.

(2) See Chapter 15.

The first attack of the year on Turin took place on 4th/5th February. Heavy cloud over Germany prevented operations there, so 188 aircraft were directed against Turin, whilst most of the Wellingtons and less experienced crews were sent to Lorient.(1) Three alternative marking techniques using H2S were planned, to be used according to weather. If visibility was good, flares and ground markers were to be employed. If cloud made illumination impossible, ground markers alone were to be dropped by H2S. If there was too much cloud for ground-marking, sky-markers would be used. Good weather conditions enabled the first method to be carried out. Markers were observed near the Fiat factory in the West, and close to the city centre. Large fires were started on both of these but mainly in the West. The later attacks spread gradually along the line of approach.

O.R.S. Final Night Raid Report.

On the same night four Lancasters of No.8 Group were despatched to Spezia in an experimental attack. It was desired to test the effect of proximity - fused 4,000 lb. bombs. As the Italian naval base of Spezia was so far untouched, it was a suitable place for the experiment. From photographs brought back it was estimated that two of the bombs burst at from 200 to 600 feet above the ground. Reconnaissance later revealed considerable roof damage. A similar experiment was carried out on the occasion of the next Italian operation on 14th/15th February, with similar results.

Milan was the principal Italian target on this occasion, 142 Lancasters being employed. Cologne was attacked through cloud on the same night by over 200 aircraft. This was the first attack on Milan since 24th/25th October, 1942. Ten Pathfinders marked the target, none being equipped with H2S. Owing to very good weather and visibility great accuracy was achieved, a well concentrated attack being delivered. The damage revealed by reconnaissance was considerable and no district of Milan escaped. Twenty-seven factories were believed to have been destroyed.

D.B.Ops. folder Bombing Policy III Encl.46A.

At the meeting of the Chiefs of Staff Committee on 15th February, reference was made to the small attacks on Spezia. The V.C.N.S. said that the three 16" Italian battleships were in harbour there. While heavy air attacks might achieve damage to them, very small scale attacks might only make them move. At present Admiral Cunningham (C. in C. Med.) preferred that they should remain in harbour, so that he knew where they were. If prior information of an air attack could be given he could arrange his submarine patrols, in case the battleships should put to sea.

S.46368/ III Encl.91A. 17.2.43. Ibid. Encl.92A.

As a result of these representations Bomber Command were ordered to carry out only heavy attacks on Spezia, and, if it should be possible, to give the Admiralty advance warning. The C. in C. Bomber Command replied that more than 12 hours advance warning could not be given, and that he considered the target ill-advised and inconsistent with agreed policy on the employment of the Bomber Force. Moreover, it was improbable that air attack would drive the naval units to sea. The Air Staff reply was that such an attack might become necessary in connection with amphibious operations in the Mediterranean, referred to in paragraph 3 of the Directive. A heavy attack was not, in fact, undertaken until 13th/14th April.

Ibid. Encl.94A.

/On 25th/26th February

(1) See Chapter 4 (2).

On 25th/26th February, a cold front, with heavy cloud and icing conditions prevented operations in North Germany or the Ruhr. The weather further south promised well, so a heavy attack on Nuremburg was decided upon. This town was the scene of the annual Nazi party rally, and was almost entirely engaged in engineering and armament production. Bad weather en route made the H2S Pathfinders very late. Inaccurate marking on top of this caused most of the attack to fall to the North of the town. Reconnaissance showed most of the craters outside the town. German reports reveal no important damage.(1)

"The Bomber's Baedeker"

(3) March - Berlin and South Germany

A personal signal was sent to the C.-in-C Bomber Command on 16th February in the following terms:-

BC/S.23746/4
Encl.146A.
(A.H.B./IIH/241/3/621A.B)

"Recent events on the Russian Front have made it most desirable in the opinion of the Cabinet that we should rub in the Russian victory by further attacks on Berlin as soon as conditions are favourable. The C.A.S. wishes you to act accordingly".

This request was in accordance with the special status given to Berlin in the Casablanca Directive. It was to be attacked "when conditions are suitable for the attainment of specially valuable results unfavourable to the morale of the enemy or favourable to that of Russia".

The necessary favourable weather conditions were obtained on the night of 1st March. Two hundred and thirty-seven heavy aircraft, out of a force of 302, delivered the most successful attack to date against the German capital. The H2S aircraft had difficulty in identifying the aiming-point in so large a built-up area, and most of the bombing fell on the south-west suburbs. Air reconnaissance revealed sever damage in this area, including 20 factories and the railway repair shops at Templehof. German reports confirm that this was the most severe raid to date.(2)

The next large scale diversion from the main bomber task was a second heavy attack on Nuremburg on 8th/9th March. Although about the same weight as the first, some 300 aircraft, this attack had a vastly greater effect. A good concentration was achieved in the later stages upon the industrial southern and western suburbs. German records show 490 H.E. and over 48,000 incendiary bomb incidents, and state that considerable damage was caused in many areas.

A.H.B.6.
Translations.

The police reported four waves in the attack, the first on the city centre and the town of Furth, the second and third on the southern side of the city, and the last on the north. This was due to early markers being scattered, whilst the bombing later spread back along the line of approach, which was from the W.S.W. The final stage shows a recovery of position by the main force. There were 1,438 casualties in the city area, and serious damage was caused to the Siemens-Schuckert works, which produced 40% of the transformers made in Germany. A report stated that it took some four months to restart production. The M.A.N. works and the railway workshops were also damaged.

Target Committee Report 21.5.43.

/A cold front

(1) See Appendix 18 for German records of raid damage in this and other attacks.

(2) Descriptions of this and other raids can be found in The Goebbels Diaries edited by Louis Lochner.

A cold front over the north German coast the following night, 9th/10th March, led to the choice of Munich as the target for 264 heavy aircraft. A wrongly forecast wind made most of the H2S Stirlings and Halifaxes late, as they were slower than the Lancasters which formed the first wave of the attack. The faulty wind also caused the marking to be north-west of the aiming-point in the centre of the city. Fortunately the factory area was on the western outskirts and was mainly affected. Little damage was done to residential property, accordingly to the reconnaissance report. The German account gives details of a vast amount of damage in the Northern, Western and Southern police sectors. Over 1,200 buildings were destroyed or heavily damaged, and production was stopped at 51 factories.

Bad weather at home bases prevented operations, except on a small scale, the following night. On 11th/12th March a warm front from Mannheim to Leipzig made operations south of this line necessary once more. Stuttgart was chosen for a heavy attack on this occasion. Like Munich it manufactured important submarine components. Twelve H2S aircraft were despatched, and accurately marked the target. The backers-up tended to drift south-west of the aiming-point. As the main force arrived late, the bombing centred some 3½ miles S.W. of the aiming-point, or two miles outside the town. The small town of Vaihingen was the only place to receive serious damage. It was thought that enemy use of dummy target indicators contributed to this result.

After attacks on the Ruhr and St. Nazaire already dealt with, and a number of idle nights owing to fog, the next heavy raid on Berlin took place on 27th/28th March. The Russian advance in the south had been halted, but Marshal Timoshenko's offensive in the north was progressing well. Further demonstrations against Berlin were considered worth while. This raid was a complete failure, falling to the south and south-west up to 17 miles from the aiming-point. Decoys were again blamed.

Two days later, on 29th/30th March, another attack was undertaken against Berlin. On this occasion the H2S marking was much better, but the main force arrived too late to take advantage of it. Most of the bombing was south-east of the city. No day reconnaissances were undertaken after these raids, owing to their evident failure. German sources also give no indication of their effect.

(4) April - South Germany and Spezia

The campaigns against U-boats and the Ruhr continued in early April. On the 10th, however, it was decided to penetrate to South Germany again. Frankfurt was chosen as the target for over 500 aircraft. It was obscured by cloud, but the red target indicators dropped by H2S glowed through the cloud. In the later stages of the attack a large area of cloud was illuminated from below, and the bombing became scattered.

/On 13th/14th

On 13th/14th April the heavy attack on Spezia requested by the Admiralty in February was carried out. Two hundred and eleven heavy bombers were despatched and three of the Lancasters landed in N. Africa after the attack. H2S was used to illuminate the target with flares, and all aircraft attacked visually in spite of a smoke-screen. Many spent some time searching for the battleships before bombing. There was no evidence of damage to these, however, although considerable damage was done to the town and naval docks.

O.R.S. Final Night Raid Reports.

The following night Stuttgart was again attacked, by a force of 462 aircraft. Although the concentration of bombing was north of the aiming-point, it was not wasted, as most of the town's industries were situated in this northern area. Day reconnaissance showed heavy destruction, including 40 industrial concerns.

On 16th/17th, a night of full moon, two large forces were despatched, 327 to Pilsen and 271 to Mannheim. The Pilsen raid, directed against the great Skoda armament works, was carried out entirely by Lancasters and Halifaxes, led by eight H2S aircraft. Mistaken identification by the markers owing to thin cloud and smoke caused the main concentration to fall on the village of Dobrany, seven miles south west of Pilsen.

The simultaneous attack on Mannheim by a force mainly composed of Stirlings and Wellingtons was more successful. The H2S and other early markers did an excellent job, but later the bombing drifted back along the line of approach. Considerable damage was done to the vast I.G. Farbenindustrie plant on the west bank of the river.

Owing to the danger from enemy fighters under these moonlight conditions, special tactics were planned on both these operations. Crews were instructed to climb to about 15,000 feet before reaching Dungeness. They were then to lose height and gain speed on crossing the enemy coast to 3°E and fly at 1,500 - 2,000 feet above ground level through the fighter belt.(1) After that they were to climb to a suitable bombing height before reaching the target. This height should be above 9,000 feet for Mannheim and between 4,000 and 8,000 feet for Pilsen. These instructions were modified by some Groups, Nos.4 and 6 remaining at about 10,000 feet all the way - only Nos.1 and 3 Groups observed them strictly.

AHB/ II/69/125 11.5.43.

In spite of these tactics the losses were exceptionally heavy, 6.3% for the Mannheim operations, and 11.0% for Pilsen. The Prime Minister called for a report on the reasons for the heavy casualty rate. It was attributed to the ideal fighter conditions, full moon, little cloud and deep penetration. If the target had been put out of action these losses would have been justified. In future moonlight periods the Commander-in-Chief, as far as possible, selected less well-defended objectives, requiring little penetration of the enemy defences.(2) A further raid on Pilsen in May was carried out in half-moon conditions. Some light was considered necessary for a precise target of this nature.

This heavy loss rate was one of the reasons for selecting Spezia for a second heavy attack on 18th/19th April. Low cloud in Germany reinforced the decision. Whilst 178 aircraft were despatched to bomb the target, an additional seven Lancasters laid 28 mines off the port. H2S was used to

/assist

(1) See Map 2.

(2) See Chapter 9.

assist navigation, but identification and marking were visual, in the light of the full moon which was shining throughout the attack. A good concentration was achieved, and in spite of the smoke-screen which obscured the harbour, a destroyer was sunk.

(5) May - Pilsen and Berlin

During May the Ruhr campaign was intensified. In addition another attack was undertaken against Pilsen, in view of the lack of success in April. On the night of the heavy raid on Bochum, 13th/14th May, 168 heavy bombers were sent to Pilsen. An extraordinary concentration of bombing was achieved, 95% being within three miles of the aiming point. Unfortunately the visual marking was slightly to the N.N.W., and few bombs hit the Skoda works. A half-moon illuminated the target, resulting in a loss rate of 5.4%. On a precise target of this nature the risk had to be taken, but there were no further heavy moonlight raids this month.

Since the March raids upon Berlin, the experiment had been carried out of sending a small number of Mosquitoes to attack the city as a diversion during a heavy raid on another target. The first of these nuisance raids was on 20th/21st April during the attack upon Stettin and Rostock. Eleven Mosquitoes had successful diverted attention to the capital. On the occasion of this second Pilsen raid on 13th/14th May, 12 Mosquitoes were sent to Berlin. After this a harassing scale of attack was maintained on every suitable night during May and June. The number employed averaged about four Mosquitoes.(1)

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(1) See Appendix 10 for dates of attack, etc.

CHAPTER 8

BOMBER COMMAND DAY OPERATIONS

(1) Policy and Type of Operations

The scale of Bomber Command day operations during 1943 was very small. Up to June, No.2 Group, before it was transferred to the Tactical Air Force, was principally employed by day. Anti-submarine patrols were regularly carried out by O.T.U. aircraft, and an occasional special operation was accomplished by heavy bombers or Mosquitoes.

The policy for the use of the light bombers of No.2 Group had been built up over the previous two or three years, and has been dealt with in earlier volumes. The Boston and Ventura squadrons were employed in Circus and Ramrod operations, the Mitchells joining in when they became operational in mid-May. The Mosquito squadrons were employed in cloud cover, dusk and moonlight attacks upon railway targets and towns in Germany.

No.2 Group O.O. No.28

No.2 Group O.R.B. App. B923.

The object of Circus operations was to draw enemy fighters into combat with the fighter escort of the bombing formation. For this purpose a formation of 12 or 24 light bombers was ordered to attack targets in France or the Netherlands of importance to Germany, such as docks or oil stores. A Ramrod operation, on the other hand, was an attack by a similar bomber formation upon an important target, such as a merchant vessel, with a fighter escort. In this case the bombing operation took priority.

The Mosquito squadrons were employed primarily under No.2 Group operation Order No.84, dated 16th December, 1942. The object was "to cause maximum damage to the German railway system in Belgium and Northern France". The main targets were engine sheds and repair depots. If the primary target could not be found, attacks might be made on locomotives, goods trains, goods rolling stock or railway equipment, but not on passenger trains. Operations were carried out at low level, using cloud cover, or at dusk or dawn, or by night in moonlight. The Oboe-equipped Mosquito Squadron of No.8 (PFF) Group was used, in addition to its Pathfinding tasks, in single night attacks at high level, by the aid of Oboe, upon German targets. The two Mosquito squadrons of No.2 Group were transferred to No.8 Group in June, and joined in these tasks.

Anti-submarine patrols were carried out daily, weather permitting, by a detachment of No.10 O.T.U., which was stationed at St. Eval, in Cornwall, for the purpose. This task has already been dealt with under the anti-U-boat campaign in Chapter 2. These patrols ceased on 19th July, 1943.

B.C.O.I. No.65.

One other type of operation, known as Moling, was carried out in daylight. This was intended as a harassing attack under the protection of cloud cover. Group Commanders of the heavy Groups were authorised to despatch single aircraft at their discretion to attack small targets in Germany. Very few such operations were carried out, and the orders for them were cancelled on 30th April, 1943.

After the transfer of No.2 Group from the Command in June, no further day operations over enemy territory were undertaken, with the exception of meteorological sorties.

/These were

These were carried out by No.1409 Flight from the time it joined the Pathfinder Group, in March, 1943. It was equipped with Mosquito aircraft, and reconnoitred areas proposed for night operations. A full list of the day operations carried out can be found in Appenidx 10.

(2) Political Restrictions in Occupied Countries.

The necessity for taking political considerations into account when attacking targets in enemy-occupied countries was recognised at Casablanca. The Directive stated:-

> "In attacking objectives in occupied territories, you will conform to such instructions as may be issued from time to time for political reasons by His Majesty's Government through the British Chiefs of Staff."

O.S.15803/Encl. 7A.

The British Government's bombardment policy in enemy-occupied countries had been defined in a letter addressed to all Air Commanders-in-Chief on 29th October, 1942. These instructions remained in force until the close of hostilities. Bombardment was to be confined to military objectives and subject to the following principles:-

(i) The intentional bombardment of civilian populations, as such, was forbidden.

(ii) It must be possible to identify the objective.

(iii) The attack must be made with reasonable care to avoid undue loss of civilian life in the vicinity of the target and, if any doubt should exist as to the possibility of accurate bombing, and if a large error would involve the risk of serious damage to a populated area, no attack was to be made.

In the choice of targets in France, Belgium and Holland, therefore, one of the primary considerations was always its proximity to a centre of civil population. The lists of fringe targets and of Circus targets were scrutinised to ensure that they were not too close to such centres.

In spite of these precautions, many cases occurred in which complaints were received of unnecessary loss of life. This was especially the case when the American day bombers began to attack targets in occupied territories from a high level. In fact, Monsieur Massigli, of the French National Committee in England went so far as to say in a letter to the Foreign Secretary on 16th April, 1943, that the Bretons were crying "Vive l'Angletere et vive la R.A.F.", but "A bas l'American Air Force." The American raids on the Renault works at Billancourt and on Rennes had each killed more than 300 French people, he said, whilst the R.A.F. took obvious precautions to avoid such incidents.

S6 Folder 30 16.4.43.

CMS.330/1 Encl.114A.

The Dutch Naval Attache complained in April of the effects of day bombing attacks in his country. In particular the R.A.F. raid of 18th March, 1943, on the Oil Refinery at Maassluis was said to have rendered 1200 people homeless, and and American attack on Rotterdam on 31st March, to have devastated 500 acres. Later in the month the Belgian Foreign Minister complained of the bombing of Antwerp by United States Flying Fortresses on 5th April. He said that:-

OS.15803/Encl. 9A

/"for a long

"for a long time past his Government had admired the manner in which the Royal Air Force when bombing objectives in Belgium had scrupulously respected the desire of his Government that care should be taken to avoid causing unnecessary suffering to the civil population. The attack on Antwerp by the United States forces had, however, been of a very different nature." German propaganda claimed that 2,000 Belgians had been killed, and arranged an imposing funeral.

CMS.330/1 Encl.118A.

These complaints caused the Foreign Office and Air Ministry to call for the strictest supervision in selecting these targets, and considerably restricted those available for attack. The Commanding General of the American Eighth Air Force was instructed on 7th April, 1943, "To select targets in occupied territory in such a way as to avoid, as far as possible, the risk of heavy casualties to the civilian population." Reference was made to the matter at the Target Committee meeting on 9th April, and a letter to Bomber Command emphasised the care required in this respect in similar terms. Finally the Prime Minister requested the C.A.S. on 20th April, to bring the matter to the notice of the American Commander with a view to the avoidance of such attacks.

Ibid. Encl.122A.

AHB/ I.D.4/373 Encl.37A. 22.4.43. S.6 Folder No.30 9.5.43.

General Eaker issued new instructions to the U.S. Bomber Command on these lines. But he pointed out the danger of allowing the enemy's obvious propaganda to succeed. The Secretary of State agreed. In his reply to the Foreign Secretary he said "It is, for example, a little difficult to believe that the cry of the Bretons to which Massigli"refers in the last paragraph of his letter to you is not an unconscious expression of what the Germans would wish to hear." It was inevitable, however, that the United States forces should cause greater civil destruction than the R.A.F., owing to the greater scale of their daylight attacks, and the high level from which they bombed.

CMS.330/1 Encl.140A.

The possible targets in France, Holland and Belgium were again examined in May in the light of their economic and military importance and their relationship to populated areas. Nineteen were selected and approved. (See Map 2). Their purpose was to provide alternatives for the Americans when weather conditions precluded the bombing of Germany or the Biscay ports, to give opportunities for diversion of enemy fighters during large-scale day attacks, and to permit new Groups to obtain operational experience. At the same time the targets authorised for Circus operations were revised, and a large number were eliminated. In the case of many ports, attack was only authorised where the presence of important shipping warranted it.

AHB/ ID4/373/Encl. 45A. 6.5.43.

Ibid. Encls. 53A,55A.

In order to carry out the provisions of the new bombing directive in June, 1943,(1) certain important targets in occupied territory had to be attacked. It was decided to distribute warning leaflets before such operations took place, as well as issuing radio warnings. These specified the types of objectives to be attacked - Aircraft and Aero-engine factories, repair plants, storage depots and component works. Those living or working in the vicinity of such targets were told that they would be endangering their lives if they continued so to do. These warnings applied to American raids, as Bomber Command ceased operating in daylight with the withdrawal of No.2 Group in June, 1943.

/The U.S. Eighth

(1) See Chapter 9 (2).

Ibid.
Encls.60A, 61A, 62A, 63A.

The U.S. Eighth Air Force was informed on 22nd June, 1943, that warning, by radio and propaganda leaflets, had been given to the French population. By 25th June similar warning had been given to the Belgians, and by 15th July to the Dutch. Similar warnings to the Norwegians were decided to be unnecessary, as no targets which might seriously endanger civil life were on the list for attack.

Ibid.
Encl. 64A, 65A.

Another protest was received on 25th July from the Netherlands Embassy. In an attack by 21 Fortresses on the Fokker aircraft factory at Amsterdam, some 150 civilians had been killed and others injured. The factory itself had not been hit. The Commanding General of the Eighth Air Force investigated this attack, and took a very serious view of its inaccuracy. In his letter to the Chief of the Air Staff on the subject he said that he hoped that most of the American attacks would now be upon Germany. He sincerely believed that there would be little trouble in future from reasonable complaints.

(3) Circus and Ramrod

The principal occupation of No.2 Group in its concluding months with Bomber Command continued to be Circus and Ramrod operations. These formation attacks upon short range targets, escorted by fighters of Nos.10 and 11 Groups, were carried out by Ventura, Boston or Mitchell aircraft. They took place in considerable numbers in the early months of 1943 - 26 in February, 9 in March, 19 in April and 30 in May. They were continued in June under the control of Fighter Command, to which No.2 Group had been transferred.

A large variety of targets were attacked, as can be seen in the Diary of Operations at Appendix 10. The towns most frequently attacked were Caen (12 times), Dunkirk and Abbeville (10), Boulogne (7), Ijmuiden (6) and Cherbourg (5). The principal targets chosen at these places were engine sheds, docks, airfields, torpedo and steel works. Most of the attacks on Dunkirk and Boulogne were Ramrods against a particular merchant vessel sheltering in the port.

As their primary purpose was to draw enemy fighters into combat, Circus operations seldom had any substantial effect upon the bombing target. The Ramrods carried out were even less successful. It will suffice, therefore, to give a few examples and to mention the few occasions on which a substantial result was achieved.

AHB/IIH/241/19/1
~~BC/S24949/2~~
ORS Report.

On 2nd February, 1943, three formations, each of 12 Venturas with fighter escort, set off to attack railway targets at Bruges, St. Omer and Abbeville. Cloud interfered with the bombing at Bruges and the St. Omer operation was abandoned owing to thick cloud. Abbeville was attacked in good weather an hour and a half later, bursts being seen on the marshalling yard and nearby buildings. The fighter escort shot down one M.E.109.

On 13th February, five escorted formations were despatched. Two of these were directed against the steel works at Ijmuiden. A further two were sent to attack an armed merchant raider in dock at

/Boulogne,

AHB/ ID/12/27 13.2.43.

Boulogne, in response to an urgent request from the Admiralty. No hits were scored, and bad weather prevented any repetition of the attack the next day.

AHB/ IIH/185

The torpedo workshops at Den Helder were successfully attacked by Venturas on 19th February. Photographic cover showed that more than two-thirds of the torpedo workshops were destroyed. Bad weather again precluded further attacks until 26th February, on which day five formations, each of 12 Venturas, attempted to attack an Altmark class merchant raider at Dunkirk, without any success.

Ibid

The engine repair shops at Aulnoye were attacked on 4th and 8th March, as a result of which the main repair shop was unserviceable for two months. On 22nd March and 16th April heavy civilian casualties were caused by bombing errors, at Maassluis and Haarlem respectively. These resulted in Dutch protests. In an attack on Brest on 5th April, heavy losses were suffered. Three Venturas were shot down, and seven damaged.

Target Committee 23.4.43.

BC/S24949/2

On 17th and 20th April successful operations were carried out by six formations. On the 17th railway targets at Caen and Abbeville, and coke ovens at Zeebrugge, were attacked. On the 20th the same target at Zeebrugge, as well as a railway target at Boulogne and shipping at Cherbourg were attacked.

On 2nd May 24 aircraft were despatched against the Royal Dutch Blast Furnaces and Steel Works at Ijmuiden. Fighter attack was experienced, as well as heavy flak, resulting in damage to seven Bostons and five Venturas, but considerable damage was caused. The following day, in an attack on the Amsterdam power station, 10 out of 11 Venturas were shot down, the remaining aircraft returning to England after both engines had been on fire. The escort of 74 Spitfires were outnumbered by three to two, and were very heavily engaged. They shot down three F.W.190's, and damaged four more for the loss of one of their number. An attack by six Bostons on Ijmuiden, intended as a diversion for the Amsterdam raid, failed in its purpose, although the target was successfully bombed.

In the last half of May Caen airfield was attacked on five occasions, and the coke ovens and benzol plant at Zeebrugge on three occasions. At the end of May all the Venturas, Bostons and Mitchell aircraft of No.2 Group were transferred to the control of Fighter Command. Their tactical role was more nearly akin to that of Fighter Command. The formation, a short time later, of the Second Tactical Air Force unified the control of all offensive units whose employment was of a tactical nature, including No.2 Group and the fighter units employed in offensive sorties over the Continent.

(4) Mosquito and other operations

No.2 Group O.O. No.84.

The Mosquitoes of No.2 Group, and occasionally other types of aircraft, carried out low-level and cloud cover sorties during this period. These were sometimes at dusk, to give added security for the return journey. These operations were of a harassing nature, aimed principally at communication targets, as has been described above. Moling operations by the heavy Groups were carried out on only three occasions, by Wellingtons on 17th February, and by Lancasters on 20th March and 1st April. These cloud cover attacks on targets inside Germany became too risky, and were discontinued after April.

/The first

BC/S24949/2
ORS Final Day
Raid Reports.

The first attack in February under No.2 Group Operation Order No.84 took place on the 11th. Eight Bostons were despatched in pairs to attack the marshalling yards at Alkmaar, Roosendaal, Caen and Serqueux. Of these only the yard at Roosendaal was attacked. The Colombelles steel works were attacked at Caen, and a factory at Neufchatel was mistaken for the yard at Serqueux. On 12th February, the steel works at Liege were attacked at dusk by Mosquitoes, and a further 10 Mosquitoes were despatched against various railway targets. Hits were observed on all these objectives. Railway targets at Tours were attacked by Mosquitoes on 14th, 15th and 18th February.

B.C.O.I.
No.65.
18.11.42.

On 17th February, six Wellingtons were despatched on a Moling operation, to attack Emden under cover of low cloud. Moling operations had been ordered in 1942, to be undertaken at the discretion of the A.O.'s.C. of the heavy bomber Groups. Their object was to disorganise German industry by forcing the enemy to sound Air Raid Alarms over a wide area. On this occasion three of the aircraft attacked Emden, and two others alternative objectives in the vicinity.

BC/S.24949/2
Target
Committee
28.2.43.

There were several Mosquito operations which achieved outstanding success during this period. The first of these was on the Naval Stores Depot at Rennes on 25th February. Twenty Mosquitoes were detailed to attack at dusk. Five of them made low-level attacks with delay bombs, followed immediately by 11 with instantaneously fused bombs. The Eastern end of the depot was seriously damaged, 17 sheds being destroyed and 19 damaged according to photographic evidence. Three aircraft were missing, two of which collided.

AHB/
ID/12/24

Ops. Folder
Directives IV
Encl.42a.

On 3rd March, 10 Mosquitoes carried out an outstandingly successful low-level attack on the flotation plant of the Molybdenum mines at Knaben, in Norway. Such an attack had been discussed at the Target Committee Meeting on 29th January. All relevent information, including an M.E.W. estimate of the time of recovery from a successful attack, was forwarded to the Command, and the operation was officially requested by D.B. Ops. on 10th February.

ATH/DO/3
Cypher from
Sweden.

P.R.U. photographs showed that extensive damage had been done. Intelligence reports indicated a production loss of about 10 months. It was later learned that the crushing and grinding plant and the flotation plant had been put out of action. Owing to the great importance of the supply of molybdenum to the German war effort, repairs were immediately put in hand. By "cannibalisation" and the aid of new equipment, output was restarted in June at 50% of its normal level. A message of congratulation from the C. in C. concluded with the observation "Mosquito stings judiciously placed are very painful".

At dusk on 9th March a very accurate attack was carried out upon the Renault works at Arnage, Le Mans. Direct hits caused severe damage to almost all the main buildings, whilst only one house was hit outside the works area. Many such attacks were carried out with considerable accuracy, against such targets as the steel works at Liege, engine sheds at Paderborn and other railway targets in Germany and occupied countries. Another such attack of great accuracy was upon the St. Joseph locomotive works at Nantes on 23rd March. Fifteen Mosquitoes took part, but only four bombs fell outside the target.

/Further

Further Moling operations took place on 20th March and 1st April. On each occasion one Lancaster was despatched. The first, whose objective was the village of Leer, in Germany, dropped eleven 1,000 lb. delay bombs. The second, detailed to attack Emmerich at dawn, did not return.

One further outstanding Mosquito operation remains to be described in this period. On 27th May, 14 Mosquitoes were despatched to make a dusk attack upon Jena. Eight were to attack the Zeiss works and six the Schott glass-works. Three bombed each objective and five attacked alternatives. The remaining three were missing. Two of these collided while taking evasive action. P.R.U. photographs taken a month later showed that six buildings in the Zeiss works and five in the Schott glass-works had been damaged.

The two Mosquito squadrons of No.2 Group employed on these tasks were transferred to No.8 (PFF) Group on 1st June, 1943, when No.2 Group left Bomber Command. No.105 Squadron was equipped with Oboe Mark II and H2S and employed in night operations after this date. No.139 Squadron was employed in nuisance raids, and later fitted with G-H. The only day operations carried out by Bomber Command aircraft after June were anti-submarine patrols and meteorological flights over enemy territory. The latter were carried out by the Mosquito meteorological flight attached to No.8 (PFF) Group. It was not until the last few weeks of the war that Bomber Command again undertook regular daylight bombing operations over Germany.

CHAPTER 9

PROGRESS OF POLICY, APRIL TO DECEMBER, 1943

(1) Political and Strategic Background

COS(43) 286(O), COS(43) 287(O) 7.6.43.

The decisions made at Casablanca began to be implemented in the months following. After the successful campaigns in Egypt, Libya and North West Africa the British and American leaders met again at Washington in May, 1943. This conference, code-name Trident, resulted in no major changes in strategy. The Americans were anxious to concentrate all resources after the capture of Sicily upon building up the assault forces in the British Isles. The British Staff was convinced that the successes in the Mediterranean should be exploited. This was the best means of giving immediate support to Russia, and if Italy could be knocked out of the war Germany would face further large commitments in the south. The Americans suspected that the British aimed to postpone the final cross-channel assault. They were finally convinced that further Mediterranean operations would absorb little of the Round-up force, and that the supply of shipping would anyway not allow of all the Mediterranean troops being brought back, simultaneously with the Bolero build-up from America.

CCS. 242/6 25.5.43.

It was eventually decided that the exploitation of the Mediterranean successes should continue, but the forces available to the theatre commander should be strictly limited. Sickle, the build-up of U.S. air forces in the United Kingdom, was to proceed as quickly as possible, so as to supplement the expanding power of the British air offensive. Maximum resources were to be concentrated as early as practicable in the United Kingdom, so as to mount an invasion with target date 1st May, 1944.

C.O.S.S.A.C., (Chief of Staff, Supreme Allied Command) had now been appointed in the person of General Morgan, who was engaged in preparing plans for invasion. A large-scale bluff (Cockade) in the summer of 1943 was the first major scheme prepared. It was meant to draw German troops to the west and to induce large-scale air engagements.

After the Trident conference the Prime Minister, with General Marshall and General Sir Alan Brooke, visited North Africa to confer with General Eisenhower and his Staff. The Trident decisions regarding the European theatre were clarified, and it was agreed to leave to General Eisenhower the responsibility for recommending to the Chiefs of Staff the most favourable means of exploiting the success of Husky.

COS(43) 513(O) 11.9.43.

It was decided at the Trident Conference that further combined meetings should be held at frequent intervals. The next took place at Quebec in August 1943, and carried the strategic planning of the war a considerable stage further. Improved understanding created a greater measure of agreement and speedier decisions. The usual difference of opinion between the American and British Chiefs of Staff over the importance of the Mediterranean theatre had, however, to be reconciled. The final compromise was worded as follows:-

CCS.319/5 24.8.43.

> "as between Operation Overlord and operations in the Mediterranean, where there is a shortage of resources, available resources will be distributed and employed with the main object of ensuring the success of Overlord.

/Owing to

Owing to the success of the anti-U-boat war, shipping and landing-craft were not expected to be so limiting a factor as had been anticipated at Trident. The Quadrant Conference affirmed that Pointblank was a pre-requisite to Overlord, and that the latter - the full-scale cross-channel assault - was the primary U.S./British ground and air commitment against the Axis in Europe. The target date was confirmed as 1st May, 1944, and Normandy was decided upon as the area. Plans for Operation Rankin, to take advantage of any weakening in the German strength in the west, were approved.

C.O.S.(43) 513(O) Part C.

The Prime Minister and President met at Washington in early September, and discussed the exploitation of the Italian collapse. But the decisions reached were too late owing to the speedy German occupation of the country. The landing at Salerno was made whilst the conversations were in progress.

COS(43) 791(O)

The Sextant Conference at Cairo took place after reverses in the Eastern Mediterranean, and a hold-up in the Italian campaign, in late November. The presence of the Chinese Generalissimo Chiang Kai Shek with the President and the Prime Minister, led to commitments regarding operations in South East Asia. These commitments conflicted with others entered into with the Russians during the Eureka Conference at Teheran, which immediately followed. After Stalin had approved the date for Overlord, and agreed to co-ordinate a Russian offensive with it, Anvil, a simultaneous attack in Southern France was promised. As a result landing-craft had to be withdrawn from South East Asia.

CCS.426/1

CCS.138th 7.12.43.

On return to Cairo after the Teheran meeting, Sextant was continued. The over-riding importance of the Pointblank air offensive was re-emphasized. The immediate appointment of General Eisenhower as Supreme Commander for Overlord was decided upon.

A review of global strategy was once more carried out, but owing to lack of time many points were left undecided. It was agreed that future conferences should be on a reduced scale, as they would undoubtedly have to take place at shorter intervals. The number of subjects discussed should also be reduced.

Further discussion of strategic planning during this period is reserved to the next volume, as the decisions arrived at took effect in 1944. We now proceed to an examination of the bombing policy resulting from these strategical plans, and the extent to which it was implemented.

(2) The Combined Bomber Offensive Plan

A Plan for implementing the task given to the air forces in the European theatre was drawn up in April by a Committee under the auspices of the United States Eighth Air Force.(1) Representatives of the British Air Staff collaborated in its preparation. One of its primary objects was to lay down the allocations of American aircraft required to carry it out. These figures were then to be used in Washington to ensure that allocations were adequate and up to time, and to avoid diversions to other theatres.

/The American

(1) The Committee was composed of Commanders with operational experience and target analysts. A full account can be found in the U.S. Air History, Vol.II, Section II Chapter 11.

CCS217/Encl.B
14.6.43.
AHB/
1 IIJI/90/9

The American Operations analysts had decided that the neutralization of some 60 targets would impair and might paralyze the German war effort. Several combinations of targets might achieve this. From the systems proposed the Committee chose six groups, comprising 76 precision targets. These were within the radius of action, and were aimed at "the three major elements of the German military machine: its submarine fleet, its air force, and its ground forces, and certain industries vital to their support." The six systems were:-

Submarine construction yards and bases

The German aircraft industry

Ball bearings

Oil

Synthetic rubber and tyres

Military transport vehicles.

The effect on these systems, respectively, should be:

To reduce construction by 89% by destroying building yards. Attack on bases would affect the submarine effort at sea.

The plan provided for the destruction of 43% of fighter and 65% of bomber capacity.

Concentration rendered the ball bearing industry vulnerable. 76% would be eliminated by the targets specified, with immediate effect upon tanks, aeroplanes, guns, diesel engines, etc.

If Ploesti (35% of refined oil supply) could be destroyed in addition, the destruction of the synthetic plants in Germany (13%) would have a disastrous effect.

Loss of 50% of synthetic rubber, and nearly all tyre production.

Loss of seven plants which produced the bulk of these.

German fighter strength was growing fast, however. It had increased by 44%, at the expense of bomber strength, since the United States entered the war, in spite of heavy casualties. It was essential to arrest this growth quickly.

The target forces were evaluated in four phases. The existing force was too small for deep penetration, a force of 300 aircraft being considered the minimum for this purpose. Such a force would require 800 aircraft in the theatre to maintain it.

The first phase, from April to July, would be restricted to reducing the German fighter strength and submarine installations within range of fighter cover. The second phase, July to October, should achieve an average striking force of 400 aircraft. This should break the German fighter strength by deep penetrations up to 400 miles. In the third phase, October to January, 1944, the striking force should be 550 aircraft. This should keep down German fighter strength, and undermine other sources of German war strength. The last phase, after January, 1944, would prepare for operations on the Continent.

/The

The integration of the R.A.F. and U.S. offensives would be achieved by several means. The task of the R.A.F. was so to "destroy German material facilities as to undermine the willingness and ability of the German worker to continue the war". Whilst the U.S. forces were "directed towards the destruction of specific essential industrial targets", the R.A.F. could be aimed at those related to the U.S. effort. "When precision targets are bombed by the Eighth Air Force in daylight, the effort should be complemented and completed by R.A.F. bombing attacks against the surrounding industrial area at night." The Plan went on to detail the specific targets recommended for each phase, which can be seen in Appendix 3
A list of those area targets which contained primary precision bombing targets was meanwhile prepared by the Air Staff for the guidance of Bomber Command, and is given in Appendix 4.

AHB/II/70/175/11A.
AHB/ID/12/33

This plan received 100% backing from the Chief of the Air Staff and was sent to Washington. It was approved by the Combined Chiefs of Staff at the Trident Conference there. A new bombing Directive was issued in June 1943, (see below) to conform to it, In this, Bomber Command, was given wider tactical flexibility than was envisaged in the Plan, with the result that the integration of operations by the two bomber forces was not as close as had been planned.

(3) The Pointblank Directive

S46368/IV Encl.7A.

The preparation of the Directive to put into effect the Combined Bomber Offensive Plan involved considerable discussion with Bomber Command, Fighter Command and the United States Eighth Air Force. It was necessary to co-ordinate the activities of each to obtain the maximum impact upon German fighter strength. The A.O.C.-in-C. Bomber Command did not wish to be deprived of his tactical freedom to attack any area targets suitable. The final form of the Directive, therefore, which later came to be known as the Pointblank Directive, laid down specific target systems for attack by the Eighth Air Force. The forces of the British Bomber Command were to be "employed in accordance with their main aim in the general disorganization of German industry." Their action was, however, to "be designed as far as practicable to be complementary to the operations of the Eighth Air Force."

AHB/ID/12/33

The full text of the Directive can be found in Appendix 6. It reiterated the primary object of the bomber forces as laid down in the Casablanca Directive:

> "the progressive destruction and dislocation of the German military, industrial and economic system, and the undermining of the morale of the German people to a point where their capacity for armed resistance is fatally weakened."

In view of the increasing strength of the enemy fighter forces deployed on the Western Front, German fighter strength was now laid down as the Intermediate objective with first priority for attack by the Eighth Air Force. The British Fighter Command was also ordered to further this object by attacking enemy aircraft in the air and on the ground, and providing the support necessary to pass bomber forces through the enemy defences with the minimum cost.

Further primary objectives laid down were U-boat yards and bases, the remainder of the German Aircraft Industry, Ball Bearings and Oil. The latter was contingent on attack upon Ploesti from the Mediterranean. Two secondary objectives were also given - synthetic rubber and tyres, and military transport vehicles.

The

The specific tasks laid down were:-

(i) The destruction of German airframe, engine and component factories, and the ball bearing industry on which the strength of the German fighter force depends.

(ii) The general disorganisation of those industrial areas associated with the above industries.

(iii) The destruction of those aircraft repair depots and storage parks within range.

(iv) The destruction of enemy fighters in the air and on the ground.

The attack upon German fighter strength was called an "intermediate" objective to satisfy the protagonists of other target systems that their aims had not been overlooked. As it was an essential pre-requisite to any successful bombing campaign, however, it took absolute priority.

(4) The German Air Force

M.E.W. Intelligence weekly. Report No.72A. 3.7.43.

USSBS Aircraft Division Report - Page 10.

During the spring of 1943, it was realised that earlier assessments of German aircraft production seriously understated its capacity. With the advent of the Speer Ministry a big increase in aircraft production had been planned, and during 1943, the industry's excess capacity of plant and equipment, estimated at 100 per cent, began to be effective. A big increase in fighter aircraft had been planned in September, 1942, and successive further increases were made during 1943. Actual production was stepped up to over 1,000 single and 200 twin-engined fighters per month by July, 1943, more than twice the production in January, 1943.

C.B.O. Report App. U.

In addition to this increase in production, the distribution of German fighter strength was radically altered during this period. In August, 1942, 38% had been concentrated on the Western Front, as against 43% in Russia. By April, 1943, these figures had been changed to 45% in the West and only 27% in the East, and the transfer to the West continued during the year. As a result of this big increase in the strength of the German fighter defences, the wastage rates of the Allied Bomber Forces, both Day and Night, showed a steady increase.(1) In the words of the June Directive - "Unless this increase in fighter strength is checked we may find our bomber forces unable to fulfill the tasks allotted to them by the Combined Chiefs of Staff."

D.B.Ops.16C/70A
II/70/272(C)

The British and American Air Staffs recognised this threat by April, 1943. It was suggested that the whole of the British and American striking forces in the form of fighters and fighter bombers, medium and heavy bombers should be directed against the German fighter resources in Germany and the Occupied Countries. On examining the tactical feasibility of this proposal, however, it was found that the American bomber force would not be strong enough until July to achieve the penetration required in attacking the German fighter plants; Bomber Command could reach none of the towns required except Bremen during the summer months, owing to the limited hours of darkness; the Light Bombers could attack only 5 out of a possible 30 aircraft repair works in Occupied Territory, owing to the Prime Minister's ruling that heavy casualties amongst civilians must be avoided; whilst the range of the fighters and fighter-bombers reduced the number of airfields which they could attack to about 34 only.

/In view of

(1) See Chapter 18(1)

A.H.B. II/70/175/ Encl.9A.

In view of these difficulties it was decided to postpone an all-out offensive until the American and British heavy bomber forces could both play their full part, and the Combined Bomber Offensive Plan laid down the stages in which this Offensive could be put into effect.(1) Meanwhile urgent signals were sent to Washington to hasten the allocations of American heavy bomber groups to the European theatre. The American bomber force, as well as the light bombers of No.2Group, immediately began to turn their attention to German Air Force targets. It was not until 10th June, however, that the new bombing directive authorised the attack of such objectives on the highest priority.(2)

M.E.W. Report No.72A. 3.7.43.

The Ministry of Economic Warfare "Survey of Economic Developments in German Europe in the six months ending June 30th, 1943" emphasised the increase in German fighter strength.

> "Output of all types of aircraft in Germany is believed to have been well maintained, and in the case of fighters to have shown a substantial increase. The programme of rationalisation and standardisation which has been largely responsible for this increase, is also reflected in the high proportion of existing types produced. A further accretion of output may be expected in the near future from new factories in Austria, Hungary and South Eastern Europe."

The same survey reported "a significant change" in the Axis rubber position, a raw material of great importance to the aircraft industry as well as that of land armaments and transport. Due primarily to the interception of blockade runners, lack of natural rubber for admixture with synthetic would affect its durability. Supplies of rubber of all sorts were reported, in any case, to be barely sufficient to meet high priority requirements.

At the "Quadrant" Conference in August (3) the Chief of the Air Staff reported the progress of the offensive to the Combined Chiefs of Staff:

CCS.109th 16.8.43.

> "German fighter strength was stretched almost to breaking point, and in spite of their precarious situation on the Russian and Mediterranean fronts, they had found it necessary to reinforce their fighter forces on the Western Front from these sources. On the other hand, the expansion of German fighter strength was continuing and had increased 13 per cent during this year."

He asked the C.C.S. to take action to make a victory in the air as certain as possible before the autumn. If this was not done, the Germans, by a conservation of their strength and by the development of new methods of defence, might be in an unassailable position by the spring. Diversions from the Eighth Air Force should be stopped, loans to other theatres returned, and the bomber command built up and reinforced to the maximum extent.

/Admiral

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(1) See Section (1)

(2) See Section (2)

(3) Conference between President of U.S. and Prime Minister of G.B. and their Chiefs of Staff at Quebec and Washington between 14th August and 11th September, 1943. See Section (1).

Admiral Leahy replied that every resource within United States capabilities was being strained to provide the maximum reinforcement of Pointblank.

In their final report to the President and Prime Minister, the C.C.S. re-emphasized the importance of Pointblank, with a rewording of its overall objective:-

CCS.319/5
24.8.43.

> "The progressive destruction and dislocation of the German military, industrial and economic system, the disruption of vital elements of lines of communication, and the material reduction of German air combat strength by the successful prosecution of the Combined Bomber Offensive from all convenient bases is a pre-requisite to Overlord.....
>
> "This operation must therefore continue to have highest strategic priority."

In spite of this priority and the effective attacks carried out in the summer and autumn, the offensive could not be carried out according to plan. When the U.S. Chiefs of Staff suggested in November that a new Directive should be issued the C-in-C., Bomber Command commented that no revision of the directive should be agreed without an assurance of its terms being carried out by the United States. In spite of the proviso that "the forces asked for were the absolute minimum", diversions of forces had been accepted ever since Pointblank. General Eaker commented that

> "the only reason Pointblank has not been fully accomplished is because the forces required and as called for in the plan were not furnished."

CCS.403/1

In presenting his and General Eaker's report on the C.B.O.(1) to the Sextant Conference (2) on December 3rd Air Chief Marshal Portal stated that only 89 per cent of the planned strength was provided for the first phase, 76 per cent for the second phase, and 67 per cent for the first half of the third phase, up to that date. In spite of this 90 per cent of the sorties required by the Plan had been despatched, but it had not been possible for them all to be against targets in the Plan.

> "The hard fact is that we are almost exactly three months behind schedule and German fighter production and strength are both higher than the Plan contemplated. This is in spite of the most gallant and successful efforts on the part of the squadrons to use surprise instead of numbers for achieving penetrations which were only intended to be attempted in the later stages of the Plan and with far greater strength."

The C.A.S. asked for a decision by the C.C.S. on the policy for the Eighth Bomber Command in the remaining phases of the Plan. Was General Eaker to proceed with the Plan, in spite of the fact that, being short of planned strength, he must expect disproportionate losses? The C.C.S. agreed that he should proceed with it up to the limit which could be achieved without seriously outrunning the supply of replacement aircraft and crews.

/Policy on oil

(1) See Appendix 15 for facsimile of this report.

(2) Conference between President and Prime Minister and Chiefs of Staff at Cairo, between 22nd November and 7th December, 1943.

(5) Policy on Oil

At many stages in the war it had been suggested by various authorities that the German oil situation was critical. Her conquest of new sources of supply in territories overrun, and the development of synthetic production had falsified these predictions.(1) The question of an all-out attack upon oil had been brought up at a meeting of the Chiefs of Staff on 11th January, 1943. It had then been deferred until the land fighting in North Africa should be finished, freeing the heavy bomber forces there for an attack upon the refineries at Ploesti, and until full experience of H2S and Oboe should have been gained.

C.O.S.(43)14(o)

The subject was again reviewed on 1st April, 1943. The M.E.W. judged that a reduction of 250,000 tons in the Axis' oil supply during the next three months should be critical. This could be achieved either by attacking the Rumanian oil plants or the synthetic plants in Germany. These three months were a critical period as new synthetic plants were due to come into operation in that time.

D.B.Ops.Folder Bombing Policy III II/70/272(c)/66A.

An attack on Ploesti by a single overwhelming force from the Mediterranean had been planned. The disappointing range performance of the early Fortress on operations, however, indicated that it could not reach the area, whilst the bombing commitment for the invasion of Sicily enforced postponement of this plan. To achieve the necessary result in Germany 50 per cent destruction would have to be achieved at five plants in the Ruhr and two large plants further afield. With the aid of Oboe the attacks upon Ruhr plants might be successful, but experience of H2S did not promise success against the plants at Leuna and Poelitz. The proposal to carry out a full-scale attack upon Germany's oil resources was once more postponed to a later date. The prospect of a decisive result did not justify raising the priority of oil targets in the June Directive.

C.O.S.(43)200(o)

C.O.S.(43)214(o)

AHB/II/71/99/9.

Meanwhile the American and British Air Staffs continued to explore the possibility of an attack upon Ploesti. The failure of the Germans to obtain supplies of oil from the Caucasus, owing to Russian successes, rendered their supply again precarious. After attacks from the United Kingdom, Russia, the Lebanon and Turkey had been considered, an American plan was drawn up for a single heavy daylight attack from bases in Cirenaica. This plan was discussed at the Trident Conference on 18th May. The distance from Tobruk was under 900 miles, which was within the range of B.17.F, B.24.C and B.24.D aircraft. The latter could carry a load of 6,000 lbs. over the distance. Losses were expected to be heavy, but to be justified by the results. It was decided to submit the plan to the C.-in-C., North African Theatre for comment.

CCS.87th 18.5.43.

Operation Tidalwave.

Special bomb sights for a low level attack were sent out to North Africa. Three Liberator Groups were also sent out from the United Kingdom, to reinforce the heavy squadrons already there. The operation was finally carried out by 178 aircraft on 1st August, 1943. Fifty-four aircraft were lost, but the results were outstanding. Eight out of the nine targets were hit, and five of them virtually destroyed. /The C.A.S.

CCS.109th 16.8.43.

CCS.106th 14.8.43.

(1) The views on German shortage of oil at various periods of the war can be found in the History of Economic Warfare.

The C.A.S. said that it was "perhaps the most brilliant and outstanding single air operation of the war."

It was an operation too expensive to be repeated, however, and the forces used were urgently required in the United Kingdom. The offensive against German fighter strength continued to have highest priority, and further attempts to deprive the Germans of oil resources had to wait until 1944. United States economic experts urged attack upon them, but the British authorities were inclined to be sceptical of its effect owing to frequent disappointments in the past. Until the acquisition of bases in Southern Italy should enable sustained attacks to be carried out upon the Ploesti refineries by day and night, it was considered a waste of effort to attack the relatively small synthetic producers in Germany.

M.E.W. Report No.72A Page 20.

The M.E.W. view in July was that, although "lack of oil continues to be a major weakness", when the new plants should come into full production Germany's needs should be fully met.

Ibid. No.108 Page 20.

In the next of their six-monthly surveys, however, dated 29th February, 1944, the M.E.W. view had changed.

> "Germany was unable to meet her oil requirements in 1943. The deficiency made itself felt not only in the further restriction of supplies for industrial purpose, but also in some impairment of military training and in limitations in Naval activity."

> "Notwithstanding the fact that the total production of oil was well maintained in 1943, it is evident that the position is causing serious concern. The heavy consumption of the Armed Forces, which attained the highest monthly rate for the year in December, is resulting in an excessive drain upon supplies. This is reflected in the diminishing allowances of liquid fuel for industry and agriculture and for the armed forces in non-operational areas."

(6) Tactical Policy

The heavy attack upon the Ruhr with the aid of Oboe had been in progress since early March, 1943. By May it was considered that many of the Ruhr towns had been sufficiently damaged for the time being, and that the balance would soon be dealt with. Losses in this campaign had been considerable, and the C.-in-C. decided that less well defended objectives should be attacked during moonlight periods. In view of the importance attached to German Air Force targets, he requested permission on 12th May to attack certain objectives of this type in France.

S.46368/III Minutes.

Owing to the political effects of attacks upon occupied countries which might involve civilian casualties,(1) this request had to be carefully considered. The C.-in-C. wished for a small number of targets in areas where little resistance was to be expected, for moonlight attack. Targets suggested were the Schneider Works at Le Creusot, attacked in October, 1942, but long since repaired; the S.A. Gnome Rhone at Gennevilliers, Paris; the aircraft works at Villacoublay, Paris; and the Renault plant at Billancourt, Paris.

/Attack upon

(1) See Chapter 8 (2) on Political Restrictions.

Attack upon these was authorised on 21st May on condition that only reliable and experienced crews were to be employed; that attack was to be made under clear and favourable weather conditions, and all possible precautions taken to minimise civilian casualties.

This permission was received too late, and its conditions were too strict, for an opportunity to attack during the May moon period. Heavy-scale operations were suspended between 14th and 23rd May instead. An attack upon the Schneider Works was made during the moonlight period in June, and upon the Peugeot works at Montbelliard during the July moon.

B.C/S.23746/5 Encl.54A.

Variations in the lists of these targets available were discussed by the Target Committee.(1) After the issue of the new directive on 10th June this Committee began to issue weekly signals under the code-name Jockey, incorporating amendments in the list of targets in Appendix A of the directive. These signals carried executive authority. The amended priorities were recommended by the Jockey Committee, an intelligence committee under the chairmanship of D. of I(O), which was formed in June.

Ibid. Encl.43A.

In a D.O. letter to the Chief of Air Staff on 16th June, 1943 the A.O.C.-in-C. of Bomber Command explained his current methods of target selection. Short nights were the main handicap at the moment, limiting the range to an arc covering Emden, Munster and Dortmund. The selection of a target within this area was governed by a combination of weather and navigational aids. On a clear night when ground marking could be employed, it was best to go for the most valuable target for a heavy concentration, as considerable accuracy should be attainable. On a cloudy night when skymarking would be necessary, a scattered area target or very large town was advisable. In addition, attacks must be spread as widely as possible within the available radius of action. Otherwise enemy defences were quickly concentrated. In this connection, the A.O.C.-in-C. favoured shuttle attacks, landing in North Africa, Malta or Cyprus. These should ensure the dispersal of the defences to areas normally outside bombing range. The first of such raids was carried out against Friederichshaven on 20th/21st June, bombing Spezia on the return on 23rd/24th June.

Ibid. Encl.91A, 99A.

Further targets in France for use in the moon period were approved in September and October, 1943. The Command suggested seven targets in the South of France as tactically suitable on 9th September. Authority for attack on one of these, and on three airfields, which were not suitable, was given next day. Another was authorised on 15th September, and three more on 10th October. Tactical alternatives also became available in Southern Germany, North Italy and elsewhere with the long nights of winter.

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(1) See Chapter 3(1) above.

CHAPTER 10

OPENING OF THE POINTBLANK OFFENSIVE

(1) The American Offensive

The American bomber force played the major part in the direct attack upon the German Air Force under the Pointblank Plan. Since the subject of this narrative is the R.A.F. Bombing Offensive this attack is only briefly described. It began in a small way in April, 1943, as soon as the Combined Offensive Plan was formulated. After this it remained the primary commitment of the American bomber forces throughout the period covered by this Volume (to February 1944).

DB Ops. 32/1.

It was realised when the Plan was formulated that the deep penetrations required could only be accomplished when the American force had been built up to a certain minimum size. The programme provided for only one fighter plant, the F.W. at Bremen, to be attacked during Phase I, April to 30th June. In Phase 2, July to 30th September, two airframe plants, at Bremen and Kassel, and four engine plants, at Brunswick, Kassel, Hamburg and Eisenach, were to be attacked. By the beginning of Phase 3, October to 31st December, it was hoped to build up the force to 1,192 aircraft. This would allow deep penetrations to be begun, and six airframe and five engine plants were scheduled. In point of fact the force had only been built up to 1,038 aircraft by the beginning of Phase 3. The build up had been delayed by three months.

USSBS Aircraft Industry Report Page 7.

In spite of this delay the U.S. Bomber Force kept well up to schedule in its attacks upon the German single-engined Fighter airframe industry. The engine objectives were not so well up to schedule, as a more immediate effect was expected from airframe factories. Post-war investigation indicates the reverse of this. A number of important targets in other categories were also attacked. These included the ball-bearing plant at Schweinfurt (1) and the M.E.109 plant at Regensburg in August, a number of repair and storage depots in France in September, and deep penetrations in October to the Arado plant at Anklam and the Focke Wolf factory at Marienburg in East Prussia. Schweinfurt was attacked again in October. In November the U.S. bomber force made a heavy attack upon the Molydbenum mines at Knaben which were recovering from the successful R.A.F. Mosquito raid in March. They were vital to high-grade steel production for aero-engine crankshafts. The ball-bearing works at Paris were attacked in December. Their importance had increased since the two attacks upon Schweinfurt, and now warranted the risk to civilians involved in a high-level attack.

DB.Ops.14/1 17.11.43.

DB.Ops.23/1 16.11.43

/A full

(1) See Chapter 17 on Ball-Bearings

A full list of the operations carried out by the Eighth U.S.A.A.F. can be found in Appendix 12.[1]

(2) Night Area Attacks

When the plan for attack upon the German Air Force was under discussion, Bomber Command was in the midst of its campaign against the Ruhr by the aid of Oboe. This continued to employ the major effort of the Command until July, 1943. Then came the series of heavy attacks upon Hamburg and the final blows at Italy in August, to speed up her capitulation. Little could be done about German Air Force targets during this period. The short summer nights precluded attacks upon the majority of these objectives, which required deep penetration into Germany.

In spite of these handicaps, a few special operations against aircraft objectives were carried out before August. These are reviewed in the next sections. They include attacks upon the Schneider works at Le Creusot and the Zeppelin works at Friederichshaven in June, and the Peugeot plant at Montbelliard in July. The heavy raid upon the V-weapon research establishment at Peenemunde in August is dealt with in a later chapter.

From about August 1943, the importance of an area target to the aircraft industry became a predominating factor in the choice of such targets for night attack. Tactical factors such as the weather and opposition expected, the degree of penetration required, and the navigational and bombing aids available, naturally continued to exercise a great influence. A growing proportion of the bombing effort in support of the Pointblank aircraft objectives resulted. Since these were area attacks, however, it is impossible to consider their influence upon this particular industry in isolation from the other industries contained in the area. The attacks are therefore reviewed chronologically in the sections below and in later chapters. A brief résumé of the attacks upon towns connected with the G.A.F. plan is included here.

In August, Nuremburg, which contained ball-bearing plants, was twice attacked by heavy forces of over 600 aircraft. Leverkusen, which contained one of the vast I.G. Farben chemical and rubber plants, was also attacked. In September the attack on rubber was continued by two raids on Hanover, as well as that on the Dunlop works at Montluçon.

In October Kassel was attacked twice, Stuttgart, Hanover and Leipzig once each. Kassel contained fighter assembly plants, Stuttgart an important ball-bearing factory, as well as numerous small aircraft component plants. Hanover's principal importance to the aircraft industry lay in its production of aircraft tyres. Leipzig contained the big Erla group of factories, making and assembling Messerschmitt 109s, as well as a number of other aircraft and component plants.

/In November

(1) For further information the U.S. Air History, The Army Air Forces in the Second World War, can be consulted.

In November Ludwigshaven and Leverkusen, both containing vast plants of the I.G. Farben chemical combine, were attacked. Stuttgart was also again attacked.

DB Ops.16D/1
Sig. 2.12.43

New priorities for attack were decided upon in December by the British and American planning staffs. High priority targets included Leipzig, Brunswick (M.E.110s), Schweinfurt (ball-bearings)(1) and Augsburg (M.E.410s), each of which was heavily attacked during December, January and February. Further attacks were also made on Leverkusen and Stuttgart during these months. The weight of attack and a full list of targets attacked can be found in Appendix 10.

(3) June - Moonlight and Shuttle Raids.

S.46368/III
Minutes

The increased loss rate during the moonlight period has been mentioned already. During May the C.-in-C. had finally decided that operations against heavily-defended targets during this period were too expensive. He therefore requested the Air Ministry for permission to attack certain objectives in France.(2) A short list of such targets was authorised, subject to every precaution being taken to avoid civilian casualties.

B.C.O.O. No.175
14.6.43

Among these was the Schneider works at Le Creusot, which was engaged on armament work for the Germans. Its importance had increased following the attacks on Krupps at Essen and the Skoda works at Pilsen. Accordingly, when the moon was nearly full, on the night of 19th June, an attack was undertaken by 290 aircraft. A further 26 were directed against the transformer station at Montchanin, which supplied power to Le Creusot, the same P.F.F. marking aircraft being instructed to mark this target after illuminating Le Creusot.

AHB/II/70/9
Target Committee
5.10.43

In spite of the small size of the target at Le Creusot, it was severely damaged, and ceased to operate for a long period. Severe damage was also done to surrounding property, however, leading to further French protests. This target was deleted from the list in October. At Montchanin a steel and bronze foundry was mistaken for the transformer station and damaged. The latter was successfully put out of action by saboteurs later, thus interrupting supplies of power to Le Creusot.

AHB/IIH/241/3/663(E)
~~BC/S.23746/Vol.5~~
Encls. 36A, B,
Minutes

On 8th June the Air Ministry had written to the C.-in-C., Bomber Command to point out the importance of the Zeppelin factory at Friederichshaven. It was now producing R.D.F. equipment for night fighter control. As it lay to the south of the main German Defence system, it was suggested as a suitable moonlight target. Owing to the short nights at this time Bomber Command considered it could not be carried out from the United Kingdom. After

/consideration

(1) See Chapter 17.

(2) See Chapter 9 (5)

consideration, however, it was decided that 50 Lancasters of No. 5 Group should undertake the attack, going on to land in North Africa. In this way the night would be long enough for the attack, and the enemy defences, aroused to await the return flight, could be out-manoeuvred.

This plan was carried out on 20th/21st June with great success. Sixty Lancasters were despatched, four from the P.F.F. and the rest from No. 5 Group, and not one was lost. A Leader, a Deputy Leader and two Controllers were detailed, one of whom was to control the attack. This system was later developed into the Master Bomber method of control. (1) Considerable damage was achieved, although the attack was not as accurate as had been hoped for. The Leader had to hand over control owing to failure of one engine, and the Deputy Leader, owing to unexpectedly heavy defences, ordered all aircraft to climb 5,000 feet. This altered the wind setting, and reduced accuracy. After the attack the whole force proceeded to bases in North Africa, at Algiers (Maison Blanche and Blida airfields).

On their return on 23rd/24th June 52 of these aircraft attacked Spezia. This attack was also controlled by the leader. A lucky hit, which set fire to an oil tank, provided a useful aiming-point, but radio interference prevented all aircraft from receiving instructions relating to it. A fairly concentrated attack was delivered, however, and most of the damage done was to harbour-side buildings. This was the first shuttle-bombing operation, and served as a pointer to what was to come.

A conference was held by A.C.A.S.(Ops) on June 24th to discuss the implication of such shuttle operations. It was agreed that they had considerable value as special operations, to assist in spreading the German Defences and reaching distant objectives without prohibitive loss. Their principal advantage would be in the summer only, and it was not worth providing adequate base facilities in North Africa for some three months only. Temporary immobilization of aircraft in North Africa must therefore be accepted. The decision for such operations was left to the C.-in-C., Bomber Command.

An analysis was made of the cause of losses on night raids from the United Kingdom. It was estimated that 75% were due to enemy fighters, of which 25% were on the outward journey and 50% on the return. 25% were due to flak, 15% over the target and 10% to and from the target, more or less equally divided. The immobilization of aircraft in North Africa might therefore be entirely offset by reductions in operational losses.

/(4) July

(1) See Chapter 13

(4) July - Moonlight Targets

Concentration upon the Ruhr campaign continued in July. During the moonlight phase, however, less costly targets were chosen. On 12th/13th July Turin was chosen, as is described later. (1)

The following night, with the moon in its third quarter, Aachen, a short-range target which did not involve penetration of the full Ruhr defences, was chosen. This target was really an outlying appendage to the Ruhr industrial area, and its attack was in line with the Ruhr campaign. The timing and accuracy of the operation was excellent, and daylight reconnaissance indicated that over half of the town was devastated. German records confirm that the attack was well-centred. Three railway stations and the Veltrup aero-engine works were damaged, and the gas, water, electricity and telephone systems were dislocated. Sixteen textile factories were destroyed. (2)

A.H.B.6
Translations

On 15th/16th July advantage was taken of one of the targets in France agreed as a moonlight objective. The moon was visible throughout, 85% of full. The Peugeot factory at Montbelliard, covering an area of 1,100 by 600 yards, was the target. The need for extreme accuracy was stressed, to avoid civilian casualties. The attack was very concentrated, but unfortunately centred round the first target indicator, which overshot the works by about 700 yards. The only parts damaged seriously were the coachbuilding shop and foundry. This factory was put out of action by agents of the Special Operations Executive later in the year.

AHB/
II/70/9
5.10.43
D.B.Ops.Folder
Bombing
Policy IV
13.11.43

The harassing attacks by a few Mosquitoes, which were an almost nightly feature of bombing operations by this time, were increasing in strength by the end of July. They were frequently used to divert the enemy defences during a major raid. During the first heavy attack on Hamburg on 24th/25th July (3) diversionary attacks were ordered by four Mosquitoes upon Duisburg and three each upon Kiel, Lubeck and Bremen. The Diary of Operations at Appendix 10 shows the increasing scale of these diversionary attacks, which were carried out by No. 139, the non-Oboe Mosquito Squadron of No. 8 (P.F.F.) Group.

C.O.S.173rd(O)
J.I.C.(43)294

A report on the "Effects of the Bombing Offensive on the German War Effort" was presented to the Chiefs of Staff by the Joint Intelligence Committee on 27th July. Its conclusions were that all the great industrial centres of the Ruhr and Rhineland had been so devastated as to be front line battle areas requiring assistance from elsewhere. Physical destruction throughout Germany was considerable, but affected a small proportion of total capacity. About one third of German industry had been

/affected

(1) See Chapter 12 on Italy

(2) See Appendix 18 for German damage statistics

(3) See next chapter.

affected by heavy attacks for about a three month period. Reductions had been felt in steel supplies, submarines, W/T and other signals equipment, motor transport and a few other items. The bombing offensive had been a major factor in forcing Germany to adopt a defensive air strategy.

(5) August - Increasing Range

With the longer nights of August it was possible once more to reach the area of Southern Germany, and, later in the month, Berlin. Neither had been within range during the hours of darkness for the past three months. Mannheim, last attacked on 16th/17th April, was chosen for the night of 9th August. Ten-tenths' cloud was expected over the Ruhr, which should clear to the south. Four-hundred and fifty-seven heavy bombers were despatched, but the cloud persisted, partially obscuring target and ground markers, and causing a scattered attack. No extensive damage was observed on day-reconnaissance photographs, although several armament and chemical works were affected. This is confirmed by German records.

A.H.B.6
Translations.

The following night 653 heavy bombers were despatched to Nuremburg. In addition, three Mosquitoes were sent to each of the towns of Dusseldorf, Cologne and Mannheim for diversionary harassing attacks. Spoof markers were dropped on the latter. At Nuremburg cloud again caused a wide scatter, both of markers and bombing. Early bombing was about eight miles south-east of the aiming point, but the recentrers employed on this occasion succeeded in bringing it back towards the target with the aid of their H2S equipment. Thirty-eight of the main force aircraft also carried H2S sets on this occasion. Reconnaissance showed most damage in the north-east of the town. German records reveal extensive damage, especially severe in the north.

Mosquito harassing attacks upon the Ruhr by No.139 Squadron were continued during this month, although the main Battle of the Ruhr was over by the end of July. Duisburg, Cologne and Dusseldorf had been attacked by about three Mosquitoes each on most nights of the month up to the 12th, when the nights became long enough to reach Berlin. Thereafter heavy raids upon Italian targets, and upon the research station at Peenemunde, which are dealt with in later chapters, were carried out, whilst the Mosquitoes of No.139 Squadron went to Berlin.

On 22nd/23rd August the I.G. Farben Works at Leverkusen, ten miles north of Cologne, were attacked by 427 aircraft. At the same time Brauweiler Power Station, just outside Cologne, was the target for 12 Oboe Mosquitoes. The I.G. Farben was the largest chemical combine in Germany and the Leverkusen plant stood just outside the town on the right bank of the Rhine, making an ideal precision target, against which the Baillie Beam technique was tried out.(1)

This target did not feature in the current target directive, and no special reason for attack upon it is recorded or remembered by those concerned. It can only be presumed, therefore, that the C.-in-C. chose it for its suitability as a practice target, being in an isolated position, and its general industrial importance. Incorrect laying of the Baillie Beam caused the failure of attacks on both targets. A German communique reported very heavy casualties in Cologne.

(1) See Chapter 13.

BC/S.27462
Encl.127A
(AX.614)

The following night, 23rd/24th August, 727 aircraft were despatched against Berlin. This attack was twice the weight of those in February, and was very carefully planned, but the loss rate was 7.7%. The C.-in-C. obtained permission during the day for the use of Oboe aircraft to mark the route for the main force. It will be remembered that Oboe Mosquitos had been restricted for use only in the vicinity of heavy raids since March.(1)

Six Oboe Mosquitos acted as route markers and nine others were sent to drop Window over Berlin to protect the early Pathfinders. A Master Bomber was in charge.(2) Some of the markers were short of the target to the south-south west and the Master Bomber thought these were well placed. Consquently, the bulk of the bombing was in the Charlottenburg/Wilmersdorf areas, which suffered severely, and the centre of Berlin escaped lightly. The German report assessed the attack at 300 to 400 aircraft and reported 67 targets of industrial importance hit, as well as Templehof Airport. 854 people were killed and 65,000 rendered homeless. Following this raid, all non-essential persons were evacuated from Berlin. Himmler was appointed Minister of the Interior to curb increasing dissatisfaction.

Harassing raids by eight and six Mosquitos, respectively, were carried out against Berlin on the two nights following.

On 27th/28th August a second very heavy attack was carried out against Nuremburg by 674 aircraft. The target was clear of cloud, and the first markers were well placed. Later a severe creepback developed downwind to a point about eight miles south east of the target. Recentrers were employed, but only five of them functioned, and they were not supplied with distinctive coloured markers. The Master Bomber could do little owing to the difficulty of visual identification once the initial flare illumination was over. Most of the damage was in the south east of the town, from which the approach was made.

On 30th/31st August another blow was struck at an outlying area of the Ruhr industrial complex. The neighbouring towns of Munchen-Gladbach and Rheydt, 35 miles west of Dusseldorf, were the target for 660 aircraft. Two aiming points were used in turn, and the attack covered both towns. Daylight reconnaissance six days later showed very heavy devastation, mostly by fire, especially in the centres of the two towns. The Goebbels Diaries record that 80% of Rheydt's business area was destroyed.(3)

The final heavy attack of August was on Berlin on the last night of the month. 622 aircraft took part, 47 of which were lost (a percentage of 7.6), mostly to fighters. The H2S aircraft were misled by responses on the outskirts of Berlin, and the target indicators were placed from eight to thirteen miles south south west of the city. The first ones were bombed, owing to cloud obscuring those more distant. As a result the attack spread back some 30 miles along the line of approach. German reports show a number of districts and sixteen industrial targets affected. (4)

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(1) See Chapter 5(2)

(2) See Chapter 13.

(3) See Appendix 18 for German Damage reports.

(4) See Appendix 18 for damage reports.

CHAPTER 11

THE DEVASTATION OF HAMBURG

(1) The Target and the Task

The city of Hamburg was the second city of Germany and the greatest port in continental Europe. With a population of over 1½ million before the war, it contained U-boat, aircraft and oil targets of the first importance, as well as every other major war industry. The main built up area was on the north of the River Elbe, while the port area lay mainly to the south. The principal industries were situated in the port area and round the perimeter of the main built up area. Harburg was part of greater Hamburg, lying to the south of the main dock area.

B.C.O.O. No.173
27.5.43.

The attacks made upon Hamburg in the early months of 1943 have been recorded.(1) In May an Operation Order was issued in preparation for the Battle of Hamburg. The following extracts illustrate the intention:-

> "The total destruction of this city would achieve immeasurable results in reducing the industrial capacity of the enemy's war machine."

> "The Battle of Hamburg cannot be won in a single night. It is estimated that at least 10,000 tons of bombs will have to be dropped to complete the process of elimination. To achieve the maximum effect of air bombardment this city should be subjected to sustained attack."

> "On the first attack a large number of incendiaries are to be carried in order to saturate the Fire Services."

This "battle" took place between 24th July and 3rd August, 1943. Four attacks, each of over 700 aircraft, were made by Bomber Command, and two small daylight attacks on the dock area by the U.S.A.A.F. Well over 8000 tons of bombs were dropped on the area, in spite of the failure of the last heavy night attack. This concentrated attack upon the city became known in Hamburg as "The Catastrophe". Some 40,000 people were killed in the course of it.

Two new factors contributed very largely to the success of this assault. The development of H2S and experience gained in its use in the preceding months enabled a target situated against water, such as this, to be accurately marked by Pathfinders. The use of Window to counter the enemy radio defences reduced the loss rate to very small dimensions. These factors are therefore considered in the sub-sections following.

(2) Development of H2S

ORS. Report
No.S99
25.8.43.

H2S had been used as a navigational aid and target marking device by Pathfinders since the night of 30th/31st January, 1943. Owing to inexperience in its use and various difficulties encountered, it had not at first given much improved results. The reasons for this are examined to show how the development of H2S made possible the outstanding success of the Hamburg raids.

/Very few

(1) See Chapter 4(4)

Very few H2S sets were available during the first two months of its use. The average was 13 per raid, but poor serviceability reduced the effective number to about five. This difficulty was aggravated by bad timing of the Pathfinder and Main Force aircraft, and by the absence of long-burning Target Indicators. Those used burned for only about 2½ minutes. A single badly-placed T.I. could therefore mislead the whole force. The need for more H2S equipped aircraft to mark the target was imperative.

As a navigational aid H2S was found to be highly satisfactory. Difficulties arose, however, in its operation over the target area. Poor definition and gaps in the polar diagram limited positive identification, whilst the effect of evasive action made the picture very difficult to interpret. The definition was improved by fitting a limiter, to reduce contrast on the P.P.I, and a wave guide scanner, giving a narrower beam, removing extraneous objects and filling up gaps. The addition of a roll-stabiliser to the scanner overcame the difficulties due to evasive action.

Overcoming these early troubles took considerable time. Both the number of H2S aircraft available and the timing of raids gradually improved. The provision of modifications to the sets took four to five months of experiment and manufacture, and a similar time lag was needed for the provision of long-burning T.I.'s. At the same time bombing technique with H2S was being developed. The tendency to undershoot was countered by orders to the backers-up to overshoot the T.I.'s; and it was found that the greatest success was still obtained by the laying of flares by H2S, so that the target could be visually checked by selected backers-up. The tendency to faulty identification at night had caused the suspension of this method for a time. By the end of July sufficient experience had been gained, and enough H2S aircraft were available to ensure an accurate concentration upon Hamburg.(1)

(3) Introduction of Window

The introduction of radio counter-measures has been described in the previous volume.(2) Counter-measures introduced during 1942 were:-

Harris Dispatch App.E.

(a) Shiver - Modulation of IFF sets to oscillate on the frequency of the Wurzburg enemy control stations, approved in October, 1942.

(b) Mandrel - Air and ground jamming sets for use against Freyas. Four per squadron were fitted by December, 1942.

(c) Tinsel - Modification of the T 1154 aircraft transmitter to produce engine noise on the HF/RT wave band used by enemy fighters.

(d) Boozer - A visual identification of enemy radar plotting of an aircraft by A.I., to give warning of attack.

/In April

(1) The later development of H2S is discussed in Chapter 14(1) and 15(2)

(2) Volume IV, Part II - Chapter 6.

In April, 1943, a Ground Grocer station was opened at Dunwich, on the Suffolk coast, to jam enemy A.I. signals within a range of about 150 miles.

The use of Window had been under consideration for a considerable period. This was a mechanical means of producing misleading echoes on Radar apparatus, by means of strips of aluminium dropped from aircraft.(1) Difficulties of quantity production, and above all, fear of enemy retaliation in kind had prohibited its use up to 1943. On 3rd May the Chiefs of Staff Committee considered an Air Staff memorandum advocating its use. In urging that the slight risks entailed were justified in view of the resulting increase in striking power, the C.A.S. said that some 455 bombers and their crews should be saved in the first eight months. This would not only build up the strength of the bomber force, but would also increase its average of experience and therefore of efficiency. This would still further reduce losses and greatly improve morale.

COS(43)227(0)
1.5.43.

AHB/1D4/186
~~ID/4/186~~

The C.O.S. approved the use of Window from 1st July, 1943, subject to technical examination of its implications, especially upon the launching of Husky the invasion of Sicily. The Ad-Hoc sub-committee which examined the question reported on 11th May. They considered that the success of Husky should not be endangered by the use of Window before that operation had been launched. The target date was set at 1st July, with the intention of temporary postponement after that date as the progress of Husky should require. Bomber Command were therefore informed of this provisional date.

CS. 14198
27.5.43.

BC/ORB
17.7.43.

In the instruction for its use issued by Bomber Command on 17th July, 1943, all heavy and medium operational squadrons were ordered to be ready to discharge it by 23rd July. It was only to be discharged on the occasions and at the rates ordered by Bomber Command. The optimum rate of discharge was estimated at one bundle per minute per aircraft for a concentration of 600 aircraft per hour. Rates of dropping for use in orders were laid down, from Rate A, one bundle per two minutes to Rate E, three per minute. On occasion 350 to 400 lbs of Window would have to be carried in each aircraft. Care had to be taken not to stow it too far aft of the centre of gravity. A height concentration of 6000 feet would be required, so aircraft must fly within 3000 ft of the height specified.

As Window was only effective against RDF apparatus, its discharge was to be limited to those areas where known G.C.I. or G.L. stations were sited, or enemy fighters equipped with A.I. operated. A map of these areas had been prepared, and Window was to be discharged whilst traversing them.(2) Regular spacing was important, and the crew member releasing Window - the air bomber or Wireless Operator were suggested - must be provided with a watch.

/Window was

(1) A bundle of Window weighed 2 lbs and consisted of 2200 strips 25 x 2 cms Rate of fall 300/400 ft. per min. Effective 15/20 mins.

(2) See Map 2. - The enemy fighter defence belt at this date is shown.

Window was first used on 24th/25th July, 1943, in the first of the big attacks upon Hamburg. It was used only against Würzburgs, which were used for G.C.I. control and gunlaying. The system of control was immediately thrown into confusion, and new expedients had to be sought by the enemy to bring their fighters into contact with the bomber stream. Later types of Window were devised for use against all known forms of enemy radar.(1)

One further countermeasure was introduced during the Battle of Hamburg. This was Ground Cigar, which jammed the VHF/RT frequencies beginning to be employed by enemy night fighters. A transmitter had been set up at Sizewell on the Suffolk coast to operate a jamming barrage over the whole waveband employed. It came into operation on 30th/31st July, 1943.

(4) The Attacks

The Battle of Hamburg was planned and carried out as a single operation. Commencing on 24th/25th July with a night raid, followed by American daylight attacks on the 25th and 26th, the climax was reached with the very effective night raids of 27th/28th and 29th/30th July. The final attack on 2nd/3rd August was largely abortive owing to bad weather. The breathing space between attacks gave no time for the city to recover, so that the effect was one of continuous assault. This was augmented by Mosquito harassing attacks in the intervals. Large scale attacks were continued on Ruhr towns in the intervals, to prevent a concentration of defences at Hamburg.

The scale of attack upon the city was unprecedented. On the four night raids a total of 3095 aircraft were dispatched. 8,622 tons of bombs were dropped, including 4,309 tons of incendiaries. The German police report gives the average number of bombs per square kilometre on the first raid as 7 landmines, 147 H.E. bombs, 17,580 stick incendiary and about 500 other incendiary bombs. On the second raid the density was about five times as great. Over 700 aircraft were employed on each attack.

Home Office Intelligence Report Jan. 1946.

The plan of attack on each of the big raids was similar. Route markers were dropped at a given point off the mouth of the Elbe. H2S aircraft marked the target, with a large force of backers up to maintain the marking throughout the attack. Among these at intervals were crews expert in the use of H2S, whose duty was to recentre the attack when necessary. A total of 74 H2S aircraft were despatched. Backers-up were ordered to overshoot, usually by two seconds, the centre of the markers, so as to avoid the usual creep-back of the attack. Window was dropped by all aircraft whilst in the dropping zone at the rate of one bundle per minute, from the maximum height possible. A few Mosquitos were despatched to other targets to create diversions.

On the first raid visual markers were employed, but their T.Is were scattered round the aiming point. The early attack as a result developed four distinct concentrations. Later the attack was centred, but it began to creep back towards the end. "By zero plus 30 a long carpet of incendiaries extended back along the line of approach for seven miles". Losses on this raid were abnormally low (1.5%) due to the use of Window.

ORS Final Night Raid Report.

/R/T traffic

(1) See Chapter 16 for later developments, and Narrative on Radio Warfare for the full story.

R/T traffic overheard showed the confusion into which the fighter defences were thrown. One remark was "It is impossible - too many hostiles". The AA guns were also affected, as evidenced by the minor flak damage experienced, and the searchlights wandered aimlessly about the sky.

The second attack carried a higher proportion of incendiaries, and caused the "fire typhoons" for which these raids are chiefly remembered. No visual markers were employed, and the blind markers were well concentrated in the Billwarder district, slightly E.S.E. of the aiming point. After a good initial concentration, the bombing spread to the west and north and later to the east. There was little creep-back on this occasion. The approach to the target was made from the south east. Losses were 2.2%, and new methods were used by the enemy defences. Barrage firing was used by the A.A. and a running commentary on the bomber movements was given to the fighters, instead of the usual brief instructions.

In the third raid spoof markers were dropped to attract enemy fighters. It had been found that interceptions frequently occurred in the vicinity of route markers. Some PFF aircraft carried anti-personnel bombs to discourage the ground defences, as they had in the first raid. Blind marking on H2S indication was employed again. The T.Is. were scattered, the mean point of impact being on the east side of Hamburg, two to three miles due east of the aiming-point. The bombing remained centred in the eastern area of the city, spreading to 24 square miles by the end of the attack. Losses were 3.5%, the defences having been strengthened since the previous attack.

The fourth and last raid was planned in six waves four to attack an aiming point in Hamburg and two in Harburg. As the weather forecast was doubtful, skymarking as well as ground marking was used. Spoof markers were dropped on the island of Nordstrand, 92 miles north west of Hamburg. The report of the attack says that "in view of the confusion caused by the Arctic conditions experienced over Hamburg it is impossible to reconstruct the course of the attack". The markers were mostly hidden by cloud, and only 54% of the aircraft claimed to have attacked the target. Thirty aircraft (4%) were missing on this occasion. Lack of concentration led to insufficient Window for effective protection, and both predicted flak and fighters were more in evidence than before.

(5) The Results

There is a large volume of evidence of the results of this raid from contemporary German reports and postwar research.(1)

/These fire

(1) Sources include:-

R.E.8 Report on "Effects of the Air Attacks on Hamburg", dated 13th December, 1943. M.E.W. Industrial Damage Report No.73, dated 9th September, 1943. Report of the Police President and Air Protection Leader, translated January, 1946.

O.R.S. Report No.S240, dated 29th October, 1945.

B.B.S.U. Report on German Towns.

U.S.S.B.S. Report "Effects of Area Bombing on Hamburg".

These fire raids were always referred to as "The Catastrophe". Between 40,000 and 50,000 people were killed in the city, and the principal effects of the raid were felt in the most densely inhabited areas. The table below shows the weight of attack, according to the zoning system used for German cities, which was described in the previous volume.(1) Half of the houses in the city were burnt, and an almost complete evacuation took place. About 30% of the population did not return. The rest were back at work within two months. Production returned to 80 per cent of pre-raid level five months after the attacks. In the year following the catastrophe the larger factories lost from one to two months production, the smaller some six months. Their labour was drawn upon for the larger and more important war factories.

The first attack of 24th/25th July caused severe damage chiefly in the north and west of Hamburg where very serious fires were started. Casualties were about 1,500.

The second night attack of 27th/28th July produced unique phenomena, and accounted for most of the casualties - some 30,000. The main weight of attack fell upon the heavily built up area east of the Alster lake. Within half-an-hour this region was enveloped in a sea of fire, intensified by firestorms of hurricane strength. Trees of three feet in diameter were uprooted, roofs of houses carried away, and people were hurled to the ground or sucked into the flames. Thousands lost their lives in the air raid shelters and streets, often poisoned by carbon-monoxide and then burned to ashes. This area became known as the Dead Zone, and was barricaded off, with numbers of bodies lying in the streets. The War Minister asked women and children to leave the city after this raid, but most of them were already leaving.

The third big night attack on 29th/30th July affected some parts not previously hit, particularly Barmbeck in the northeast. Further enormous damage was done, but casualties were lighter owing to the evacuation. The raid was again accompanied by strong winds, but the fire typhoons of the previous raid were not repeated. Damage to property was enormous, as the effects of the earlier raids held up fire fighting. Water mains had been destroyed and many fire fighters killed. Also fires from the earlier raids were still out of control. Hamburg was now crippled. The complete absence of gas, water and electricity supplies brought to a standstill even those establishments which had escaped.

/The last

(1)

	Zone	Density of Attack in tons of H.E. per sq. mile.	Percentage of Buildings destroyed.
1	City Centre	102.7	54.9
2a	Residential	115.2	58.1
2b	Intermediate	78.4	54.3
3	Suburban	21.8	15.0
4	Industrial	43.9	29.7
5	Railways, docks	24.5	25.2
	Unzoned	13.5	
	Average	28.9	

The last raid on 2nd/3rd August was scattered by bad weather. Casualties were small, and many bombs fell in areas already devastated.

The annihilating effects of this series of raids can be shown by a few figures:-

900,000 people homeless and missing

40,385 houses and about 275,000 flats destroyed or badly damaged, as well as 580 factories, 80 military, 22 transport and 2,632 commercial units; also 12 bridges and 180,000 tons of shipping sunk. Much of this was refloated later.

A Ministry of Home Security assessment was made in December, 1943 as to the effects of these raids on German Military capabilities. It was estimated that about ten 500 ton submarines were lost, and about five Blohm and Voss aircraft. There was a small loss of oil through storage fires, but the two refineries damaged were not essential, as excess capacity existed elsewhere. The ratio of industrial to non-industrial damage was assessed at 21% to 79%. Port activity, at an average level of 200,000 gross tons before the raids, dropped to 15,000 tons on 1st August, rising gradually to 75,000 tons on 18th August, 163,000 tons on 7th September. After this it dropped again to 75,000 on 9th October.

Postwar research throws light on the accuracy of these estimates. The output of 500 ton U-boats was reduced by two to three per month. As the type was becoming obsolescent no real effort was made to improve on this figure. The Blohm and Voss works were only being used for contract work for Messerschmitts of a low priority. The other aircraft factories had been evacuated. There was a production loss of oil of about 40% for a month after the raids, mainly as a result of shortage of electricity. There was a temporary drop of about 30% in port activity in August, 1943.

(6) Discussion of Incendiary Technique

The development of the policy and technique of incendiarism during 1942 has been described in the previous volume. The policy of carrying a two-third ratio of incendiary bombs to one third of H.E. had been agreed upon by 1943. It was not yet possible to carry these proportions, however, owing to the design of bomb stowages and weapons. The small bomb container (S.B.C.) used for the carriage of incendiaries took up a disproportionate space in the bomb-bays, and prevented an aircraft carrying its full economic load if used to excess. To overcome this difficulty cluster incendiaries were in production, carrying a varying number - 166 and 220 - 4 lb. incendiaries in cases which would only take the space of a 500 or 1,000 lb. bomb. These were not available until the end of 1943.

AHB/ II/70/164

Discussions upon the improvement of incendiary technique continued to occupy much attention at all levels in the early months of 1943. Meetings took place approximately fortnightly under the aegis of the Ministry of Home Security, in which experts upon fire protection, members of the Research and Experiments Dept. the Ordnance Board, the Armament branch of M.A.P. and American

/experts,

experts, as well as representatives of the Operational Commands, took part. The principal result of these meetings was the production of the 'J' type incendiary, producing a petrol jet blaze, which was used in April 1944. A number of papers and suggestions also resulted on the technical and tactical problems of fire-raising.

Although serious fires had been produced in earlier raids, notably at Exeter and Lubeck, the July attacks on Hamburg provided the first case of "fire-storms." These were caused by a number of simultaneous outbreaks in close proximity joining up to form a single, uncontrollable area of fire, The very high local temperatures resulting produced winds of great violence, which carried the fire with them to new areas. This self-propogating method was that which all the discussions had been aiming to produce.

The principal practical advances in incendiary technique achieved during this year resulted from improved concentration and timing of raids, and improvements in the stowage of incendiaries in aircraft. Many of these improvements were devised within Bomber Command. A number of new designs of the small bomb container were produced, some of greater depth, others of short length, in order to load the full area of the bomb bays, using a variety of bomb-loads, including the 8,000 lb H.C. bombs. By this means the "maximum economical incendiary load" was increased.

War Statistical Analysis B.Ops.2.(b)

It has been mentioned above that the optimum proportion of incendiaries to H.E. had been agreed as 66 2/3rd to 33 1/3rd by weight. (1) This could not be achieved owing to difficulties of stowage. The actual proportions used in February, 1943 were 54.4% Incendiary to 45.6% H.E. The incendiary proportion was lower than this in every succeeding month of 1943, and reached a low peak of 41% to 59% in January 1944. These figures graphically illustrate the failure to find an adequate solution to stowage problems on the Lancaster.(2)

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(1) See Appendix 19, for relative efficiency of Incendiary and H.E. Bombs.

AHB/IIH/241/3/634(B)
~~BC/S.22240/2~~
~~Vol.II~~
Encl.1A.

(2) Examples of "Economic loads" with varying H.E. percentage used on the Lancaster in August, 1943, are as follows:-

(a)	1 x 4000 lb. H.C.	4000	
	10 S.B.Cs. x 150 x 4 lb. Incendiaries	6000	
	6 S.B.Cs x 16 x 30 lb Incendiaries	2496	
	2 " x 8 x 30 lb "	416	
	Carriers and S.B.Cs.	1306	
	Total Weight	14218	lbs.
	Percentage Incendiary to H.E. approx. 70%.		
(b)	1 x 4000 lb. H.C.	4000	
	4 x 500 M.C.	2000	
	6 S.B.Cs x 150 x 4 lb Incendiaries	3600	
	6 " x 16 x 30 lb "	2496	
	2 " x 8 x 30 lb "	416	
	Carriers and S.B.Cs.	1002	
	Total Weight	13514	lbs.
	Percentage Incendiary to H.E. approx 52%		

CHAPTER 12

THE DEFEAT OF ITALY

(1) Planning

AHB/II J11/15
~~2J11/15~~

In view of American opposition to continued ground operations in the Mediterranean after the capture of Sicily[1] plans had been discussed for the defeat of Italy by air action alone. In April, 1943, a plan had been drawn up by the Air Staff "to take advantage of the wave of demoralization which will certainly spread over Italy as the result of the capture of Husky-Land" (Sicily). In view of the limitations imposed by the short summer nights, heavy scale attacks could only be begun from the United Kingdom in mid-August. Heavy day operations by United States bombers from North Africa could cover Central and Southern Italy and medium night bombers could operate from Malta.

AHB/II J11/14
~~2J11/14~~
14/6/43

As a result of subsequent Anglo-American agreement to a limited scale of ground operations in Italy, plans for air attack were subordinated to these operations. In June, General Eisenhower was authorised by the two Governments to undertake daylight bombing attacks against the marshalling yards at Rome at the moment he should think best. Great care was to be exercised that no bombs should fall in the vicinity of the Vatican City. General Eisenhower decided on the attack on 19th July, 1943. A suggestion by the C.-in-C. of Bomber Command to bomb Mussolini's villa and office, using the specially trained No. 617 Squadron, was frowned upon by the Foreign Office.

Ibid 13/7/43

Ibid 26/7/43

On 25th July Mussolini resigned and Marshal Badoglio became Italian Prime Minister. The British Cabinet decided on 26th July not to increase bombing attacks on North Italy for the moment. On 28th July, however, the inauguration of heavy scale attacks was authorised as from 30th July. The C.A.S's minute concluded -

Ibid 28/7/43

S.46368/IV
Encl. 36A

"A very heavy scale is not expected in view of the need to land in Africa, but C.-in-C. should do his best to 'heat up the fire'". Propaganda leaflets were also to be distributed over the North Italian cities. Special leaflets were delivered at Scampton on 31st July with orders to drop them during the next bombing attack on Northern Italy. On the obverse they bore the words "The Government of Rome says the war continues" and on the reverse "That is why our bombardment continues". Broadcast warning from Algiers was given to the Italian people on 31st July of the resumption of the air offensive.

15E/D.B.Ops.
1/8/43

COS(43)440(O)
29/7/43
J.P.(43)280,
etc.
NAF.371 in
16D/D.B.Ops.

At the end of July a plan for the attack of strategic railways into Northern Italy was prepared, to be used when General Eisenhower should consider best. Examination of the best method of achieving interruption in German communications in Northern Italy continued during August. These attacks began at the urgent request of General Eisenhower on 16th September. Following the armistice with Badoglio announced on 8th September and the return of Mussolini to power on the 15th, the U.S. Army's position at the Salerno bridge-head was precarious. Maximum air support was required

/to hold up

(1) See Chapter I

to hold up German reinforcements. The three Liberator groups which had been loaned for the attack upon Ploesti on 1st August were returned to the Mediterranean for about two weeks to provide extra support.

AHB/IIH/241/3/5 Vs
~~BC/S.30578~~
Operation Puff.

A plan had been prepared by which Bomber Command was to cut the three western routes into Italy. The Riviera route was to be attacked at the Antheor Viaduct, the Mont Cenis route at the Modane marshalling yard, or by attack on the Bissorte Dam, and the Brenner route at the Avisio Viaduct. The two former were attacked by Bomber Command on 16th September, but the Avisio Viaduct was considered to be tactically impracticable. The Bissorte Dam was not attacked in view of political implications. It would involve considerable loss of life amongst French civilians. In spite of this, the advantages of attacking it were discussed for a considerable period.

AHB/
II/70/149(F)
18.10.43.

(2) Operations up to August, 1943

Attacks upon Italy during the early months of 1943 had been few, and had been carried out merely as weather alternatives to German operations. They have been dealt with in Chapter 7 above. Turin, Milan and Spezia had been attacked during February. In April two heavy attacks upon the latter were made as a result of Admiralty requests. In June, Spezia was attacked again by 49 aircraft returning from North Africa after shuttle operations against Friederichshaven.(1)

On 12/13 July the weather forecast for Germany was "solid cloud to great heights", while Northern Italy was expected to have little cloud. Turin was, therefore, chosen for attack by 295 Lancasters of Nos. 1, 5 and 8 Groups. The night was too short for the slower types of aircraft, and even Lancasters had to be routed home through the Bay of Biscay, well clear of land, as they had to return in daylight.

The moon was at two-thirds of full for the attack. With accurate marking a good concentration was achieved, although the usual tendency to drift back appeared in the later stages. Day reconnaissance revealed severe damage to a number of factories, whilst residential property appeared to have escaped lightly. Italian records confirm heavy damage to the town, including hits on the F.I.A.T. works, the Italian Oxygen Co., an oil depot, a railway station and many other factories.

Further operations aimed at speeding the collapse of Italy were undertaken on 15/16 July and the night following. Montbelliard was the principal target on the former night, as described above.(1) In addition, a small number of Lancasters were despatched to attack various transformer stations in Italy, going on to land in North Africa. Twenty-four aircraft took part the first night, six each against Bologna, Arquata Scrivia, San Pola D'Enza and Reggio, the first three of which were damaged. On 16/17 July nine aircraft were sent to each of the transformer stations at Cislago and Brugherio, the former alone being damaged.

On their return trip from North Africa, 33 of these aircraft bombed Leghorn on 24/25 July. Three aircraft had

/been lost

(1) See Chapter 10.

been lost during the outward operations, but none was damaged on the return. This was the night of the first big Hamburg attack described in the previous chapter. Nine aircraft were sent to drop leaflets over Northern Italy on 29th/30th July. Good weather over Germany and the prosecution of the "Battle of Hamburg" prevented further attacks on Italy until August.

(3) The Final Assault in August

On 31st July broadcast warning was given to the Italian people of the resumption of the allied air offensive. American and British aircraft continuously attacked close support targets in Sicily and Southern Italy from North Africa and Malta. When enemy resistance ended in Sicily on 17th August, the air effort was turned against communications in Italy.

Bomber Command began the final offensive against the will to resist in the North Italian cities on 7th/8th August. Two hundred and two Lancasters were evenly divided between Milan, Turin and Genoa. There was no moon, but ground marking attacks were carried out and all three targets were clearly visible by the light of flares. All attacks were well placed and successful. That on Turin was directed by a Master Bomber, this being the first occasion on which the Master Bomber technique was tried out operationally.(1) Window was used within 50 miles of the targets and only two aircraft were lost. No. 5 Group aircraft dropped leaflets containing President Roosevelt's speech on 28th July, and the leaflet described in Section I above.

On 12th August a very heavy force was despatched, 504 aircraft were directed against Milan and 152 against Turin. The attack on Milan was somewhat scattered, in spite of the efforts of a Master Bomber. Damage was observed throughout the whole city. Accurate and well timed marking and illumination at Turin led to an attack well concentrated on the centre of the city.

A follow-up attack upon Milan was carried out on 14th/15th August. Of the 140 Lancasters despatched, 31 were directed against the special target of the Breda works. They were instructed to bomb between 5-8000 feet. Concentration of the main force was not good, but large fires were started, so that daylight reconnaissance sorties were frustrated by smoke covering the city.

O.R.S. Final Night Report

Milan was attacked again the following night. One hundred and ninety-nine Lancasters carried out a very concentrated attack on the centre of the city. Daylight reconnaissance photographs revealed the cumulative results of the four August attacks. It was estimated that about 44% of the fully built-up areas were destroyed or seriously damaged, and 14% of the less fully built-up areas. Over 239 factories were damaged, including Alfa Romeo, Isotta Fraschini, Breda and Pirelli amongst the most important. Many public utilities were also affected.

A further attack on Turin was made the next night, 16th August. One hundred and fifty-four heavy bombers of Nos. 3 and 8 Groups were engaged on this occasion, 25 Stirlings having orders to attack the Fiat Works if they /could be

(1) See Chapter 13 for description of the "Master Bomber" technique.

could be identified. Some of them succeeded, the rest joining the main force in a concentrated attack on the town.

Italian reports of the damage done on these raids can be found in Appendix 18. After the Milan attack of 12th/13th August all industries were at a standstill through lack of transport. Railways, electricity, gas and water were interrupted. At Turin the F.I.A.T. works were hit on each attack.

(4) Operations after the Capitulation

Italy surrendered unconditionally on 3rd September, 1943. The German Army's grip upon the country was too fast for the armistice to take effect. Mussolini was rescued, and replaced in power on 15th September. German reinforcements were brought into the country and, for a time, the foothold of the Allied armies at Salerno was precarious. The plans prepared for cutting the railway routes into Italy were put into effect. Bomber Command was requested to attack the Avisio Viaduct, on the Brenner route, Modane marshalling yard on the Mont Cenis route, and the Antheor Viaduct on the Riviera route, during the September moon period.

AHB/ IIJ11/14 C.O.S. 213th 11.9.43. Signal AX.82 Sept.11th

A force of 345 heavy bombers, including five United States Fortresses, were sent to bomb the Modane rail centre on 16th/17th September. Most of the force bombed the International Station, which was east of the target, in mistake for it. The aiming point chosen was at the east end of the marshalling yard, which led to confusion. The aircraft approached from the west and the first visual marker mistook the station for the yard and dropped a red T.I. on it. There was full moon throughout the attack and most aircraft reported identifying the yard, but were misled by this target indicator. The centre of the concentration was about a mile east north east of the aiming point. Daylight reconnaissance a few days later showed a great concentration of craters running from the east end of the station, near the entrance to the Mont Cenis tunnel. Tracks were partly cut but the railway was not rendered impassable.

The official French report says:-

A.H.B.6. Translation VII/75

"From the 17th to 21st September traffic was suspended in the direction of St. Julien and for ten days in the direction of the entrance to the tunnel. The town of Modane itself was severely hit and its evacuation was necessary, three-quarters of the population having been rendered homeless.

The raid caused serious damage to the chemical factory of St. Gobain."

Twelve Lancasters were despatched simultaneously to make a low level attack on the Antheor Viaduct. They were controlled by a Master Bomber, who waited until all aircraft had replied on the R.T. before ordering the first aircraft to bomb. The attack went smoothly and several explosions were seen close to the viaduct. Daylight reconnaissance, however, showed that the viaduct was atill serviceable, although masonry at the base of one pier was damaged.

Another attempt was made to cut the line at Modane on 10th/11th November. A most accurate attack was delivered in full moonlight by a force of 313 Lancasters. Many hits were scored on the yard and the railway was still inoperative 27 days after the attack. The lines were cut in two places and the sidings were practically empty at the time of the reconnaissance.

/On this occasion

A.H.B.6.
Trans: V11/75

On this occasion the French report states that the railway lines were severely damaged again and a German goods train standing in the station was demolished. Of the station itself, only a few walls remained and the engine shed was also completely destroyed. In the town of Modane only a few houses remained standing after the second attack and these were uninhabitable. "The area of Modane and Fournau indeed had the appearance of front line villages of the First World War."

The following day a second attempt was made to cut the Antheor Viaduct. Ten Lancasters of No. 617 Squadron were despatched; six of them mistook a nearby bridge for the viaduct and damaged it severely. The viaduct itself was intact. On the same day an attack was carried out by 134 aircraft on the marshalling yard at Cannes. This was also on the Riviera line. A concentrated attack was delivered in full moonlight and damage was done to the railway repair works and several other useful targets, but the marshalling yard escaped serious damage.

On the night of 12th February a third attempt was made to cut the Antheor Viaduct. The Allied bridge-head at Anzio, just south of Rome, was in need of support at this time. Eleven Lancasters of No. 617 Squadron attacked the viaduct. Since the previous attack the enemy defences had been reinforced and accurate flak and search-lights were encountered. The leader was dazzled and could not identify the viaduct. Once more it was undamaged.

AHB/
A II/70/149(F),
16D/D.B.Ops.

(5) Italy as a Strategic Base

During the progress of the Sicilian and Italian campaigns, plans were in preparation for the use of Italian airfields when they should be secured. In addition to the rich target of Ploesti oil fields, which were much nearer to Southern Italy than to Africa, a number of Pointblank targets in Austria and Germany would be more accessible from the south. The most important were the fighter factories at Augsburg, Regensburg and Wiener Neustadt. Attack from Italian airfields should reduce losses, as well as spreading the German defences, to the advantage of aircraft operating from the United Kingdom.

AHB/
A 1D/4/23A

AHB/
A II/70/149(F)
6/10/43

Appreciations of the advantages of operating from Northern, Central and Southern Italy respectively were prepared. Italy lay at the hub of Axis controlled territory. The strategic bomber forces were at present almost entirely concentrated in the United Kingdom, which lay outside the perimeter of Axis territory. This enabled the enemy to concentrate his defensive resources over a narrow arc. Operations from Italy would mean the provision of a new defensive network by the Germans to cover all the southern occupied territory. In addition to German and Austrian targets, the Balkan capitals could be attacked from Italy, as well as all the lower reaches of the Danube.

CS.22500
Encl. 1B

Signal
FAN.254
23/10/43

In view of the anticipated acquisition of Italian bases, General Arnold put forward, at the Quebec conference, a proposal for unified control of the Combined Bomber Offensive throughout the European theatre of operations, by a Supreme Allied Air Commander. In preparation for this, the Fifteenth United States Air Force was formed as from 1st November to take over the heavy bomber groups and long range fighter groups in the Mediterranean area from the Twelfth United States Air Force. The former was to be the Mediterranean section of the United States Strategic Air Forces in Europe.

/After

CS.22500
Encls.39A & 39B

After mature consideration by the Air Staff, the C.A.S. replied to General Arnold on 27th October. He agreed with the arrangements for the build-up of the Fifteenth Air Force. The slow progress achieved in Italy meant that there was no possibility of operating additional heavy bombers from there during the coming winter. When that situation should arise, it was considered impossible for one Supreme Commander to exercise effective control over night and day forces in the United Kingdom and Italy. He could not maintain the close contact necessary, and the variations in weather conditions would be too great. The local Commander of the ground forces in the Italian theatre would also be too much involved to be divorced from all control. The Chief of the Air Staff was the only man in close enough contact with the policy of the Allied governments and Chiefs of Staff to exercise supreme control in the air. It was, therefore, recommended that he should continue to carry out that function.

FROZEN 398
7/12/43

The question of the command of strategic air forces was thrashed out at the Cairo conference in November. The Americans were adamant that a Supreme Commander for the whole European theatre should be appointed. So it was agreed that they should appoint a Commander for their day bomber forces. He should be subject to policy direction by the C.A.S. for the present, and should later come under the Supreme Allied Commander for Overlord. The night bomber forces were to continue to be controlled as before. An Air Staff note on 14th January, 1944, summed up the view at that time:

AHB/
II/70/149(F)
~~2/70/149~~(F)
14/1/44

> "The overriding consideration in the allocation of heavy groups to the Mediterranean is that of airfield capacity and the ability to maintain the aircraft efficiently through the Italian ports. No groups should be flown into Italy until it is confirmed that these factors will not in any way limit their operational efficiency. Pending such confirmation, they should be operated from United Kingdom bases as the impact upon the enemy must, in view of the time factor, be maintained at a maximum."

CHAPTER 13

THE CROSSBOW CAMPAIGN

(1) Plans to Counter Rocket Attacks

AHB/ II/70/81 encl. 6.

Hitler's "Secret Weapon" had loomed large in German propaganda since the beginning of the war.(1) By 1943 it became evident that experiments were being conducted in the use of long-range weapons. Reports of the development of a "Long-Range Rocket" were received from Agents, and from the interrogation of prisoners-of-war. These pointed to the research station at Peenemunde, on the Baltic Coast, and aerial reconnaissance gradually filled in the picture.(2)

AHB/IVA/39 ~~IV/A/39~~ COS(43)184(o)

Sufficient evidence of the existence of this threat had been amassed by April 1943, for it to be submitted to the Chiefs of Staff. As a result the Prime Minister charged Mr. Duncan Sandys, Joint Parliamentary Secretary to the Ministry of Supply, with the task of investigating the reports, reporting on the form of the weapon and suggesting counter-measures. He was to call, as necessary, upon scientific advisers, technical branches of the Service and Supply Ministries and other suitable bodies.

COS(43)203(o)

These wide terms of reference resulted in an inter-departmental organisation which lasted until November. By then the accumulated evidence had been built up into definite conclusions and the task of putting counter-measures into effect was passed to the Air Ministry.(3)

COS(43)259(o) 17.5.43 COS(43)349(o) 28.6.43. D.O.(43) 5th 29.6.43

Mr. Sandys submitted a number of reports, dealing principally with the possible use of long range rockets. A warhead of up to ten tons was suggested in May. Skilful interpretation of reconnaissance photographs of Peenemunde confirmed this estimate in June. At the Defence Committee Meeting, however, Lord Cherwell questioned the validity of the evidence, suggesting that the whole thing might be a hoax to cover some other form of attack, such as pilotless aircraft. It was decided, however, that the evidence warranted an attack upon Peenemunde, as well as upon extensions to the I.G. Farben factories at Leuna and Ludwigshaven which were suspected of being connected with the fuel used in the rocket.

CMS 82/Encl.16A

A directive was issued to Bomber Command on 1st July. In order to achieve the maximum surprise an attack on Peenemunde on the heaviest possible scale was to be made as soon as the length of night and other factors should permit.

B.C.O.O. No.176 and 177. 9.7.43

A conference was held at Bomber Command on 7th July, and Operation Orders were prepared for the attack of the three targets. For security reasons the importance of the targets was attributed to special developments relating to enemy fighter aircraft. The attack upon Peenemunde was carried out on 17th/18th August, as described below, but the evidence for the importance of Leuna and Ludwigshaven was not conclusive enough to warrant attack at this stage.

/Meanwhile

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(1) See Volume II, Page 92.

(2) A full account of the Evidence up to May 1943, can be found in D.B. Ops. Folder Rocket Projectiles (II/70/81)

(3) A full account can be found in the Narrative on The Air Defence of Great Britain, Vol. 7. The Flying Bomb and Rocket Campaigns.

CMS.82/Encl.18A

Meanwhile the Defence Committee had decided to press forward with the provision of an R.D.F. warning system and all other preparations of a defensive nature; and to keep a close watch upon the area in Northern France lying within 130 miles of London. Photographic reconnaissance of this area had already revealed significant activity at certain "large sites", notably that at Watten, near St. Omer. Detailed reconnaissance soon revealed the construction of long-range gun sites, and later numerous "Ski-sites", so named because of the shape of parts of the construction.

Attacks upon the construction at Watten were made by the U.S. VIIIth Bomber Command in August and September, as described below. The nature of the other constructional works observed was not adequately verified until later.

D.O.(43)8th 14/9/43

C.M.S.82 Encl.110A.

The Defence Committee ruled, on 14th September, that further attacks on Peenemunde should not be undertaken at present but that a close watch should be kept on the area. Attacks on factories suspected of being connected with the development of rockets were to be included in Bomber Command's current programme. A directive to this effect was sent to the Command on 18th September, with a list of provisional objectives. These were re-examined by the Ministry of Economic Warfare and a revised list was forwarded on 5th October.(1)

D.O.(43) 10th

C.M.S.82 Encl.140A.

Ibid, Encl.151A 16/11/43.

At the Defence Committee meeting on 25th October it was agreed that all factories suspected of Crossbow activities should be high priority targets for the bomber forces. The C.A.S. found, on investigation, however, that the evidence was insufficient to warrant such a diversion from the attack on the German aircraft industry. The C. in C. of Bomber Command was averse to such attacks, but a short list of factories was finally agreed by the M.E.W. and the J.I.C. Their attack could be included in the general operations of the Pointblank offensive. A diversionary attack by sixteen Lancasters of No. 8 Group was carried out upon the Luftschiffsbau Zeppelin at Friederichshaven on 7th/8th October. The other first priority targets were not attacked owing to tactical objections. Some of the second priority targets were included in night area attacks during the last three months of 1943.(2) After a further reconsideration of the importance of some of the targets by the J.I.C., in early January, 1944, the C.O.S. agreed, on 1st February, that production centres should not be attacked until more definite evidence was available.

C.M.S.82, Encl.163A.

C.O.S.(43) 276th and 278th meetings.

On 13th November, the Prime Minister had approved the suggestion of the Chiefs of Staff that the Air Ministry should take over responsibility for Crossbow counter measures. The Special Enquiry stage was passed, and Mr. Duncan Sandys' Committee was dissolved. The D.C.A.S. (Air Marshal Bottomley) was now made responsible. A special Crossbow sub-committee of the Joint Intelligence Committee was formed to co-operate with him.(3) A new Directorate of Operations (Special Operations), was set up in the Air Ministry, whose director was

/also chairman

(1) The Directive and Target Lists are given in Appendix 7.

(2) See Chapters 14 and 16.

(3) Crossbow was the code name covering enemy long range weapon development. The code name Bodyline, previously in use, was supplanted in November.

C.O.S.(43) 283rd and 292nd meetings.

also chairman of the J.I.C. sub-committee. In January the sub-committee was dissolved, the new directorate being entrusted with both intelligence and operational responsibilities, under the D.C.A.S. The latter reported, at first weekly and later fortnightly, to the Chiefs of Staff.

D.O.(4) 10th 25/10/43
C.M.S.82, Encl. 130A
A.W.3 II/70/180 31/10/43

Ibid, 9/11/43

Meanwhile, the Defence Committee had decided upon attacks on the "large sites" at Marquise/Mimoyecques and Martin Vast, as well as camps of workers engaged on their construction. Fighter/bomber attacks were ordered, and Bomber Command was instructed to drop a special leaflet warning the French of these attacks. Instructions were issued that no reference should be made to the code name Bodyline or to "firing points" in discussions with lower formations. The term "constructional works" was to be used. The preparation of Oboe co-ordinates for the Channel coast area had been ordered in August, and they were ready for use by early November.

C.O.S.(43) 715(0)

After intelligence reports had been received regarding the purpose of the "ski sites", a reconnaissance, flown on 3rd November, provided photographs showing an evident launching platform with its axis aligned on London. Other similar sites were identified in the Pas de Calais and photographs of the Peenemunde area, on 28th November, provided the link required. Careful examination revealed similar sites in that neighbourhood and a small platform was identified on re-examination of earlier photographs of Peenemunde. Thus the pilotless aircraft, later called the "flying bomb" was finally identified and the confusion between it and the long range rocket was resolved.

C.O.S.(43) 745(0) 2/12/43

By December, more attention was being paid to the "ski sites" than to the large sites. Some 30 of the 60 sites, so far identified, were considered to be more than half complete. Attacks were first planned by the Tactical Air Forces, but before the end of the month it was necessary for Bomber Command and the U.S. VIII Bomber Command to join in. Both Commanders were very averse to these diversions from their main strategic role, and it was finally agreed that the Stirling squadrons alone should be used by Bomber Command. Their high loss rate had already caused them to be withdrawn from operations against distant or well defended targets. Similarly, the VIII Bomber Command was only to attack sites in Northern France when weather conditions over Germany did not allow of operations there.

C.O.S.(44) 46(0) 19/1/44

(2) Peenemunde and "The Master Bomber"

The attack upon Peenemunde on 17th/18th August, 1943, was outstanding both in its planning and importance. It therefore merits individual description in detail, and will serve as an example of the stage of development reached in raid planning and marking technique. It was the first occasion on which the "Master Bomber" system had been employed on a large-scale operation in Germany, and one of the most successful.

B.C.O.O. No.176 9/7/43 (Operation "Hydra")

The research and experimental station at Peenemunde, on the Baltic coast near the island of Rügen, was engaged in the development of 'V' weapons. It was, therefore, a target of the utmost importance, whilst secrecy was essential in order not to alarm the British public. Even the aircrews knew only that it was a "Boffin Bashing" job.(1) Its buildings were scattered and would be difficult to destroy completely by

/ordinary

(1) "Boffin"-R.A.F. slang for scientist.

ordinary area attack. So it was decided to use three separate aiming points in succession in order to cover the target. Exercises in timing and other aspects of the attack were carried out over a similar spot on the British coast in preparation for it.

B.C.O.R.B. 26.2.44.

The use of a leader to direct the course of the attack on the spot had been tried by No. 5 Group on the raid on Friederichshaven in June. Since then, there had been much discussion within the Pathfinder Group and Bomber Command, and trials had been carried out for some time. The intention was to provide a raid commentator, later called a "Master of Ceremonies" or "Master Bomber" who would provide minute to minute information on the progress of a raid by means of R/T. He could give warning of any misplaced markers, give the position of dummies and generally direct the bombing of the main force to the best advantage. The individual selected for the task had to have great experience, and had to stay in the vicinity of the target throughout the whole period of the attack.

BC/S27764. Encl. 145A.

In 1944 Lancasters with specially supercharged engines were provided, to allow him a better margin of security.

A raid commentator on these lines had been provided in attacks upon Italian cities on two occasions earlier in August.(1) For the Peenemunde raid, in which almost 600 aircraft took part, his task was of outstanding importance, and he was called the "Master Bomber". Two deputies were appointed to take over if necessary.

H.2.S. marking was not sufficiently accurate for such a target, so moonlight conditions were essential. Bombing was ordered from an unusually low height, between six and ten thousand feet. Most of the bomb load was H.E. and no incendiaries were to be dropped until the close of each attack, so as not to interfere with target marking. "Red spot fires" were used for the first time. They consisted of a 250 lb case whose contents ignited at 3000 feet, and burned with a vivid crimson fire on the ground for about ten minutes. Ruden island,(2) a small island just off the coast, from which the approach was to be made, was marked by these red spot fires.

O.R.S. Final Night Raid Report.

Window was dropped continuously from 08.00° east and back to that point, and eight Mosquitoes were despatched on a diversionary raid on Berlin, one hour before the main attack. The route of the main force was designed to give the impression that Berlin was the target. Enemy fighters were successfully deceived at first, as the German controllers forecast the probable target successively as Kiel, Berlin, Rostock, Swinemunde and Stettin. Forty aircraft were lost which was not excessive for an operation of this magnitude and degree of penetration under moonlight conditions.

The three aiming points were called 'F', 'B' and 'E' respectively. For the first, sixteen blind marker aircraft were to drop red Target Indicators and strings of flares by H.2.S. Six visual markers followed immediately, marking the aiming point with yellow T.Is after they were certain of

/identification.

(1) See Chapter 12.

(2) Not Rügen, a larger island near-by, as stated by Sir Arthur Harris in his book Bomber Command.

identification. Fifteen backers-up were to aim green T.Is at the yellow. Failing these, they could aim at the centre of all green T.Is or the centre of all red T.Is with three seconds overshoot. A main force of 227 aircraft was to attack this aiming point.

At 12 minutes after zero hour, six "shifters" were to mark aiming point 'B' with red T.Is. They were to approach over Ruden Island, aiming at the first point, 'F', but using false settings on their bomb sights. Twelve backers-up were to maintain this marking with green T.Is for the 115 main force Lancasters. Six further shifters and thirteen backers-up were to mark point 'E' similarly from Z plus 24 onwards. 180 main force aircraft were allotted this point.

Some of the blind marking was inaccurate, as Ruden island did not register well on the H.2.S. The Master Bomber and five visual markers placed their yellow T.Is accurately, however. A smoke-screen, started soon after the first markers were dropped, hampered visual identification. The backers-up and most of the main force aimed accurately at the correct aiming point. Most of the first shifters overshot point 'B', being nearer to point 'F' and the backers-up tended to do the same. Warning was given by the Master Bomber and the attack was fairly well centered on the correct point. The transfer to the third point was less successful, both markers and main force being centered more on point 'B' than 'E'. The Master Bomber apparently thought that this was the correct point and continually broadcast that the greens were well placed. Some aircraft, however, visually identified the point, or did a time and distance run from Ruden island.

P.R.U. reconnaissance 12 hours later showed severe damage in all areas. Both the factory and the living quarters had suffered. Twenty-seven buildings in the factory area were demolished and fourteen damaged. In the living quarters forty huts were demolished, fifty more as well as three large barrack blocks being gutted by fire or H.E. In the nearby labour camp half the huts were completely destroyed. Rumours which spread in Germany, reported by British P.O.W's, said that 16,000 were killed in this raid. Although obviously exaggerated, this shows that the raid was a heavy blow. Its principal importance lay, however, in the destruction of experimental models and equipment and the killing of scientists engaged on this work. The delay caused to the opening of the 'V' weapon offensive cannot be assessed definitely.

BC/S24945/XI
Encl.51A

U.S.S.B.S.
"Crossbow"
Campaign.

The United States Strategic Bombing Survey report states that this attack took place "too late to interfere seriously with the development of V-1". The V-2 programme may have been delayed some two months, it is estimated. Dispersal took place immediately, however, to a number of places.

On 10th September the Goebbels Diaries state that the raid on Peenemunde and the Todt structures in the west had thrown preparations back four, or even eight weeks; "so that we can't possibly count on reprisals before the end of January".

A German report says that the west plant was not hit. At the east plant, important testing equipment escaped damage, but the administration building, the drawing office and the main workshops were completely destroyed. The housing estate, part of the railway lines and the Karlshagen hutted camp were almost entirely destroyed. 600 to 800 people were killed, about 50% being foreign workers. Dr. Thiel, who was in charge

/of development,

of development, and another important scientist were among the casualties. Experimental work in the west plant was fully resumed by 6th September.

(3) The Baillie Beam and Operation Starkey

Late in 1940 a narrow radio beam, named the Baillie Beam had been developed by No. 80 Wing and used in December 1941 and January 1942, against the Scharnhorst and Gneisenau at Brest in the Trinity operations. The Baillie Beam was used in conjunction with an Oboe station, then in its experimental stage, which gave the release signal. (1)

AHB/IIH/241/3/532
~~BC/S.30300~~
Minute 12.

In August 1943, the use of a Baillie Beam combined with Oboe was suggested for attacking targets in the Pas de Calais area. In addition to the Bodyline targets whose attack was under discussion, this area was designated for attack under the Starkey deception operation. (2) Gun emplacements and ammunition dumps were to be attacked by Bomber Command. Bomber Command suggested that a Baillie Beam should be used by the U.S.A.A.F. for attack upon Bodyline targets in blind weather conditions.

Ibid. Encl.5A.

The Starkey operation, coming just at this time, provided valuable experience in attacking short range precision targets similar to Flying Bomb launching sites. For this reason, and because its results produced fresh evidence concerning the latter, it is included in this chapter. Air operations took place during the period 30th August to 9th September after repeated leaflet warnings to the French.

On the night of 30th September, forty-five aircraft were directed against "ammunition dumps" in the Foret d'Eperlecques, near the Watten constructional site. The following night the Foret de Hesdin, to the south, was attacked by a similar number. On 2nd/3rd September and the night following the Foret de Mormal and the Foret de Raismes respectively on either side of Valenciennes, were the targets.

On each occasion the force was led by Pathfinder Mosquitoes which marked the aiming points with the aid of Oboe. Heavy aircraft of the P.F.F. backed up, and the main force was made up of Wellingtons from the O.T.U. groups, stiffened by a few from one of the groups on the last three operations. All four attacks were carried out accurately and only two Wellingtons were missing. Another crashed on return due to anti-aircraft damage. Opposition at the targets was negligible, but some gun fire was encountered over the enemy coast.

These attacks made clearances in the woods which disclosed further constructional activity similar to that at Watten, and so served an unexpected purpose in aid of the Crossbow enquiries. American Fortresses and medium bombers of the Tactical Air Forces also attacked the Foret d'Eperlecques and the Foret de Hesdin during this exercise. The former, aimed at the Watten site, are dealt with in the next section.

/On the

(1) See history of Oboe by No. 60 Group Headquarters.

(2) Starkey was the first part of operation Cockade; the mock invasion exercise in the summer of 1943.
See Chapter 9(1).

AHB/1D/12/44

On the night before D-day of operation Starkey, which was postponed twenty-four hours to 9th September, 257 aircraft were despatched to attack gun positions near Boulogne. Other batteries were attacked by the Tactical Air Forces. The two battery areas, given the code names Religion and Andante, were at Le Portel and Cap d'Alprech, just south of Boulogne. Religion consisted of 3 x 8.2 ins long-range guns and 6 x 88 m.m. A.A. guns; Andante of 5 x 15 cm long-range guns and 6 x 88 m.m. guns.

The attack was in two phases, the first on the Northern position, the second on the southern. In each case half the Oboe marking Mosquitoes used the Baillie Beam technique, dropping green markers. The normal Oboe marker aircraft, which used Red T.Is were more accurate, however. The accuracy of bombing achieved was not good enough for such small targets. The main force was composed of Stirlings and Wellingtons of Nos. 1, 3 and 6 and the O.T.U. Groups, with five fortresses of the U.S. VIIIth Bomber Command, sent to gain experience of night operations. The report on Operation Starkey says:-

> "The attack by the night bombers does not appear to have hit either of the two primary aiming points, although their attack undoubtedly caused damage to subsidiary defences and communications in the vicinity."

A.A.F. Evaluation Board Survey of Watten, 31/3/45.

(4) Watten and Other Launching Sites

AHB/II/70/180 ~~2/70/180~~, 1/7/43.

Post hostilities information has revealed that preparations for the construction of the Watten site began in March, 1943. British Intelligence became aware of high priority construction there during July, 1943, following a Defence Committee decision on 29th June "that the most searching and rigorous examination of the area in Northern France within a radius of 130 miles of London should be organised and maintained". The site at Wissant had been identified earlier, but it was decided to delay bombing it in order to watch its development, and reach some conclusion as to its purpose. Fortnightly air reconnaissances were ordered. The activity observed at Watten in mid July led to an order for weekly reconnaissance there.

Ibid 5/7/43.

C.M.S.82 Encl.53B

On 11th August a meeting was held at Air Ministry, under the chairmanship of the D.C.A.S. to discuss the attack of installations in Northern France.

> "The timing of attacks was the main problem; these should be left as late as possible in order that we could obtain correspondingly more information and cause the maximum setback to the enemy's arrangements, provided that the targets still remained vulnerable to the bombs we had available."

The Committee agreed that, from the information available, Watten was the only target which merited an attack in the near future.

In preparing the Air Staff opinion resulting from this meeting of the Chiefs of Staff, the D.C.A.S. pointed out that the necessary accuracy could not be obtained with Oboe for some time as Oboe was not yet fitted to heavy bombers.

/Also

Also the Tallboy bombs of 12,000 and 20,000 lbs. would not be available before October at the earliest. As the Watten construction was believed to have a massive reinforced concrete roof it would be preferable to wait for these heavy bombs. In the meantime, however, the U.S. VIII Air Force could use 2,000 lb. bombs to delay construction.

Ibid, Encl.69A

AX.792

The Chiefs of Staff referred the question of bombing Watten to the Deputy Prime Minister. On 25th August the following signal was sent to the U.S. VIII Air Force,

> "It has been decided to proceed immediately with destruction of special construction at Watten....."
>
> "Request you proceed with attacks as soon as possible when circumstances do not permit of attack of targets in Germany. Object of attacks is the maximum scale of destruction to cause maximum delay in completion."

A.A.F. Survey of Watten, Page 5.

C.M.S.82, Encl.87A.

The VIII Air Force despatched 224 aircraft to attack the site on 27th August and a further 127 on 7th September. The first attack was the most successful of the fourteen carried out against Watten between this date and 19th June, 1944 by the U.S. VIII Air Force. It caused the abandonment of construction of the principal building. A new building was begun nearby to replace it. The railway line and electricity supply to the site were also broken. It is interesting to note that Sir Malcolm McAlpine, whose advice was sought regarding the damage revealed in photographs, gave it as his opinion as "an experienced constructor in concrete", that the simplest method for the enemy to adopt would be to start again from the level of the foundations.

Ibid Encl.106B.

On 14th September the Defence Committee decided "to go for the industry concerned in rocket manufacture, in the course of our ordinary operations". As a result, no further attacks on firing points were carried out by the heavy bombers until December. By that time the threat of the "flying bomb" had become apparent, as even more imminent than the rocket. The identification of the "ski sites" with pilotless aircraft during November(1) opened the way to attacks on these sites.

AHB/ II/70/181

The Tactical Air Forces were first allotted the task of neutralising these Noball targets, as they were called. During November the village of Audinghem, which housed the Todt Organisation Workers engaged on the construction of sites was attacked twelve times and destroyed; excavations at Martinvast and Mimoyecques were also heavily damaged. Attacks during the first fortnight of December were held up by bad weather. Only one day were they possible - 5th December, - when 198 Marauders and 24 Hurricanes attacked three sites in the St. Pol area.

C.O.S.(W) 994 15/12/43

In view of these delays the C.O.S. considered that the heavy bombers should be employed on the task. The VIII Air Force were asked to plan a large scale operation with all available heavy bombers to neutralise as many sites as possible which were more than half completed. In addition, Bomber Command was allotted three sites to be attacked for experimental purposes. The three were at Ailly le Haut Clocher, Domart en Ponthieu and Bristellerie.

/The first

(1) See Section (1)

The first two of these were attacked on the night of 15th December by four Pathfinder Mosquitoes and 21 Stirlings, and two Mosquitoes and nine Lancasters respectively. The latter, belonging to No. 617 Precision Bombing Squadron, used 12,000 Tallboy bombs. December 24th was the first occasion on which conditions were suitable for the employment of heavy bombers of the VIII Air Force. On that day 24 objectives were attacked by 670 out of 722 aircraft despatched. The Tactical Air Forces continued to attack whenever possible. By the end of the year 52 ski sites had been attacked, five of them by Bomber Command, which had now been allotted eight sites. The damage inflicted was divided into four categories of which Category A indicated decisive damage. Twelve sites were assessed in this category by 1st January, 1944.

Crossbow Progress Report No. 25, 4/1/44.

B.C./S.30919/1, Encl.8A.

On 27th December, 1943 a new schedule of Noball targets was instituted, which was revised at approximately weekly intervals. This gave the priority for attack, assessed on the state of completion of the targets, and allotted objectives to the various Air Forces. Bomber Command retained the same eight, which were given code names of birds - Thrush, Robin etc. - until the end of January, 1944, when they were relieved of their Crossbow commitment. During January the Command operated against Noball targets on ten nights, in numbers varying from three Mosquitoes on 2nd January, to a mixed force of 111 Stirlings, Mosquitoes and Lancasters, the latter being from No.617 Squadron, on 21st January.(1) The targets, in addition to the original three were Bois des Huit Rues, Freval, Bonnetot and Herbouville.

Ibid, Encl.52A

The latter was used on 27th and 29th January for the calibration of Oboe ground stations. The Command Operational Research Section had discovered a systematic error in Oboe bombing and suggested the need for this calibration. This target was, therefore, suspended from attack until daylight photographic cover had been obtained on 2nd February. The remaining objectives were added to the lists of other Air Forces. Temporary suspension was requested for two of these sites, which had been allotted to No.617 Squadron, so that an assessment of bombing accuracy could be made. One new target was later requested for this squadron. Fervin Palfart was allotted on 8th February, but was not used during the month.

Ibid Encl.59A

AX.917

The only operations connected with Crossbow carried out by Bomber Command during February were on the 21st and 29th. These were both for the purpose of trying out the new Fountain-Pen transmitter used with Mark II Oboe. It was found to have insufficient power and was eventually replaced by the Album Leaf type, with an American transmitter. The U.S. VIII Bomber Force was now also using Oboe for these targets. Three operations were carried out in January and seven in February by the Americans in daylight.(2)

(5) Effects of Counter Measures

The effects of the measures taken to neutralise or delay German 'V' Weapon attacks are difficult to assess. As

/mentioned

(1) See Appendix 10.

(2) See Appendix 12 for American Operations.

U.S.S. B.S. Crossbow Campaign.

mentioned above, the Peenemunde attack was too late seriously to affect the V.1, or flying bomb, which was already in production. Two or three months delay was probably caused to the V.2 Rocket, but delays in the start of attacks by this weapon were due primarily to technical defects which took a long time to overcome. Production was delayed, however, by lack of electrical instruments and other parts, partly caused by the air raids on the factories at Peenemunde, Wiener Neustadt and Friederichshaven.

Attacks on ski sites caused the greatest delay to the flying bomb campaign, a delay of three or four months. "They forced the replanning of the whole launching procedure, and the design and construction of an entirely new system of sites". As early as 20th December the subject ocurred at one of Hitler's conferences. When Jodl said that the recent attacks had done little damage, Hitler remarked that small targets were not so easy to hit. He went on to say that

Fuhrer Conference.

> "the important thing was to keep the sites as small as possible and to instal heavy flak defences,"

and he ordered that an entire months output of 3.7 c.m. guns should be sent to the West.

Ibid

Ley had stated publicly in October that a new weapon, by which he meant the V.2, would be in use within six weeks, "which would raze whole towns in England to the ground". On Jodl pointing out that a date could not be fixed as it might well lead to disappointments, Hitler ruled that no public mention was to be made of the weapon.

U.S.S.B.S. Crossbow Campaign

The delays in development of the V.2 gave time for improving on launching methods. As a result the complicated structures at Watten, Wizernes and other large sites became redundant. These sites had been effectively bombed, but it is doubtful whether, in any case, their use would have been necessary.

In the United States Strategic Bombing Survey, from which some of the above assessments are taken, an interesting point is made. In the attack on Peenemunde, "it is quite probable that more serious interruptions were caused in the work on other weapons". This Research Establishment was working on other secret weapons as well as the A.4 or V.2 Rocket. One of these weapons was the anti-aircraft rocket called the Wasserfall. The detachment working on this project at Peenemunde in 1943 was loaned during the summer to speed up the A.4 project. Such delay was caused to the Wasserfall that it never came into service.

CHAPTER 14

THE AUTUMN OFFENSIVE

(1) Development of Radar Aids

The autumn of 1943 saw important developments in Radar aids to bombing. Oboe Mk.II and Gee-H were introduced and tried out on operations. The Oboe Mk.I repeater system was also tried, but the results were not encouraging and it was abandoned. H.2.S. Mk.III (3 centimetre) was also introduced and used against Berlin in November. In September the name Radar was adopted as official nomenclature for all radio aids to bombing, navigation and defence, formerly known as R.D.F. or Radio location. The name Radar was taken from the initials of the term Radio Detection and Ranging.(1)

Oboe had proved itself by this time as the most accurate means of blind bombing so far devised. The effect of its use on the Ruhr and Rhineland area has already been described. Its use had been restricted to target marking and operations in the immediate vicinity of a large scale raid. This was designed to minimise the risk of an Oboe set falling into enemy hands. The A.O.C.-in-C. on 23rd August sought and obtained permission to use it for marking the route of the main force. The A.O.C. of the Pathfinder group was most anxious to use Oboe independently of the main force. In view of the introduction of Oboe Mk.II and Gee-H, it was suggested by the Air Staff in September that Oboe Mk.I might be released for such independent use. The D.C.A.S. decided to wait for an official request from Bomber Command. Oboe Mk.II was first tried out operationally on 26th/27th September. After several more trials during October, the Deputy C.-in-C. requested the release of Mk.I, and on 1st November permission was granted by signal:-

AHB/ 1D/12/205 21.9.43.

Signal AX.990

> "Oboe aircraft may now be employed for destructive effect against important precise targets independently of main force operations. Oboe aircraft should not, however, be used for harassing attacks."

Following this, the list of Oboe targets was re-examined. In consultation with the Ministry of Economic Warfare, two target systems were chosen, special steels and electric power supplies, which were considered suitable for precise attack by Oboe or Gee-H. Bomber Command were notified of these on 25th November, but had meanwhile chosen a list of 35 targets considered operationally suitable, ranging from Bodyline to oil, steel and chemical plants. They considered that concentration upon one or two systems would give away the intention, so the recommended systems were added to the list already chosen.

AHB/IIH/241/3/GL3(E) ~~BC/S.23746/ Volume V.~~ Encl.114A and minutes.

History of Oboe.

Oboe Mk.II was designed on the same principle as Mk.I, but used a centimetre wavelength. The first two types of aircraft transmitter, the Penwiper and Fountainpen, were unsatisfactory due to lack of power. Trial of a third type, the Pepperbox, was abandoned in favour of the Albumleaf, an American ASG.3 transmitter, slightly modified, which gave highly satisfactory results.

/The repeater

(1) See A.H.B. Signals Monograph.

The repeater system of Oboe had long been under development. It was designed to use repeater aircraft to relay signals from ground stations to aircraft operating. These repeaters would fly along a chosen line half-way between target and ground station. The range of Oboe might thereby be increased, it was hoped, to reach perhaps as far as Berlin. Trials were carried out with a single channel repeater against Emder from 7th to 31st October. The second channel transmitted direct. Many technical failures occurred, only ten out of 26 bombing sorties obtaining satisfactory results. As the accuracy was not much better than H.2.S. and the number of repeater aircraft required, twelve, could ill be spared, the Command decided to abandon the project. The aircraft belonged to No.139 Squadron, which was now being fitted with Gee-H, and it was considered that the latter should have priority.

Gee-H was a new device which is described in the Annex.(1) It was decided to equip No.139 Mosquito Squadron in the Pathfinder Group, and the squadrons equipped with Lancaster II aircraft with 8,000 lb. bomb doors. These were not suitable for H.2.S. equipment which other Lancaster Squadrons were receiving. Operational trials of the Mosquitos began on 4th/5th October and seven sorties were carried out by the end of the month, only two successfully bombing by Gee-H.

AHB/IDA/177

Forty-five Lancasters of Nos.3 and 6 Groups were equipped with Gee-H by 9th November, 1943. They first used the device for bombing on 3rd/4th November, when 38 Gee-H equipped aircraft were directed against the Mannesman plant at Dusseldorf. Fifteen bombed with the aid of Gee-H and two were lost. As Gee-H had no better range than Oboe, and was not quite as accurate, its value was limited. With the increased threat of flying bomb attacks in December, it was decided to transfer the equipment to the Stirlings used for attacking launching sites.

Ibid. 28.12.43.

(2) September - Improving Technique

Berlin was attacked again on 3rd/4th September, but only 316 aircraft were employed on this occasion. Although the marking and bombing was west of the aiming-point, a good concentration was achieved in an area not previously heavily damaged. Siemen's electrical engineering plants were heavily damaged, as well as numerous other important factories.(2)

On 5th/6th September a highly successful H2S attack was carried out on the towns of Mannheim and Ludwigshaven, on either side of the river Rhine. Six hundred and five aircraft took part in cloudless conditions. Accurate marking, and planned overshooting by backers-up and recentrers prevented the usual creep-back. The final report claims that "from the tactical point of view, this raid was a model of all that a Newhaven attack should be." All blind markers not absolutely sure of their position refrained from dropping markers, and there was very little loose bombing.

O.R.S. Final Night Raid Report No.419.

/Daylight

(1) See Annex, Chapter 5(2)

(2) See Appendix 18 for damage reports.

Daylight reconnaissance revealed very severe damage, some of which was the result of the raid of 9th/10th August. The fully built-up areas of both towns were assessed as being almost 50% destroyed or severely damaged. The most important factory, I.G. Farben, was relatively lightly damaged in proportion to its size. This plant had gained added importance, as it was believed to be producing special fuel for Crossbow weapons.

A.H.B.6. Translations.

German reports of this raid show that two rubber factories, an aircraft and a motor works were hit in Mannheim with heavy casualties and house damage, but Ludwigshaven was not as severely affected. This incidental damage illustrates the unexpected effects of area attack. These rubber factories were not even mentioned in the British target reference books. As it happened special emphasis was given to attack against rubber, as well as aircraft plants during this month and the next.

The attacks against the Dunlop works at Montlucon and against Hanover described below were aimed at reducing production of aircraft tyres. Following the successful American attack upon the important synthetic rubber plant at Huls in June, the German rubber supply was considered by M.E.W. to be highly vulnerable. Their representative expressed the view on 15th July that attack on rubber tyre plants

M.E.W. File 2 Z.634/A/1

> "affords the best prospects of affecting the mobility of wheeled vehicles and aircraft already in service with the German armed forces (not even excluding attack on oil.")

On 6th/7th September a force of 404 aircraft was despatched against Munich. Cloud prevented visual identification, and the main weight of attack fell on the edge of the town, to the south-west, the direction of approach. The German report shows 47 factories hit. On 8th/9th September the Starkey operation described in the previous chapter took place.

AHB/IIG/86/6A

The next heavy attack was a moonlight one upon the Dunlop Works at Montlucon on 15th/16 September. This target had been cleared for attack at the 98th Target Committee meeting on 10th September. Five U.S. Fortresses took part in this operation with 369 heavy bombers of the R.A.F. The factory was located visually and well marked. Many buildings were set on fire early in the attack, and the smoke from burning rubber, as well as cloud below the aircraft, caused the later attack to scatter. Both photographs and intelligence reports confirmed that the Dunlop factory was very heavily hit, the latter saying "Dunlop works entirely destroyed in flames."

O.R.S. Report and Target Committee.

A.H.B.6. Translation VII/75.

The official French report contains the following description of the raid:-

> "Nearly every part of the Dunlop complex was hit by H.E., but it was incendiaries which caused the greatest damage to buildings. More than half of the area covered by the complex was completely destroyed by fire. These exceptional circumstances were due in the main to the construction and distribution of the buildings, and to the inflammable nature of the products produced. Work at the

/factories

factories came to a complete standstill and more than six months later only the cycle shop, which had been rebuilt, was in any way capable of renewal of work. Rarely has there been an air attack so completely effective as this one."

On the same night a special precision attack was carried out by eight Lancaster IIIs of No. 617 Squadron, modified to carry 12,000 lb Tallboy bombs. This was the first operation in which these bombs were used. An unsuccessful attempt was made to breach the embankment of the Dortmund-Ems canal. The force was divided into two sections of four, each escorted by three Mosquitoes of Fighter Command. The 12,000 lb H.C. bombs were fitted with a special delay fuse, to enable the attack to be made from a height of 150 feet.

The Leader was shot down on the outward flight, made at low level. Thick haze in the target area hindered the attack, but the Deputy Leader directed it as far as possible. At least one bomb was reported in the canal and one on the towpath. The attack lasted for about 1½ hours, and the Deputy Leader and three other aircraft were shot down, it was believed in the target area. The fighter escort remained in the target area throughout the attack. No enemy fighters were encountered, and all the Mosquitoes returned safely.

Translation
A.1.12/U.S.A.F.E.

A German intelligence report says that "the targets, probably a lock and a bridge were not hit." The bridge embankment was torn up for a length of 35 metres. In the case of one Lancaster, which was shot down, the bomb detonated on impact and caused a crater 30 metres in diameter. One 12,000 lb. bomb was salvaged unexploded.

The following night the attacks on Modane marshalling yard and Antheor viaduct, on railway routes into Italy were carried out. These have already been described. (1) No further heavy operations were carried out during the moonlight period, although Mosquitoes attacked Berlin and Cologne.

On 22nd/23rd September the first operation employing "Spoof" tactics was carried out against Hanover. Seven hundred and eleven aircraft were despatched against the main target, whilst 29 Lancasters and Mosquitoes of No.8 (P.F.F.) Group carried out a realistic spoof attack against Oldenburg. Red and green target indicators, bundles of flares, and bombs were dropped. Although opposition was negligible at Oldenburg, the attack served to confuse the ground control for night fighters.

The main attack on Hanover, where 80% of German aircraft tyres were reputed to be made, was carried out in cloudless conditions and good visibility. The red blind-markers were somewhat scattered, but the visual markers dropped their yellow and green T.I.s accurately by the aid of flares. The backers-up unfortunately

/aimed

(1) See Chapter 12, The Defeat of Italy.

aimed their green T.I.s at the centre of T.I.s of all colours. An unexpectedly strong wind caused many aircraft to approach on the wrong track. The main weight of the attack, aimed at the green T.I.s, fell two to five miles south-east of the aiming point, and spread up to nine miles in the later stages. The main factory area was on the north-west and west of the town, and was little affected. (1)

The same night an operation was carried out against Emden by 12 Mosquitoes, eight of them Mark IX, which flew at 31 to 35 thousand feet. The object was to test the range of Oboe at these heights. The target was 290 miles from the ground station which was to order release. None of the aircraft received the signal, although one flying at 35,000 ft. received signals until just short of the release point.

The next night, 23rd/24th September, a force of 627 aircraft, including five U.S. Fortresses, was directed against Mannheim. A feint attack was carried out on Darmstadt by 29 aircraft, and eight Mosquitoes marked the route for the main operation. Permission for this had been obtained during the day. (2) This attack was fairly successful, and it was estimated that the damage in the fully built-up areas was increased from 46% after the last attack to 59% German reports confirm the O.R.S. estimate that most of the heavy damage was in the north of the town and the harbour area. Damage to the value of 3 million R.M. was assessed at the Mercedes-Benz works. Only a few scattered incidents occurred in Ludwigshaven, although several buildings of I.G. Farbenindustrie to the north were hit.

On 26th/27th September the first operational trial of Oboe Mark II was carried out, as mentioned above. The target was Aachen, a short range objective which did not involve penetration of the Ruhr defences. A discrepancy in the frequencies of the two ground stations prevented the use of Oboe for bombing. A second unsuccessful trial against the same target was made the following night. It was not until 3rd/4th October that the first successful attack was made using Oboe Mark II.

A second heavy attack against Hanover was made on 27th/28th September, the spoof target on this occasion being Brunswick. Six hundred and eighty-three aircraft, including five U.S. Fortresses, were employed against the former, 27 against the latter. The main attack fell from one to five miles north of the aiming-point, among villages and recently developed industrial areas north of the town. Thirty-nine aircraft including one Fortress were lost, mainly to fighters, a percentage of 5.6 as compared with 3.5 on the previous attack.

In addition to the Oboe Mark II trial on the same night, another Mark I range test, with Emden as target, was carried out. No signals were received at the full range. This attack was also intended as an extra feint attack, to draw the defences. T.I.'s, as well as bombs, were dropped.

/On

(1) See The Goebbels Diaries, 24th September, 1943.

(2) See Section (1) above.

On 29th/30th September, Bochum, already heavily attacked during the Battle of the Ruhr, was again visited by 352 aircraft, whilst 11 Oboe Mosquitoes were despatched against Gelsenkirchen. The results of the Bochum attack have been detailed above under the Battle of the Ruhr. (1) The city centre and the surburbs of Wanne-Eickel, Wattenscheid and Castrop Rauxel suffered most. The Krupp Synthetic oil plant at the latter was damaged. (2)

A.H.B.6 Translation

(3) October - Concentration on Pointblank

Out of the ten heavy area attacks carried out in October, all but the first were directed against towns named in the Pointblank directive. (3) This attack, on 1st/2nd October, was on Hagen, a Ruhr town not dealt with in the Spring. It was an important steel production centre, a raw material whose supply M.E.W. believed to have been reduced by 30% to 40% as a result of the Ruhr offensive: German sources assess the loss at about 20%. It also contained one of the most important accumulator plants, specialising in U-Boat accumulators.

M.E.W. Fol.2 Z.634(a)1, 12/11/43

A.H.B.6 Trans: No.VII/62

The operation, by 251 Lancasters, with Oboe Mosquitoes as marking aircraft, was described as devastating. Photographic reconnaissance, on 3rd and 4th October, showed very heavy damage, including the accumulator works, thirteen steel plants and other important industrial undertakings, as well as commercial and residential areas. After the main attack, twelve Oboe Mosquitoes were detailed to attack the steel works at Witten, nearby, for training purposes. Eight bombed on Oboe and two attacked Hagen owing to technical trouble.

On the second night of the month Munich, the site of B.M.W. and Dornier plants, was attacked. Two hundred and ninety-four Lancasters took part, whilst 117 Halifaxes, Stirlings and Wellingtons took part in a big mine-laying operation all along the enemy coasts. (4) The Munich attack was successful, although markers were placed about three miles South East of the aiming point. This had fortunately been chosen in the North East of the city. Daylight reconnaissance of this target covered the September night raid and two daylight raids by the U.S.A.A.F. from North Africa as well as this operation, so no assessment of its effect could be made. German reports have not, so far, been found.

The first of two heavy attacks carried out against Kassel during the month took place on 3rd/4th October. These were the only heavy operations of the year against this important aircraft manufacturing town, containing Fieseler fighter assembly and components factories and Henschel Aero-engine Works. Five hundred and forty-seven aircraft were despatched, damaging all these plants. The main weight of the attack was outside the fully built up area of the town, owing to poor target marking. Visual

/markers

(1) See Chapter 5 (5)

(2) See Appendix 18 for records of damage from German sources

(3) See Appendix 6

(4) See Chapter 4(6)

markers could not identify the aiming point owing to haze. A diversionary attack on Hanover was made by ten Mosquitoes, which flew with the main bomber stream until it turned South at a turning point near Detmold. The first successful attack with Oboe Mark II was made the same night upon the usual practice target, Aachen, whilst twelve Oboe Mark I Mosquitoes were sent to the power station at Knapsack, Cologne.

The fourth consecutive heavy attack, on the fourth night of the month, was upon Frankfurt-on-Main. Four hundred and six aircraft took part, whilst 66 Lancasters carried out a diversionary attack on Ludwigshaven, and twelve Oboe Mosquitoes were again directed against the Knapsack power station. The first operational trial of Gee - H took place on this night against Aachen, without success. The attack on Frankfurt was well concentrated. Both the British and German assessments agree as to its effectiveness. (1) The Germans report over 2,600 killed or injured, in addition to 52 suffering from shock who "would never recover and would probably have to be put to sleep." The Ludwigshaven operation was not very successful as a diversion and ten British aircraft were lost at Frankfurt as well as one of the three U.S. Fortresses which took part.

The next operation was against Stuttgart, on 7th/8th October. Three hundred and forty-two aircraft were despatched, whilst sixteen Lancasters of No. 8 (P.F.F.) Group carried out a feint attack upon Friederichshaven. Ten Mosquitoes were sent to Munich and this attack was more successful as a diversion, although that on Friederichshaven caused some useful damage to the Zeppelin Works. The attack on Stuttgart could not be assessed owing to thin cloud which obscured night photographs. Day reconnaissance showed the results of a U.S.A.A.F. attack of the previous day as well. Most of the fresh damage was concentrated in the town centre. No German records of this raid have been found.

On the same night the first operational trial of the Oboe Repeater System was carried out successfully against Emden. Aachen was the victim of another trial by four Oboe Mark II and one Gee - H Mosquito. One of the former and the latter attacked successfully, using their Radar apparatus. Airborne-Cigar was first carried on this night by No. 101 Squadron to jam V.H.F./R.T. Control. (2)

The following night, 8th/9th October, Hanover, the aircraft tyre manufacturing centre, was again attacked. This attack was well concentrated on the city centre and was much more effective than the two operations in September. About 54% of the fully built up area was claimed as destroyed, mainly by fire. Losses were severe once more, 5.4% of the total force. This was the last time Wellingtons operated over Germany.

A heavy diversionary attack was carried out simultaneously upon Bremen, which had been attacked by the Americans in the afternoon. The two attacks caused damage in the south of the town. As a diversion, the operation was only partially successful. It deceived the ground control for some time,

/but some

(1) See Appendix 18

(2) See Chapter 16 (1)

but some fighters directed to Bremen met the main bomber stream to Hanover. A diversionary operation against Berlin was also carried out that night by Mosquitoes. Ten Mosquitoes, equipped with Oboe were directed against the Castrop-Rauxel synthetic oil plant and one, equipped with Gee - H against a metal castings plant at Duren. The latter brought back a bombing photograph which was plotted 500 yards from the aiming point.

The following night widespread fog was forecast and only six Mosquitoes were despatched on a harassing raid to Berlin. No further operations were possible until the moonlight period. On the nights of 13th, 16th and 17th October further Mosquito harassing attacks were carried out, some using Oboe Mark II and Gee - H.

On 18th/19th October the fourth attack on Hanover within a month was carried out. There was a three-quarter moon during the attack, but considerable cloud hampered enemy fighters, although a record number was believed to have operated. The loss rate was 4.7%. Three hundred and sixty Lancasters were despatched, but their attack was scattered owing to ten tenths cloud. Two factories of the Continental Rubber Company suffered further damage. The diversionary raid by eight Mosquitoes on Berlin did not achieve its purpose. Mosquitoes, using Oboe Marks I and II and the Repeater System also operated.

On 20th/21st October the first large-scale night raid upon Leipzig was undertaken. Very bad weather conditions over the target, with cloud up to 17,000 feet, caused the failure of the attack. Flares and markers were obscured by cloud. Only scattered damage over the whole neighbourhood was revealed by photographic reconnaissance nine days later. The diversionary attack on Berlin by ten Mosquitoes drew off the bulk of the enemy fighters. Two of the Mosquitoes were lost. Fifteen of the Leipzig force were missing.

A second heavy attack upon Kassel was carried out 22nd/23rd October, 569 aircraft taking part. The Operational Report states that the visual marking was exceptionally accurate. Two minutes before zero hour 80 red T.I.s were burning in a compact group half a mile south-east of the aiming point. Seven days after the attack fires were still burning. "The central city area presented a scene of utter desolation."

USSBS/PDD61
Fire Raids on
German Cities

The U.S. Strategic Bombing Survey on fire raids gives a description of this raid from local evidence:-

> " The bulk of this attack was concentrated in the highly built-up central part of the city, and as a result of this concentrated attack, the entire area was practically destroyed. It is estimated that 65% of the weight of bombs reported over the target fell in an area of seventeen square miles in and around the centre of the town.....

/The planes

The planes attacked from the west and south west.... It is estimated that 50% of the buildings in the zone of bombfall caught fire immediately and fired the adjoining buildings. The H.E. bombs loosened roof tiles and opened up windows so that buildings which were not hit were easily ignited by flying sparks and radiant heat. The fires spread quickly over a thickly built-up area (4.5 square miles) which contained enormous quantities of bulk fuel. The rapidly rising heat over a large area created a great draft and inrushing air almost reached gale proportions, similar to Hamburg, turning the streets into flues and setting all combustibles on fire.

Communications and essential services were disrupted, as fires were of such proportions that no firefighting agency could cope with them. The firemen devoted themselves to saving lives and trying to check the fires at the perimeter. It was impossible to do any fire-fighting in the centre of the fire zone..... The local building office did not have any records on the exact damage to industries, but they supply the following estimates for the principal plants:-

Henschel-Werke 1, 2 and 3	50% - 60%	damaged
Spinnfaser	50%	"
Junkers-Werke	40%	"
Fieseler-Werke 1	50%	"
Salzmann & Co.	40%	"
Gottschalk & Co.	50%	"
Schule-Hohenlohe	30%	"
Anton Henschel	80%	"
Reichsbahnanlage	50%	" "

The diversionary attack on this occasion was directed against Frankfurt-on-Main. It successfully delayed the fighter reaction to the main attacking force which was routed towards Frankfurt up to the last leg. (1) Corona was first used on this occasion to jam the running commentary used by the Germans for Night Fighter Control. (2) Twelve Mosquitoes were detailed on a precision attack against the Knapsack power station at Cologne, using Oboe Mark I.

There were no further heavy operations during October. Mosquitoes operated on two nights using Oboe Marks I and II and Gee-H. Otherwise only mine-laying and leaflet sorties were practicable, owing to thick cloud or fog.

(4) November - Increase in Precision Attacks

November saw the opening of the great winter offensive against Berlin which is dealt with in the next chapter. Very few other area attacks were carried out. The scale and frequency of precise attacks, mainly against steel and armament plants, increased considerably during the month. This was made possible by the increasing supply of precision bombing devices - H-S, Oboe, and Gee-H.

The first heavy attack of the month was upon Dusseldorf, the great armament centre on the edge of the Ruhr, on 3rd/4th November. Whilst 551 aircraft were engaged in the

/area

(1) See Map 3 for routes of the various forces

(2) See Chapter 16 (1)

area attack, 38 Lancasters equipped with Gee-H carried out the first operational trial of this device by heavy aircraft, against the Mannesmann steelworks within the same area. A diversion by 62 aircraft against Cologne, ten minutes before the main attack, drew off the enemy fighters until the attack was under way. Thirteen Oboe Mosquitoes were despatched on a precision attack against the steelworks at Rheinhausen.

The aiming point for the Dusseldorf attack had been chosen in the extreme north-east of the city. The main force was ordered to approach on a heading of 060 degrees. With the usual undershooting, as the attack progressed, the main weight of bombing fell well across the centre of the city. Over 28% of the buildings still undamaged by previous raids in the fully built up area were estimated to have been affected, including a number of high priority armament and steel works. These had gained greater importance owing to their suspected connection with Crossbow construction, being included in the Crossbow Target List of 5th October. (1)

Unfavourable weather prevented further heavy operations for two weeks, except for the moonlight attacks on Italian rail communications on 10th and 11th November described earlier. (2) Meanwhile Mosquitoes operated on almost every night. Those not equipped with Radar aids made harassing attacks upon town centres, whilst those fitted with Oboe or Gee-H attacked precision targets chosen from the list of Oboe Targets laid down. (3) Many of these latter operations were also trials of new Oboe or Gee-H equipment, such as the Penwiper and Fountainpen mentioned earlier. (3)

On 17th/18th November the first operation of considerable size was carried out entirely by H2S. Eighty-three Lancasters and Halifaxes were despatched against the I.G. Fraben plant at Ludwigshaven and an accurate blind attack was carried out under conditions of bad visibility. Daylight reconnaissance showed damage to 20 buildings of the factory.

Harassing attacks had been carried out on Berlin by seven to nine Mosquitoes on three nights during the week previous to 18th/19th November. On this night the first attack of the heavy winter offensive against the capital took place. This offensive is dealt with in a chapter to itself, as it was the principal commitment of Bomber Command for several months.

A heavy scale raid was carried out simultaneously on 18th/19th November upon Ludwigshaven. Most of the weight of this raid was wasted in open country to the north-east, owing to misplaced markers. Several causes were given for this: unserviceability of many H2S sets, an unexpectedly light wind en route which delayed the backers-up, a smoke screen which hampered visual markers, and decoys.

The attack on Ludwigshaven was timed 32 minutes before that on Berlin, in order to draw the enemy fighters. This diversion was successful in reducing

/losses

(1) See Chapter 13 and Appendix 7

(2) See Chapter 12 (4)

(3) See Section (1) above

losses on the Berlin operation to 2% at a cost of 5.8 for the Ludwigshaven raid. Fog in the Berlin area contributed to the low loss rate there, by hindering the activities of fighters. The Berlin force was composed of Lancasters and Mosquitoes only, whilst all the Halifaxes and Stirlings, with a few Lancasters unfit for the Berlin operation, were sent to Ludwigshaven. The loss rate of the Halifaxes and Stirlings had compared so unfavourably with that of the Lancasters for some months past, that the former were now reserved, as far as possible, for operations involving only short penetration of enemy defences. Stirlings had been excluded from the more difficult operations after August, resulting in an improvement in their monthly loss rate from 6.2% in August to 4.6% in September and 3.4% in October. Most of their effort was devoted to mine-laying during the latter month. They only took part in three out of nine major operations. Halifaxes took part in only four of these major raids, but their loss rate was 7.4%, compared with 5% for September. The loss rate of the Lancasters was 4.2% in September, 3.4% in October, and 4.1% in November, in spite of the fact that they carried out all the more distant and hazardous operations in these months. (1)

On 19th/20th November an attempt was made to carry out a blind attack through cloud on the I.G. Farben factory at Leverkusen by 256 Stirlings and Halifaxes. All ten Mosquitoes detailed for marking experienced Oboe failure. As a result, the bombing was scattered widely over the Ruhr, according to enemy reports. It was thought that mutual interference between the three Oboe channels in use caused this failure.

The next two heavy attacks were upon Berlin, and are dealt with in the next chapter. On 25th/26th November, in order to spread the enemy defences, another attack was make on Frankfurt-on-Main by a force of 262 aircraft, mostly Halifaxes. Cloud over the target hid the T.I.s and caused the attack to be scattered.

The following night 178 Lancasters and Halifaxes accompanied the main force destined for Berlin as far as Frankfurt. They then turned off to attack Stuttgart, a manoeuvre which deceived the enemy fighter controllers, who concentrated their fighters on Frankfurt. Only 2.8% were lost of the Stuttgart force. The attack was to the east of the aiming point, resulting in heavy damage to the main Daimler-Benz aero-engine works at Unterturkheim. Apart from this the effect was scattered, and comparatively slight.

Only light scale Mosquito attacks were made against German targets on the remaining nights of the month, owing to forecasts of heavy cloud throughout Germany.

(1) See Appendix 16 for December figures

SECRET

CHAPTER 15

THE BATTLE OF BERLIN

(1) Importance of Berlin as a Target

The Casablanca Directive had specified among:-

> "other objectives of great importance either from the political or military point of view - - - - - - Berlin, which must be attacked when conditions are suitable for the attainment of specially valuable results unfavourable to the morale of the enemy or favourable to that of Russia".

AHB/ ID/12/153

As early as 17th August, 1942, a minute from the Prime Minister, when he was in the Middle East, stressed the importance attached by Stalin to bombing Berlin. At this time the Air Staff considered 500 aircraft the minimum number necessary to saturate the defences, and to give a chance of effective damage and an acceptable rate of casualties. 250 to 300 aircraft was the maximum force available at the time. A loss of about 50 was anticipated with such a force, a number which would cripple the bombing effort for a month. When it was possible to commence attacks in early 1943, Stalin sent a personal telegram to Mr. Churchill.

Ibid. 3/3/43.

> "I welcome the British Air Force, which yesterday bombed so successfully Berlin. I regret that the Soviet Air Force, absorbed in the struggle against the Germans at the front, is not yet in a position to take part in the bombing of Berlin".

AHB/ II/70/272(D) Welfare No.232 19/8/43.

The political importance of Berlin was recognised by all the Allies. After the devastation of Hamburg in July/August 1943 the C.A.S. commented

> "In present war situation attacks on Berlin on anything like Hamburg scale must have enormous effect on Germany as a whole".

"The Bomber's Baedeker".

In addition to its importance in relation to German morale, Berlin also contained more important war production factories than any other centre. In fact it ranked as the most important industrial and manufacturing city on the Continent of Europe. The aircraft industry was represented by factories of the B.M.W., Dornier, Heinkel and Focke-Wulf companies. Numerous electrical and engineering firms, such as A.E.G., Siemens, Reinmetall Borsig and Daimler Benz also had factories there.

AHB/ID4/23A. ~~ID/4/23A~~ Flags 25, 26.

The C.-in-C., Bomber Command sent a memorandum to the Prime Minister on 3rd November, 1943. He gave a review of the systematic destruction of the major German cities of outstanding service to the enemy war effort. Of these, he claimed 19 as virtually destroyed and 19 as seriously damaged. The highest priority amongst those remaining, he said, should be allotted to Berlin:-

> "I await promised U.S.A.A.F. help in this the greatest of air battles. But I would not propose to wait for ever or for long if opportunity serves". - - - "We can wreck Berlin from end to end if the U.S.A.A.F. will come in on it. It will cost between us 400-500 aircraft. It will cost Germany the war".

/The Air

The Air Staff were divided in their reaction to this claim. The A.C.A.S. (I) supported him, saying that the plan first to break the G.A.F. defence and then to get on with the war "does not appeal to a man who knows that it can be won by immediate offensive action". The A.C.A.S. (Ops) considered that the diversion of effort on to Berlin might well give the G.A.F. an opportunity to recuperate. - - - - - -
It was unlikely that Germany would throw her hand in, even if Berlin was destroyed to the extent of Hamburg; if we committed ourselves to this target, and the C.-in-C's expectations were not realised, the American and British bomber forces would be seriously weakened for return to their task of destroying the G.A.F.

AHB/ ID4/56 C.A.S. Min.4682 13/11/43.

The conclusion finally reached, and approved by the C.A.S., was that the C.-in-C. should seize suitable occasions when weather and other tactical conditions should give him the most favourable chance.

He should not plan for a sustained and costly series of assaults, or rely on the assistance of the U.S. VIII Bomber Command. It would be much too big a risk to stake the whole future of the day bomber offensive on the belief that Germany would collapse if several heavy and necessarily extremely expensive attacks were made on the capital.

AHB/ ID4/56. Sec 855

Bomber Command began the assault on 18th/19th November, 1943, with a still heavier attack on the 22nd/23rd and a follow-up attack the next night. On 24th November the Secretary of State signalled to the A.O.C.-in C:-

> "My warmest congratulations to you and all ranks serving under your command .....Berlin is not only the home of Prussian Militarism and the capital of Nazi government but it is also the greatest single centre of war industry in Germany".

The Battle of Berlin continued until March, 1944.(1) Its course and effect are considered in the sections below.

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(1) The table below shows the major raids from November to February. One further attack, in March, 1944, is usually included in the "Battle of Berlin".

Date	Despatched	Attacking	Missing	Bomb Tonnage
Nov 18th/19th, 1943	444	402	9 (2%)	1594
" 22nd/23rd	764	670	26 (3.3%)	2464
" 23rd/24th	382	322	20 (5.2%)	1334
" 26th/27th	450	407	28 (6.2%)	1576
Dec 2nd/3rd	458	401	40 (8.7%)	1686
" 16th/17th	497	450	25 (5.1%)	1815
" 23rd/24th	391	338	15 (4%)	1288
" 29th/30th	712	656	20 (2.8%)	2314
Jan 1st/2nd, 1944	421	359	28 (6.7%)	1400
" 2nd/3rd	383	284	27 (7%)	1116
" 20th/21st	769	642	35 (4.6%)	2401
" 27th/28th	536	454	32 (6%)	1760
" 28th/29th	683	555	43 (6.3%)	1954
" 30th/31st	540	456	33 (6.1%)	1960
Feb 15th/16th	891	761	42 (4.7%)	2643
Total	8321	7155	423	27,305

/(2) Attempts

(2) Attempts to Achieve Accuracy

Often before November 1943, had attacks upon Berlin been attempted, but never with much success. Two attacks in January 1943 had been frustrated by cloud, and by frozen lakes and snow-covered ground making identification difficult. The three attacks in March and the three in August and September have been dealt with in earlier chapters.(1) Harassing attacks by small numbers of Mosquitoes had been carried out on many nights of the year.(2)

AHB/IIH/241/3/8/6
~~BC/S30543~~
Encl. 1A

With the introduction of H2S it had been hoped that accurate marking could be achieved. It was found that Berlin was far too big a target, however. The H2S viewing-screen was completely filled by reflections from the built up area. A timed run from the Müggel Sea, a lake on the outskirts of Berlin, was tried. A better datum was reported, however, as a hooked promontory to the north of the city, which had been observed on the screen. This was tried twice, but on both occasions other responses were mistaken for the datum. It was presumed that varying responses were obtained according to the exact direction of approach. So the Müggel Sea was again tried, a range and bearing fix from there being combined with a datum point on the north-east edge of the target, confirmed by a D.R. run from Brandenburg. This technique produced better results, but was still not accurate.

It was hoped for a time that the Oboe repeater system could be employed against Berlin, to provide more accurate marking. The decisions to abandon its development as unprofitable in October disappointed this hope. The improvements in H2S by this time, due to modification and experience, and the introduction of H2S Mark III, gave better promise, however. When the Battle of Berlin opened in November these improvements, combined with a carefully checked D.R. run from a pinpoint such as Brandenburg or Rathenow, began gradually to show improved results.

An outline of the plan of attack on the last operation of the year, 29th/30th December will illustrate the complex planning needed for this very difficult target. On this occasion the usual mixed Wanganui and Paramatta technique was to be used, as Berlin was almost invariably covered in cloud at this season. Fifteen primary blind-markers were to mark the release point with flares (red with green stars), and the aiming point with red T.I., on H2S at zero - 2. The marking was to be maintained with green T.I. and Wanganui flares (red with green stars) by three "Special" (H2S Mark III) blind markers and 19 secondary blind markers, bombing on H2S between zero and zero plus 18. Twenty backers-up were to aim greens at the centre of reds, or if late, at the centre of greens, with a two second overshoot. If no T.I. were visible they were to retain their greens and drop their bombs blindly, or aim at the centre of flares. Forty supporters were to bomb on the same principle from Z minus 2 to Z plus 18, aiming at the centre of all Wanganui flares on a heading of 035° M; or if conditions were sufficiently clear, at the centre of greens.

Daylight photographs of Berlin showing ground details were obtained at only two stages during these three months of attack. The first, on 20th and 21st December, 1943 covered

/six

(1) See Chapter VII, X and XIV.

(2) See Appendix 10.

six major raids, apart from Mosquito attacks. The second, on 19th February, 1944, covered the remaining nine raids in the period. No reliable evidence was available, therefore, regarding individual attacks, by which to judge the success of the tactics employed, or to guide the selection of successive aiming points.

(3) The Course of the Battle

The first of the great November attacks on Berlin was delivered by a force of 440 Lancasters and four Mosquitoes on 18th/19th November. As on most subsequent occasions during this winter, the German capital was covered with a blanket of cloud, but target indicators could be seen cascading to the ground, and much of the effort fell on the city. Fighters were not very active and did not achieve many successes. Only nine Lancasters were lost. The attack on Ludwigshaven, by a force of similar size, apparently diverted the enemy defences. This force suffered 23 casualties. The American attack on Oslo earlier in the day had drawn off enemy fighters to that area and fog kept others on the ground.

On 22nd/23rd November the largest force yet despatched to Berlin, comprising 753 heavy aircraft and eleven Mosquitoes, delivered a concentrated attack through ten tenths cloud. German fighters were grounded by bad weather, and only 25 aircraft (3.3%) were lost. The route was straight there and back. The German radio reported damage and loss of life, mainly in working class districts. German records show that the areas severely hit were the city centre and Charlottenburg.

A.H.B/
II/70/272(D)
23/11/43
A.H.B.6.
Translations

The following night, 382 aircraft were sent to "stoke the fires". The city was again covered in cloud, but more thinly than before, so that ground markers and fires were visible through it. Losses were heavier owing to increased fighter activity (5.2%).

The Goebbels Diaries give an eye witness account of these raids:-

> "I just can't understand how the English are able to do so much damage to the Reich's capital during one air raid. The picture that greeted my eye in the Wilhelmplatz was one of utter desolation. Blazing fires everywhere".

Ley was furious because the fighter planes did not take to the air. "After all, the English fly in bad weather from their southern English airports all the way to Berlin".

During the attack of 23rd/24th November:-

> "Hell itself seems to have broken loose over us. Mines and explosive bombs keep hurtling down upon the government quarter. One after another of the most important buildings begins to burn".

Fire engines were requisitioned from nearby cities all the way to Hamburg, as it was taken for granted that Berlin would be the main target in future attacks. It was mainly the inner city and the working class suburbs, particularly Wedding, which were hit in these two attacks. The army had to supply two and a half divisions - 50,000 men - to do nothing but clear the main streets so that transport of food and necessities could be resumed.

/The fourth

The fourth raid was by 443 Lancasters and seven Mosquitoes on 26th/27th November from a cloudless sky. Marking was scattered, and most of the bombing fell on the north-western outskirts of the city. A group of important factories there, including Rheinmetall Borsig, were believed to have been severely damaged in this attack. Daylight photographic cover was not obtained until two more major attacks had been carried out, so no accurate assessment could be made of the effect of individual raids.

The Goebbels Diaries report that this time it was the suburbs which were mainly hit, particularly the large munitions plants in Reinickendorf. The Alkett factory, the most important German maker of field artillery, producing one half of the entire output, was on fire. All fire-fighting equipment was concentrated on it by the Fuehrer's orders, but it was too late. The assembly hall was burnt to the ground. The Diary reports, "That is a heavy blow. The Fuehrer, too, is very much depressed ..... The situation has become even more alarming, since one industrial plant after another has been set on fire".

Most of the 28 aircraft missing from this operation were lost through very intense flak, as most of the fighter opposition was diverted to Frankfurt on Main, where the two forces, intended for Berlin and Stuttgart, parted company. A Royal Artillery Major, who flew as an observer in a Mosquito, described the enemy defences:-

A.H.B./ ID/12/153 29/11/43

> "We approached Berlin from the West and observed the defences of Brunswick and Magdeburg in action - vast numbers of searchlights could be seen exposed in a dense and wide belt all round Berlin. We flew at 31,000 feet ..... In about 20 seconds we were illuminated by three to four searchlights which exposed straight on to us - in a matter of seconds these were joined by many other beams. I carefully timed the period of coning and this was 3¾ minutes. I was able to count 31 beams dead on us and it was as light as day in the aircraft. During the period of coning we were dropping Window and turning 20 degrees either side of track every 30 seconds ..... Considering that the "heavies" were underneath the Mosquitoes it is most remarkable that the searchlights were able to select targets above. It would appear that Radar can operate successfully against aircraft considerably above the main force and out of the Window cover. The initial pick up must have been accomplished by means of Radar after which it would appear that the control was visual."

In December, four more heavy attacks were carried out on Berlin. The first, on 2nd/3rd December by 458 aircraft, was the fifth raid within a fortnight. The attack was scattered, owing to unpredicted winds, and very heavy losses occurred, 40 aircraft (8.7%) failing to return.

The next attack, by 497 aircraft on 16th/17th December could not be assessed, once again, owing to ten tenths cloud. The first Intruder patrols by Beaufighters of No. 100 Group were carried out on this occasion. Bad weather conditions at bases on return caused 27 aircraft to crash, in addition to the loss of 25 (5.1%) over enemy territory. A special report was called for by A.C.A.S.(Ops.) in which it was stated that 283 diversions were planned, but few were put into effect as conditions were equally bad everywhere. The only bases fit were one or two isolated airfields in Cornwall or Scotland.

A.H.B./ II/69/74, 29/12/43.

/It was

It was doubtful whether aircraft had enough fuel to reach these and, in any case, their fitness at any particular time was problematical.

After this attack the first daylight photographs of Berlin since the battle began were obtained, after numerous attempts, on 20th/21st December. They revealed severe and widespread damage, but it was impossible to say how much was caused by any one raid. The largest area of devastation, covering eight square miles and resulting almost entirely from fire, stretched from the east side of central Berlin to Charlottenburg in the north-west and to Wilmersdorf in the south-west. Severe damage was also seen in the important industrial districts of Reinickendorf and Spandau. In the Tiergarten district, whole island blocks were completely gutted, including the Swedish, Rumanian, Hungarian, Irish, Finnish and Portuguese Legations. The War Office building was partly demolished and much destruction was visible along the Wilhelmstrasse where Hitler's Chancellery, the British Embassy, the Gestapo Headquarters and a number of other government offices were hit. The Unter den linden also suffered. The French Embassy and the Ministry of Armaments and Munitions were gutted. The results are further assessed in the next section.

The seventh attack took place on 23rd/24th December. The attack was scattered, owing to the failure of many H2S sets. Enemy fighters were diverted by a feint attack on Leipzig by seven Mosquitoes. Losses were only 4% and two enemy fighters were destroyed, one by an intruder of No.100 Group.

The final attack of the year on Berlin was by 712 Lancasters and Halifaxes on 29th/30th December through layer cloud once more. The attack appeared to be well concentrated and the glow of fires could be seen for 200 miles. Diversionary Mosquito attacks on Magdeburg and Leipzig, as well as bad weather on the ground, restricted fighter opposition. Losses were only 2.8%.(1)

A.H.B.6.
Translations.

The first of the six big attacks in January, 1944 was on the first night of the new year. Four hundred and twenty-one Lancasters were despatched, but the attack was again scattered. German reports say that it was concentrated on the southern and south-eastern sectors of the city. A diversion against Hamburg failed in its object. Many combats took place over Berlin, and 28 aircraft (6.7%) were lost while six enemy fighters were claimed as destroyed. Another attack by 383 aircraft the next night followed much the same course. It was scattered and 27 aircraft (7%) were lost.

The next raid, the eleventh of this series, did not take place until 20th/21st January. In the interval Stettin and Brunswick were attacked, the latter by both R.A.F. and U.S.A.A.F. Diversions were carried out against Berlin during the night attacks. The raid on 20th/21st January was the heaviest in the series to date, 769 Lancasters and Halifaxes being employed. A concentrated sky marking attack was delivered through thin cloud, for the loss of 4.6% of the aircraft. No daylight photographic cover was obtained until the middle of February, so no assessment of the area damaged in any of these attacks could be made.(2)

/After

(1) See Section (2) above for method of attack.

(2) The contemporary and post war evidence is considered in the next section.

A.H.B.6. Translations.

After a heavy raid on Magdeburg the next night, Berlin was again attacked on 27th/28th January by 536 aircraft through thick cloud. Flares were well concentrated but there was a wide spread of bombing up and down wind. The German report says it fell on the south eastern and eastern districts of the city, particularly on industrial targets on both sides of the Spree.(1) Losses were 6%, fighters meeting the bomber stream well out in the North Sea instead of waiting at a Beacon as usual. In spite of this, diversions by a mine-laying force of 80 aircraft and an attack on Heligoland restricted the number of combats until just before the attack on Berlin began.

Ibid

On 28th/29th January the most concentrated attack yet was delivered against Berlin by 678 aircraft. Breaks in the cloud assisted marking. German records confirm that heavy damage was caused by this attack, reporting that 200,000 people were rendered homeless. Earlier in the night Mosquitoes carried out feint attacks against Berlin and Hanover, at the same time as a mine-laying force proceeded to Kiel harbour. Enemy fighters reacted to this manoeuvre, but it was too long before hand to affect the Berlin operation and 44 aircraft (6.3%) were lost.

On 30th/31st January another concentrated attack was delivered through cloud by 540 aircraft. The German radio admitted that "extensive areas" of Berlin were hit. Losses were again high at 6.1%, six enemy fighters being claimed in return, two of them by Intruder Mosquitoes.

The last attack of the battle of Berlin, within the period of this Volume, was on 15th/16th February. Eight hundred and ninety-one aircraft, the largest force yet despatched, were engaged on this fifteenth raid. Thick cloud again enforced a sky marking attack, but H2S crews thought it to be well over the city area, and Mosquitoes which were over the capital an hour after the attack had finished, reported large areas of fire and a column of smoke rising to 20,000 feet. Losses on this occasion were 42 aircraft (4.7%), although the German radio claimed 48 as shot down.

(4) Effects of the Battle

B.C.O.R.B. Appendix Int./4.

An immediate assessment of results by the Intelligence Staff of Bomber Command was circulated to all Stations, covering the raids up to 17th December 1943. Under the heading Gotterdammerung, this paper claimed,

> "that the administrative machine of the Nazis, their military and industrial organisation and, above all, their morale, have, by these attacks, suffered a deadly wound from which they cannot recover."

A further immediate assessment collating information received up to 28th February, 1944 supplied a more factual assessment:-

> "With the single exception of Hamburg, Berlin is now the most devastated city in Germany. .....
> The whole series of attacks since mid November, which have come to be known as The Battle of Berlin, have destroyed nearly one quarter of the German capital."

/The Ministry

(1) See Appendix 18 for details of damage.

M.E.W. Report No. 134 31/8/44

The Ministry of Economic Warfare estimated that the industrial production of the Berlin area was reduced by as much as 30% during the winter.

Most important of the visibly damaged factories were stated to be The Daimler-Benz Works (Class 1) producing aero-engines, tanks and tractors, and an important research centre; the well known firm of Lorenz (Class 1) manufacturing blind-flying apparatus and military wireless equipment; and the two principle A.E.G. factories, one - the largest German cable works (Class 1 +) and the other - a leading producer of steam turbines and diesel engines (Class 1). The great Siemens Electrical Combine had suffered further damage, severe in the case of the factory turning out aircraft instruments (Class 3), less severe at the works (Class 1 +) which was the biggest German producer of electrodes and carbons for search-lights. Industrial damage was particularly heavy along the canal in the Templehof district where the main buildings of the airfield were also hit.(1)

It was estimated that 30% of industrial establishments had ceased work as a direct result of the raids, and a further 10% through lack of manpower and raw materials. 60% of the commercial establishments, including retail firms and craftsmen had been obliged to cease work.

The assessment made following the successful daylight reconnaissance on 19th February, 1944 reported damage of the following:-

5 Factories of Priority 1 +
11 " " " 1
11 " " " 2
8 " " " 3
108 Unrated factories
53 Commercial premises
2 Power Stations
4 Gas works
5 Barracks
5 Tramway depots
The Berlin Broadcasting Station
The German Air Force Research Station at Johannisthal airfield.

A.H.B.6. Translations

Contemporary German reports, translated since the war, show considerably greater damage than this, although they do not cover all the raids. In the first six raids 46 factories were destroyed and 259 damaged, in addition to many Stations and other important targets. The total casualties reported in these German records were 5,166 killed and 18,431 injured as well as a number missing. This covers twelve out of the fifteen major raids. Damage to houses, reported in seven of these raids, shows an aggregate of 15,635 houses destroyed or severely damaged. The U.S. Strategic Bombing Survey analysed a variety of statistics to show the damage to Berlin. They used the figures compiled by R.E.8.(2) for damage per ton of bombs dropped on Berlin. In the attacks from November to 15th/16th December, 1943 this figure was

U.S.S.B.S. Fire Raids Table V.

/35,400

(1) Class 1 + = Vital factories in primary war industries;
Class 1 = Major plants in industries of major importance;
Class 2 = Minor plants in major industries or major plants in minor industries;
Class 3 = Subsidiary factories.

(2) Research and Experiment Department of the Ministry of Home Security.

35,400 square feet per ton, whilst for the rest of the period up to 15th/16th February, 1944 it was 19,500 square feet per ton. From German sources it was found that about one and a half million people were homeless in Berlin by March, 1944 as a result of air raids. The majority of Berlin school children had been evacuated by the end of September, 1943, so they were safe from these attacks.

Gas and coal supplies became difficult in January, 1944. Transportation was continually disrupted:-

U.S.S.B.S. Area Studies Report No.8.

"freight movements in Berlin were repeatedly obstructed by damage to railroad stations, rails and other installations caused by the raids of 22, 23, and 26 November. Although raids in December did not do as much physical damage to the railroad facilities as the raids in November, the effect of these raids increased the already existing industrial difficulties. ..... Compared with October, 1942, the shortage of rolling stock had increased 20% ..... January and February, 1944: continued air raid damage to railroad installations resulted in severe shipping bottle-necks."

In spite of this, industrial production increased in the city, due to the measures of rationalisation and standardisation carried out under the direction of Speer. Air raids, according to a German authority, never reached the industrial nerve centre until concentration on specific types of target was achieved late in 1944.

CHAPTER 16

THE WINTER OFFENSIVE

(1) Developments in The Tactical Battle

The formation of No.100 (S.D.) Group on 3rd December, 1943,(1) marked the maturity of Bomber Command tactical methods. The various formations employed in counter measures against the German defences were brought together. These now consisted of ground radio stations of different types, used to jam enemy fighter control and intercommunication and the enemy Radar network; airborne installations, used for the same purpose; and Radar equipped fighters and intruders. The former mingled with the bomber stream and attacked enemy fighters, the latter attacked enemy fighter airfields with bombs and guns in order to restrict take offs and landings and generally to harass the enemy defences.

Window, the principal counter measure to enemy Radar, was dropped by the whole bomber force. Special sorties were despatched, however, for decoy and advanced cover purposes. The use of Window for decoy purposes had been rapidly expanded since its introduction in July, 1943. A major raid was now usually accompanied by one or more such decoy attacks by a few Mosquitoes, as well as by larger scale spoof or diversionary attacks.(2) A new and extended Window dropping area had been brought into force at the end of September. The rate of release had been decreased on the outward journey and increased in the target area, with good results.

The other radio counter measures now in use consisted of Airborne-Cigar and Ground-Cigar, to jam VHF/RT, and Corona, to interfere with the running commentary. The older counter measures, Mandrel - against Freyas, Tinsel - against HF/RT and Ground-Grocer - against A.I., were still in use. Two new measures, Dartboard and Drumstick, were introduced in December and January respectively. The first was to jam the high-powered transmitter at Stuttgart, which was used by the Germans to transmit a running commentary when their original transmitters were jammed by Corona. The second was to counter W/T transmissions which were resorted to by the enemy controllers when R.T. communication was jammed.(3)

O.R.S. Report No.88 16/12/43.

A review of defensive tactics in late 1943, was carried out by the Operational Research Section at Bomber Command in December. The principal developments, apart from the Radar devices above, were increasing concentration and constantly changing methods of routeing, with diversionary targets so chosen as to deceive the enemy to the last moment possible. Maximum concentration over the target had been aimed at for a considerable period. In August, 1943 the A.O.C. Pathfinder Group recommended an increased concentration up to about 45 aircraft per minute on Berlin. It was considered that the increased risk of collision would be more than compensated for by the reduction in losses to fighters, as they could only deal with a limited number at a time, and the majority of fighter attacks occurred in the target area.

AHB/IIK/241/3/816
~~B.O/S.30543~~,
Encls.1A.2A,3A

/During

(1) See Annex, Chapter 3 (6).

(2) For examples, see Diary of Operations, Appendix 10.

(3) See Annex and Signals Narrative for further details.

During the three months, dealt with in this chapter, maximum concentration was planned for every raid. The first concentrated attack, on 2nd/3rd December, was planned to last 20 minutes only. Six hundred and fifty aircraft had been detailed, although 458 took part owing to a threat of fog at home bases. The actual period of attack was 44 minutes. A month later thirteen minutes was allowed for an attack by 383 aircraft. Twenty-four minutes was the actual period of attack on this occasion. The highest concentration planned, during this period, was 45 aircraft per minute on the Berlin raid of 15th/16th February. The highest achieved was nearly 23 per minute on 27th/28th January against the same target.

In choosing diversionary targets and feint routeing to draw attention to them, it was found that a diversion beyond the target was most successful, preferably against an important target. A successful deception was often possible when the main target lay well off the produced direction of the outbound route, which itself suggested a raid on some important target.(1) Several successes had been scored in this way by feint routeing alone. A small diversionary raid, on the other hand, was often unsuccessful. Larger scale diversions were recommended by O.R.S., and were used successfully on important and dangerous targets such as Schweinfurt.(2)

(2) December - Diversions from Berlin

Out of the six heavy scale operations carried out in December, four were directed against Berlin. These have been described in the previous chapter. The remaining two heavy raids were intended to disperse the enemy defences and prevent too great a concentration of them at Berlin. In addition, a proportion of the effort of the Command was devoted to attacking Crossbow targets on the French Coast,(3) and precision attacks upon steel, power and other targets by Mosquitoes increased in frequency and weight. The first heavy attack of the month was that on Berlin on 2nd/3rd December. The following night Leipzig was attacked, using Berlin as a diversion. Five hundred and twenty-seven Lancasters and Halifaxes were directed against Leipzig carrying out a highly successful concentrated attack through thin cloud. Nine Mosquitoes carried out a successful feint attack on Berlin, bombing at one minute intervals from zero hour minus 20, to draw off the fighters from Leipzig.

Leipzig contained important aircraft assembly and component factories, notably the Erla complex which was one of the largest assembly plants for Messerschmitts 109 under the 1943 fighter expansion programme. The town had been unsuccessfully attacked in October. Its choice, at this time, was principally due to its suitable position for simulating an attack on Berlin. The route used led direct to Berlin, the main force making a sharp turn to starboard a few miles short of the capital, whilst the Mosquito diversionary force, a few minutes earlier, continued straight on to Berlin.

/Nearly

(1) See Map 3 for an example.

(2) See Chapter 17.

(3) See Chapter 13.

Nearly 30% of the town was estimated, from reconnaissance photographs, to have been laid in ruins by this single attack. The Goebbels Diaries say that Leipzig was unprepared and the fire department was not adequate.

> "As a result, whole rows of houses went up in smoke. The centre of the city was especially hard hit. Almost all public buildings, theatres, the University, the Supreme Court, Exhibition Halls etc. have either been completely destroyed or seriously damaged. About 150 to 200,000 people are without shelter."

During the moonlight period for the next twelve nights only Mosquito raids were carried out on precision targets in the Ruhr and Rhineland area included in the Oboe target list.(1) The most important were the steelworks at Hamborn (Duisburg), the I.G. Farben plant at Leverkusen and the Armament works at Essen and Dusseldorf, Krupps and Rheinmetall Borsig respectively. Many of the Mosquitoes were equipped with Oboe or Gee-H, but the performance of these devices was not good, and the majority of attacks were carried out on D.R. The maximum number despatched was 30 against Essen, Osnabruck and Dusseldorf on 12th/13th December.

After another Berlin raid, on 16th/17th December, Frankfurt-on-Main was chosen as the target for 650 aircraft on 20th/21st December. Fifty-four Lancasters and Mosquitoes carried out a diversion against Mannheim thirteen minutes before the start of the main attack at Frankfurt. Very heavy concentrations of fighters were encountered by the main force, which lost 40 aircraft, 6.2% of the total force. One aircraft was lost by the diversionary force. Frankfurt was obscured by cloud and no concentration of bombing was achieved. It was believed that enemy decoy markers drew most of the bombs to a decoy four and a half miles South East of the town. Daylight reconnaissance showed that most of the damage was in the Offenbach district in the south-east of Frankfurt. The bombing at Mannheim was well concentrated, but here also it was concentrated four and a half miles south-east down wind of the aiming point. So a faulty wind setting by markers may have been responsible in both cases.

On the same night an attempt was made, by No.617 Squadron, to carry out a precision attack on the armament factory at Liege. Eight Mosquitoes were employed to mark the target, but cloud hid the markers and the attack was abandoned.

Apart from the two Berlin raids already dealt with, the only operations against German targets for the remainder of the month were further small scale Mosquito raids. These continued on most nights on the scale of a dozen to twenty aircraft directed against two or three targets per night in the armament, chemical or electrical industries.(2)

A number of attacks upon Crossbow targets were also carried out in the second half of the month, the largest number employed being 51 aircraft on 22nd/23rd December.(3) A few Beaufighters of No.100 Group carried out intruder patrols on the occasion of each heavy operation from 16th/17th December onwards, using Serrate apparatus to detect enemy aircraft.

/(3)

(1) See Appendix 8 for Oboe targets.

(2) See Appendix 10.

(3) See Chapter 13.

(3) January - Directive Priorities Revised

In January, 1944, six heavy attacks on Berlin were carried out(1) and three on the neighbouring towns of Stettin, Brunswick and Magdeburg. The latter were chosen to deceive the enemy defences rather than for their importance under the Pointblank directive. Stettin and Magdeburg, in fact, did not feature in the Directive Target List.

After the two heavy attacks on Berlin, on the first two days of the month, followed by light attacks on Crossbow targets in France,(2) an operation against Stettin was undertaken as a deception on 5th/6th January. The route, a northerly one crossing Denmark, turned south directly towards Berlin. A last minute turn brought the force over Stettin, with the result that the target was undefended by fighters at the start. A small number of Mosquitoes dropped target indicators and bombs on Berlin a few minutes earlier, to simulate a major attack there. Although Berlin was covered by cloud, Stettin was clear, and the illumination and marking were successful. Some target indicators were dropped short, however, and the bombing, aimed at the centre of all T.I.s, was mainly in the west of the area and spread further along the line of approach as the attack proceeded. The centre of the town appeared, from photographic reconnaissance, to have suffered heavily from fire. The Germans reported a total of 1,194 fires, with 34 industrial and 31 military installations destroyed or damaged. In addition, five vessels were sunk, six set on fire and 20 damaged. The German report says that the attack was centred on the area of the docks. Normal working of the port was not resumed for about nine days.

A.H.B.6.
Translation

MEW/IDR No.78

Bad weather forecasts for home bases or target areas prevented any further large scale operation until 14th January. Meanwhile Mosquitoes, equipped with Oboe or Gee-H, were despatched nightly against precision targets in the Oboe target list.

Brunswick was chosen as the target for 498 aircraft on 14th/15th January. It was the first heavy attack upon this town, which contained important fighter assembly, engine and component plants. The attack was a failure, owing to bad timing. A good concentration of sky markers was extinguished before the main bombing force arrived. Only scattered damage was done in the town, whilst 7.6% of the aircraft were missing. A force of 82 aircraft was despatched against Crossbow targets in France on the same night.

After a further operation against Berlin on 20th/21st January, a deception operation against Magdeburg was carried out on 21st/22nd January. Six hundred and fifty-three aircraft were employed on this first operation against this town, which, like Stettin, did not feature in the list of Pointblank targets. The operational report of the raid states that several high priority factories in the engineering industry were damaged, although the marking and bombing was scattered. Visual identification was not possible, and there were many reports that the enemy used decoy T.I.s. The Germans recorded that this raid caused 181 fires and 412 casualties in Magdeburg. The usual diversionary raid on Berlin, in which 34 aircraft

/were

(1) See Chapter 15 for an account of the Berlin attacks.

(2) See Chapter 13 on Crossbow.

were employed, was carried out but it did not prevent losses on the main raid reaching the high level of 8.5%. The same night 111 aircraft were despatched to attack Crossbow sites in France.

S.46368/IV
Encl. 70A

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ID/4/31

On 14th January, as a result of the A.O.C. in C. of Bomber Command's criticism of Air Ministry policy, discussed in the next chapter, Bomber Command were instructed to "adhere to the spirit of the directive" of 10th June, 1943. The selection of Magdeburg as a target on 21st January, therefore, in preference to Brunswick or Leipzig, was the subject of strong criticism in the Air Staff. The proximity of the three places made it clear that weather or similar tactical considerations could have had nothing to do with the choice. Both Brunswick and Leipzig featured in the directive letter of 14th January. The importance of towns associated with fighter production had also been re-emphasised at a conference with the C. in C., Bomber Command and the other Bomber Commanders, called by the Chief of the Air Staff on 19th January. This further departure from Air Staff policy by the C. in C., together with the dispute over Schweinfurt, discussed in the next chapter, led to the despatch of a directive signal on 28th January, laying down unequivocal target priorities.(1) The order of priority was Schweinfurt, Leipzig, Brunswick, Regensburg, Augsburg and Gotha.

S.46368/IV
Encl. 81A

The remainder of the month was devoted to further heavy attacks on Berlin, a slightly larger scale of mine-laying than usual, and the regular sorties against Oboe targets and to disperse leaflets in France, which were now a steady commitment of Bomber Command. These leaflet sorties were still being carried out by aircraft of the O.T.U. Groups, as described in an earlier volume.

(4) S.O.E. Operations

The work of the Special Operations Executive does not directly concern the subject of this narrative. It has only occasionally been referred to therefore. The full story of these operations can be found in the relevant narrative.(2) The commitment of the Royal Air Force in support of these activities, which was confined to two squadrons, operationally controlled by Air Ministry up to August, 1943, began thereafter more directly to concern Bomber Command. By February, 1944, the diversion of effort required was considerable. It is thus necessary briefly to recount the growth of this commitment.

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The formation and organisation of the two squadrons concerned with S.O.E. and S.T.S. work, Nos.138 and 161, is described in the Annex. They were under the administrative control of Bomber Command, but their operations were directed by A.C.A.S.(I) until 1st September, 1943. Operational responsibility was transferred to Bomber Command at that date. The object was to bring these operations more closely into line with the normal operations of Bomber Command, and to facilitate the employment, when necessary, of supplementary aircraft of the Command in these activities.

/The scale

(1) See Chapter 17 for policy discussion.

(2) See Royal Air Force Narrative, Special Duty Operations in Europe.

Ibid 4/9/43

The scale of these operations had been increasing during the early months of the year.(1) In a letter of appreciation of the striking increase, during the August moon period, the controller of S.O.E. referred to the fact that nearly three and a half times the previous monthly average of containers had been delivered. With the transfer of control to Bomber Command, supplementary aircraft were made available from Stirling squadrons. Only three of these aircraft were used in September, and a number of technical difficulties were encountered. For the next three and a half months six Stirlings of No.214 Squadron were attached to No.161 Squadron at Tempsford during the moonlight periods for S.O.E. operations. In December, four Lancasters of No.617 Squadron were attached to No.138 Squadron to compensate for four Halifaxes detached to the Mediterranean. In January, 1944, further Stirlings were loaned, two from No.199 Squadron and one from No.149 Squadron. In spite of this assistance, the effort did not increase owing to poor weather, which also reduced the percentage of success.(2)

AHB/ID/4/104 30/11/43

On 30th November the A.O.C. in C. of Bomber Command suspended all S.O.E. operations in consequence of reports of enemy penetration of the organisation on the Continent. The Deputy Prime Minister enquired into these reports, as a result of which, operations over Denmark and Holland were suspended until the reports should be fully investigated. It was also decided that operations over Poland should be carried out only from the Mediterranean, as heavy losses had been suffered by those from the U.K. The four Halifaxes, referred to above, were detached to the Mediterranean for this purpose. The Defence Committee raised the ban on operations to Holland on 14th January, 1944. As a result of representations from Prince Bernhardt of the Netherlands it was re-imposed on 5th February before any further operations had taken place.

Signal AX.847

AHB/ID/4/104 28/1/44

The Prime Minister issued instructions, at the end of January, that special arrangements were to be made for large scale supplies to the French Resistance Movement in the Haute-Savoie area. The Stirling Squadrons were to be employed primarily on this task until they were re-equipped with Lancasters. All available Stirling aircraft were to be used for this purpose in priority over mining operations or attacks on Crossbow targets. The result of this order is seen in the vast increase in sorties during the February moonlight period.(3) The Squadrons employed on this task were Nos.90, 149 and 199, in addition to the normal S.O.E. Squadrons Nos.138 and 161.

(5) February - German Aircraft Industry Heavily Attacked

AHB/II/69/28

For the first half of February no heavy operations took place. The moonlight period was preceded and followed by spells of bad weather. There had been considerable discussion concerning suitable moonlight targets in France for Bomber Command, at Target Committee Meetings and elsewhere. Several of those previously attacked had been

/so

(1) Number of Successful Sorties
January 22, February 41, March 46, April 97, May 101, June 109, July 94, August 184.

(2) Number of Sorties and Percentage of Success
September 130 (55%), October 152 (40%), November 152 (40%), December 59 (26%), January 1944, 97 (48%), February 353 (43%).

(3) See above footnote.

so severely damaged, by bombing or by sabotage through the agency of the Special Operations Executive, that they did not warrant further attack. Others had been dealt with by the U.S.A.A.F. A short list of targets was finally agreed by 7th February, but none of these were considered of more than secondary importance. Two of them, which had been allotted to No.617 Squadron for precision attack were attacked during this moon, Limoges on 8th/9th February, and Antheor on 12th/13th February. Although discussion took place at Bomber Command regarding the tactical feasibility of the others on the list, no suitable occasion was found to attack them. The M.E.W. themselves finally came to the conclusion that there were

S.46368/IV Encl.86A

BC/S.23746/6 Minute 9 etc.

S.46368/IV Minute 98.

> "now no targets in France, the destruction of which could honestly be expected to have any appreciable effect on the enemy's war effort within six months - if at all."

The small scale operations which took place during the first half of February can be seen in the Diary of Operations.(1) The only ones requiring comment are those against Elberfeld, which are dealt with in the next chapter, and the two operations by No.617 Squadron mentioned above. Out of six targets, suggested to the A.O.C. of No.5 Group as suitable for this squadron, he chose three for this moon period. These were the aero-engine works at Limoges, the Antheor railway viaduct and the Michelin tyre factory at Clermond - Ferrand. Clearance for the attack upon Limoges, using 12,000 lb H.C. bombs, was obtained on 7th February from Air Ministry and an attack was carried out on 8th/9th February, as described below. Clearance for Antheor viaduct was obtained on 11th February and an attack was carried out on 12th/13th. The attack on Clermond-Ferrand was authorised only with incendiary or delayed action bombs, owing to the danger of French casualties. No attack was carried out against this target until March, when it was cleared for instantaneous bombs, using low-level technique.

BC/S.23746/6 Minute 10 7/2/44. Ibid, Minute 13

Target Ctee. 109th & 110th Meetings.

The attack upon the Gnome and Rhone aero-engine works at Limoges was carried out by twelve aircraft of No.617 Squadron with extreme accuracy on 8th/9th February. The S.A.B.S. Mk IIA was used, and five Tallboy bombs, fifty-five 1,000 lb M.C. and a number of incendiary bombs and red spot fires were dropped. The target was marked with the latter, their mean point of impact being almost identical with the middle of the factory with an average error of 150 yards.

Photographic evidence showed extremely heavy damage, half the factory being reported destroyed or severely damaged, and much of the rest damaged less severely. Direct hits had been scored with four out of the five 12,000 lb bombs. A later assessment put the structural damage at 32% and the damage to machinery at 40%, and considered it would take at least seven months before integrated production could be resumed. The attempt to cut the Antheor viaduct on 12th/13th February has been dealt with in the chapter on Italy.(2) The last and heaviest of the operations against Berlin during the period took place on 15th/16th February.(3)

M.H.S. R.E./H. 85 1/4/44

/On

(1) See Appendix 10.

(2) See Chapter 12 (4)

(3) See Chapter 15 "Battle of Berlin".

BC/S.23746/6
Encl.24A

Signal AX3

On 17th February a new directive was sent to Bomber Command. It contained a revision of targets approved by the Combined Chiefs of Staff. The object was to make the best use of the short time remaining before Overlord. The first priority objectives remained as in the Air Ministry Signal of 28th January, which was subsequently amended from time to time.

There were no further bombing operations until the night of 19th February when 823 aircraft were despatched to Leipzig, with 15 to carry out a diversion against Berlin, and 49 another diversion by laying mines in Kiel harbour. Neither of the diversions was successful, as enemy fighters met the bomber stream near the coast, and 9.5 were lost. Leipzig contained four of the Erla group of Messerschmitt factories, and a V.K.F. ball bearing plant. It was covered by ten tenths cloud, and the bombing spread over a wide area. Accurate attack by 184 American Fortresses the following day upon aircraft factories in Leipzig made it difficult to assess the damage from the Bomber Command raid. In the two attacks, five out of the ten most important factories in Leipzig suffered severe damage, according to photographic assessment. 3.2% of the houses in the town were destroyed.

U.S.S.B.S. Area Studies Report

This attack inaugurated the "Big Week" of attacks on the German aircraft industry, as it became known. During this week Bomber Command heavily attacked four towns, high in the priority list of the Pointblank directive. Meanwhile the U.S. Eighth and Fifteenth Air Forces attacked 23 airframe and three engine factories, and dropped a weight of bombs almost equal to the total previously dropped by them.(1) Perfect weather conditions and an adequate escort by the new P51 long-range fighters made this possible. Nearly 7,000 sorties were despatched by the three forces during this week. These attacks precipitated a crisis in the German aircraft industry and led to the decision to disperse it and to transfer control from the German Air Ministry to Speer's Ministry of Armaments.

B.B.S.U. Aircraft Industry Panel

Thunderbolt Page 72.

The second town attacked by Bomber Command during this intensive week was Stuttgart, containing aero-engine, component and ball-bearing plants. Five hundred and ninety-eight aircraft were despatched on 20th/21st February. A diversionary Mosquito operation against Munich, with a training exercise by O.T.U. aircraft over the North Sea, and intruder operations against enemy airfields in the low countries, successfully distracted the enemy fighters. Many of them were airborne two hours before the arrival of the main force, only nine of which were lost. Stuttgart was covered in cloud which cleared to the North. As a result,

/some

(1) The U.S.A.A.F. attacks were as follows:-

Date	VIIIth A.F.	XVth A.F.
Feb.20	M.E. Leipzig (3 plants), Gotha Brunswick (2 plants).	
	F.W. Oschersleben, Posen, Tutow.	
	J.U. Bernburg, Halberstadt.	
" 21	G.A.F. Installations	
" 22	M.E. Regensburg	M.E. Regensburg
	F.W. Oschersleben	
	J.U. Aschersleben, Bernburg, Halberstadt	
" 23		D.B. (Daimler-Benz), Steyr
" 24	M.E. Gotha	-do-
" 25	M.E. Regensburg (2 plants). Furth, Augsburg.	M.E. Regensburg

some markers dropped from 2 - 9 miles North of the Aiming Point were more visible than those which were accurate. Most of the bombing was concentrated between the river and the marshalling yards at Kornwestheim, about five miles North and North West of the Aiming point.

Daylight reconnaissance showed damage throughout the town. The Bosch, Daimler-Benz and V.K.F. aircraft industry plants were all seriously hit, as well as a large number of lower priority factories and transportation and public utility targets. Six and ten Mosquitoes, respectively, were sent to Stuttgart on harassing attacks on the two following nights.

The third of the heavy attacks during this week was on Schweinfurt, the main centre of the ball-bearing industry, and is dealt with in the next chapter. The fourth was upon Augsburg, which contained a big Messerschmitt assembly plant, on 25th/26th February. Both of these raids were immediately preceded by American daylight attacks on the same targets. This was the plan of attack advocated in the Pointblank directive. Five hundred and ninety-four aircraft were engaged on the Augsburg operation and carried out a highly successful attack in two waves at an interval of 2½ hours. The weather was cloudless, so that the target was clearly identified and accurately marked. Mosquito diversionary attacks upon Saarbrucken, Mannheim and Schweinfurt, together with feint routeing across France and well into Southern Germany, confused the fighter controllers, and only 21 aircraft were lost.

Augsburg was covered in snow, but was identified by the light of flares. An excellent concentration of bombing was achieved and the second force found the town well alight, the fires illuminating the built up area. Mosquitoes attacking an hour after the close of the raid reported an apparently solid mass of fires. Photographic assessment showed that nearly 60% of the built up area was destroyed. The industrial area suffered severely, all the principal factories being heavily damaged. An R.E.8 report states that six months output was estimated to have been lost at the M.A.N. works, one of the largest German producers of diesel engines, especially for submarines. The post war assessment by the U.S. Bombing Survey assesses the housing damage at 27.9% in this raid.

R.E./H.131

U.S.S.B.S. Area Studies Report No. 8

MEW/I.D.R. No.79 Page 13

The Ministry of Economic Warfare Damage Report for February 1944 assessed the week's achievements as follows:-

> "The most outstanding event of the month, and indeed of the whole of the air war to date, was the temporary elimination, in the course of a single week, of a large part of the German aircraft production by precision attacks in daylight by the U.S. Eighth and Fifteenth Air Force. This was achieved in the six days between 20th and 26th February. More than 11,000 tons of bombs were dropped on fifteen aircraft centres. These daylight operations were supported by night attacks by R.A.F. Bomber Command on the aircraft manufacturing centres of Leipzig, Augsburg and Stuttgart. Fighter aircraft production was the principal target; as a result of these attacks it has been estimated that output of T/E fighters in March will have been reduced to 80% below planned production, and output of S/E fighters 60%. Production of bomber and transport aircraft was also very substantially curtailed; March output of transport aircraft is estimated to have declined by 60% below planned production; of heavy bombers by 25%."

/Field Marshal

B.B.S.U. Aircraft Industry Report.

Field Marshal Milch, who had up to this time been responsible for aircraft production, realised the serious nature of the position after the attacks of this week. He appealed to Reichsminister Speer to take over aircraft production and bring it within the sphere of his Ministry of Armaments. As a result the "Jaegerstab", primarily concerned with fighter production, was established under Saur, with striking results.(1) By the standardisation of parts, reduction of types and increase in working hours and the labour force, production was rapidly increased, in spite of allied attacks and the task of dispersal. Saur has stated that, by the end of February, 1944, 70% of the original buildings of the German aircraft industry had been destroyed or damaged.

(1) See Chapter 19 (2)

CHAPTER 17

BALL BEARINGS, FRICTION OVER POLICY

(1) Importance and Vulnerability

The key position held by the German ball-bearing industry in the production of tanks, aircraft and machinery of all types was appreciated from the outbreak of war. Moreover, it was known that some two-thirds of German ball-bearing production was centred at the town of Schweinfurt, in Bavaria. The overwhelming merits of this town as a target had been continually stressed. Soon after Air Marshal Harris took over command of Bomber Command, it was brought to his attention by the Director of Bomber Operations. It was later suggested that the tactical difficulties might be overcome with the aid of a radio beacon on the ground, operated by an agent of S.O.E. This course was untried, however, and the Secretary of State decided that it was impracticable. The operation was held in abeyance until November, 1942, as being tactically impracticable, owing to the difficulty of locating Schweinfurt by night.

AHB/II/70/1 7/4/42.

Ibid Minute 24/8/42.

In November 1942, M.E.W. carried out a fresh review of the enemy ball-bearing industry. It was estimated that 52% of the current German supplies of ball-bearings came from the three V.K.F. factories and one Fischer factory at Schweinfurt. The next most important contribution came from the V.K.F. factory at Stuttgart/Bad Constatt. Smaller factories at Leipzig, Berlin/Erkner and Elberfeld were also of importance. Bomber Command revised their operation order for the attack on Schweinfurt, Operation Selfridge. It was not carried out, however, owing to the tactical difficulties - distance, difficulty of location, and weather conditions, - as well as the Commander-in-Chief's doubts as to the value of the target.

AHB/II/241/3/446 ~~BC/S.28302~~ Encl.30B

B.C.O.O.No.160

The subject was raised again in May 1943. The American Economic Objective Unit reported that the majority of bearings used in German aircraft were made at Schweinfurt and Stuttgart. The Leipzig and Wuppertal/Elberfeld factories were engaged in the production of special aircraft bearings. Bomber Command were requested to examine, in consultation with the Eighth Air Force, joint operations against the Axis ball-bearing industry, including the C.A.M. factories at Paris. Bomber Command replied that the hours of darkness were insufficient for an attack upon Schweinfurt until the July moon period. The Americans might by then have enough aircraft to take part in such raids, involving deep penetration into Germany.

AHB/II/241/3/446 ~~BC/S.28302~~ Encl.33A

After further pressure from Air Ministry the Operation Order for Operation Selfridge was brought up to date. It was now to follow the projected daylight operation by the Eighth Air Force. An American assessment had again stressed the importance of the industry:-

B.C.O.O.No.178 4/8/43

> "It is impossible to exaggerate the importance of ball and roller bearings to the Axis war effort. - - - - - German ball and roller bearing industry is highly concentrated and extremely vulnerable."

AHB/II/70/1 June 1943

A special brief was prepared by the Air Staff, in order to stress the vital importance of the operation to the aircrews taking part. This was transmitted to both bomber forces.

AHB/II/70/173 25/7/43

/Bad weather

Bad weather delayed the operation until 17th August, 1943.(1) The American attack was disappointing, and Bomber Command did not follow it up. The full moon period had now arrived, and such an operation would have led to prohibitive losses. Moreover the vital Peenemunde raid was laid on for that night. After an attack on the C.A.M. ball-bearing factory at Paris in September, another attack on Schweinfurt was made by the Eighth Air Force in October. This time it was highly successful, but very costly. American public concern was only allayed by statements of the immense value and effect of the attack. For this reason it was difficult for the Americans to pay another visit to the target, and the pressure upon Bomber Command to undertake it was increased.

BC/S.28688
16/11/43

The M.E.W. prepared a further note on the current importance of Schweinfurt on the day of this attack. This gave a concise statement of the main facts presented by the numerous and voluminous documents already prepared on the subject. It is reproduced in Appendix 9. A further review by M.E.W. was made in mid - November, taking into account attacks on the industry up to that date. The S.K.F. factory at Stuttgart had been severely damaged in the area raid of 14th/15th April, 1943. The small Deutsche Timken works at Berlin had been very severely damaged in the Berlin raids at the end of March, 1943. The three principal factories at Schweinfurt had been damaged in the raids of August and October, especially the latter, to such an extent that one plant was expected to be evacuated to a new site. About one month's output was thought to have been lost owing to the American attack on the C.A.M. factory at Paris in September. Factories at Annecy, Turin and Villar Perosa had been attacked from the Mediterranean, that at Turin being severely damaged. Diplomatic action, and the pre-emption of Swedish supplies to the extent of £1,000,000 had prevented Germany from making good her losses from neutral countries.

AHB/
II/70/1
30/11/43

The conclusion was that the enemy had lost at least 15% of his planned ball-bearing output for the six months ending 1st March, 1944. The Kugelfischer plant at Schweinfurt remained the largest producer in Axis Europe, and heavy night attack on the town was recommended as a first priority task. The Air Staff supported this contention:-

> "There is no doubt that the Schweinfurt complex represents the outstanding priority target in Germany, not only in respect of its importance to the armaments industry generally, but also in its relation both to the G.A.F. and to Crossbow."

Owing to the continued inactivity of Bomber Command, the subject was taken up personally by D.C.A.S. with the Commander-in-Chief, and the argument recorded in Section (3) below went on throughout December and January 1944.

Meanwhile the importance of the other sources of supply available to the Axis was not overlooked. A number of attacks were made by the American Eighth and Fifteenth Air Forces, and later by Mosquitoes of Bomber Command, which helped to whittle down these sources. These are briefly reviewed, together with the American attacks on Schweinfurt, in the next Section.

/(2) American

(1) See Section (2) for description of attacks.

(2) American Attack on the Industry

The principal German ball-bearing plants featured in the Combined Bomber Offensive Plan prepared by the American planning staff in April 1943. The Schweinfurt and Paris plants were named in the first two phases of the Plan, up to 1st October. Stuttgart was added to them for the third phase, ending 1st January, 1944. Leipzig, Berlin/Erkner and Annecy were added for the fourth and final phase, ending on 1st April. The Pointblank Directive confirmed this plan, placing ball-bearings in the short list of primary objectives. The first task to which the bomber forces were to be directed was:-

> "the destruction of German airframe, engine and component factories and the ball-bearing industry on which the strength of the German fighter force depend."

Owing to the slow rate of build-up of the American force, and subsequent bad weather, it was not until 17th August, 1943, that the first attack against a ball-bearing plant was made. Even then, the force available was split between Schweinfurt and Regensburg, the site of an important Messerschmitt assembly plant. This meant that only 183 aircraft attacked the Schweinfurt targets, and little success was achieved, although the Regensburg raid was very effective. The formation bombed Schweinfurt from about 21,000 feet. Contemporary assessments of results by M.E.W. and R.E.8[1] concluded that the damage to the Kugelfischer, V.K.F.2 and Fichtel und Sachs works, the three which were hit, was slight and unlikely to interfere with production for more than a few weeks. German records show that damage to machines was 2.5% and the finished stocks 2.3%.

U.S.S.B.S. Anti Friction Bearing Report

On 15th September the Eighth Bomber Command attacked the C.A.M. plant at Bois Colombes, Paris. 78 Fortresses attacked, but only two hits were recorded by R.E.8, who estimated that one month's loss of output would be caused. Post-war records show that only one week's output was destroyed, but damage to machines amounted to 12.1%.

A much more successful attack was made by the Eighth Air Force upon Schweinfurt on 14th October. Two hundred and twenty-eight Fortresses attacked, losing 60 of their number owing to very heavy fighter attacks, and the inability of their fighter escort to accompany them so far, or to meet them on their return owing to worsening weather. The outward escort accompanied them to Bonn, but from here onwards they were subjected to intense fighter opposition. The M.E.W. assessment reported very severe damage to the V.K.F.II plant, and considerable damage to the two other major plants. Post-war records show a 20% loss of finished stocks, with 3.5% damage to machines, and 350,000 square feet of buildings destroyed, and over one million square feet damaged. The Kugelfischer plant at Schweinfurt was still considered the most important in Germany, however.

On 8th November the Fiat ball-bearing works at Turin were attacked by the U.S. Fifteenth Air Force. Eighty-one aircraft attacked, and the assessment anticipated one month's loss of output, mostly due to destruction of stocks. Intelligence sources confirmed the serious view taken by the Germans of the damage. On 11th November, 31 aircraft of the Fifteenth /Air

M.E.W. Folder 6

(1) Ministry of Economic Warfare and Research and Experiments Department of the Ministry of Home Security.

AHB/
II/70/1
B.Ops 1349

Air Force were directed against the ball-bearing plant at Annecy but achieved no success. Agents of the S.O.E. blew up the transformers supplying power to the factory on 13th/14th November, and later in the month destroyed the ovens and grinding machines and damaged the power motors with nitric acid. As a result Mediterranean Air Command were instructed that no further attacks were to be carried out against this target. Martial law was declared in the district as a result of these attacks.

Signal AX 805
20/12/43

A report was received from an intelligence source of a conference held by the German ball-bearing controller in Italy on 20th November. Its purpose was to discuss the situation caused by the bombing of the Turin plant, and to attempt to expand production. A further attack on the Turin plant by 118 aircraft of the Fifteenth Air Force on 1st December caused twice as much damage as the previous raid. A signal to Mediterranean Air Command on 22nd December indicated that the Villar Perosa works had become the most important in Italy. Its destruction would complete the campaign against Italian ball-bearing production. Fifty-three aircraft were therefore despatched against it by the Fifteenth Air Force on 3rd January, 1944, and severely damaged it.

RE/H75
8/2/44

The increased importance of the two C.A.M. factories in Paris, following the damage to Schweinfurt in October, had been pointed out by D.C.A.S. in November. The Eighth Air Force attacked them on 31st December, 1943, inflicting heavy damage on the Ivry plant, but only very slight damage on that at Bois Colombes. The R.A.F. area raids on Leipzig and Berlin in December also damaged ball-bearing plants. A report by the Economic Effects Division of the American Embassy assessed the damage caused to enemy ball-bearing production up to 10th January, 1944 at 24.7%. This was made up of damage reported at Schweinfurt (15%), R.I.V. Turin and Villar Perosa (4.9%), C.A.M. Paris, at Bois Colombes and Ivry (3.8%), S.R.O. Annecy (1%). Other damage was considered to represent only a negligible reduction.(1)

S.46239
16/11/43
RE/H71 & 73
4/2/44

BC/S.28668
Encl.14B

It is now known that Goering called a meeting on the day following the October attack on Schweinfurt. The dispersal plan for the industry drawn up the previous year but never put into effect was ordered to be carried out immediately. All stocks of bearings were to be pooled. A special commissar, Dr. Kessler, was appointed with full power to control the industry, and users of ball-bearings were ordered to redesign and remove ball-bearings where they were not necessary. Up to 80% were removed from airframes, but only a negligible number from aero-engines. Thus although the production of bearings dropped for some three months, the pooled stocks prevented any critical shortages from being felt in the aircraft industry.

U.S.S.B.S.
Aircraft Industry
Report

(3) A Conflict of Opinion

A fundamental difference of outlook between the Air Staff and the Air Officer Commanding-in-Chief of Bomber Command came to a head over the question of attacking Schweinfurt. Air Chief Marshal Harris had always been opposed to what we called "Panacea" targets. He firmly believed in the possibility of winning the war by bombing one great production centre in Germany after another, provided the requisite bomber forces were supplied to the Americans for daylight attack, and to

/Bomber

(1) The heavy attack on the industry in February, 1944, by both American and British bomber forces is dealt with in Section 4 below.

Bomber Command for night attack. He resisted every attempt to divert attack to targets too small for the full weight of a Bomber Command attack to be effective within the target area.

AHB/IIH/241/3/586
~~BC/MS.29961~~
Encl.15A

This view was clearly expressed in the Commander-in-Chief's covering letter, on 7th December, to his review of the Royal Air Force bomber offensive:-(1)

> "It is not possible to dogmatise on the degree of destruction necessary to cause the enemy to capitulate, but there can be little doubt that the necessary conditions would be brought about by the destruction of between 40% and 50% of the principal German towns."

S.46368/IV
Encl.48A

Whilst this claim was being examined by the Air Staff, D.C.A.S. on 17th December again urged upon the Commander-in-Chief the vital importance of attacking Schweinfurt. He said that all British and American economic and ball-bearing experts were unanimous in the opinion that the destruction of the Schweinfurt ball-bearing industries would constitute a deadly blow to Germany's war economy. In a demi-official reply on 20th December the Commander-in-Chief set out his reasons against this operation. The following extracts illustrate his view:-

AHB/IIH/241/3/746
~~BC/S.28302/D.O.~~
Encl.49A

> "I do not regard a night attack on Schweinfurt as a reasonable operation of war. The town is in the very centre - by any angle of approach - of the most highly defended part of Germany. It is extremely small and difficult to find. It is heavily defended, including smoke screens - - - - - - there can be no less economic operation of war than an attack on so small a target at night - - - - - - even if Schweinfurt is entirely destroyed, I remain confident that we shall hear no more of the disastrous effects on German war production now so confidently prophesied. I am supported in this contention by an unending series of previous examples with "Panacea" targets."

He went on to quote past examples of such targets, whose elimination had had no apparent effect; the Moehne Dam, the molybdenum mine at Knaben, the Modane marshalling yard. He was convinced that the continual stressing of targets which removed bombing pressure from the German nation as a whole was a deliberately engineered A.R.P. manoeuvre initiated by enemy sources.

S.46368/IV
Minute 65
et seq.

This was a direct challenge to the Air Staff conception of bombing policy. It placed in question the soundness of the economic intelligence upon which the Combined Bomber Offensive Plan was based. If this intelligence were false, then the best plan was blindly to bomb the built-up areas of Germany by night and day. The British and American Chiefs of Staff were convinced, however, that precision bombing of carefully chosen targets was the quickest way of undermining German strength. The British Air Staff believed that the time had come when intelligence was adequate, and bombing aid sufficiently accurate, for Bomber Command to turn to precision attack by night.

/The Air Staff

(1) See Chapter 18 for discussion of this review.

The Air Staff reply to the Commander-in-Chief's review of the bomber offensive laid bare the fundamental conflict of opinion:-

C.M.S.268
Encl.31A
23/12/43

"Your proposals imply a continuation of area attack upon the largest and most densely populated centres, since this is clearly the method by which the greatest return in terms of acres destroyed for tons dropped is to be expected. The attack of small centres of population which nevertheless contain vital industries, e.g. ball-bearing or fighter assembly plants, would in terms of the policy implied in your memorandum, prove uneconomical targets. It is, however, a principle of policy as directed by the Combined Chiefs of Staff that as far as is practicable your efforts should be co-ordinated with and complementary to those of the Eighth Air Force."

- - -The attempt to achieve maximum destruction in the major built up areas should not prejudice the Anglo-American policy of employing the night bomber force whenever possible for the destruction of vital centres associated with the priority industries. This reply had the backing of the Secretary of State and the C.A.S. A.C.A.S.(I) dissociated the Intelligence staff from it, however, lining himself up on the side of the Commander-in-Chief.

The question of which policy was right cannot be adequately dealt with here. Some indication is given in the final chapter of this volume, and it will be considered in the light of all evidence in the final volume of this narrative.

On the instructions of the C.A.S. a further exhaustive examination was made of the enemy's ball-bearing supplies, before a reply was sent to the Commander-in-Chief on the subject. The resultant report was agreed by M.E.W. and the Economic Warfare Division of the U.S. Embassy. This confirmed that the highest priority for attack by all available forces should be given to the Kugelfischer plant at Schweinfurt and the devastation of the town, one-third of whose inhabitants were engaged in the ball-bearing industry.

D.C.A.S. pointed out that Bomber Command had been committed to the task of attacking areas complementary to the precise attacks of the U.S. Air Forces. The latter had twice attacked the Schweinfurt factories, and General Arnold had claimed, in his report to the Secretary of War, that:-

"The Times"
4.1.44.

"All five of the works at Schweinfurt were either completely or almost completely wiped out. Our attack was the most perfect example in history of accurate distribution of bombs over a target. It was an attack that will not have to be repeated for a very long time, if at all."

This exaggeration had been thought necessary to calm American public opinion, which was deeply stirred at the very heavy losses incurred. It meant, however, that a new attack could not be soon undertaken by American Forces.

S46368/IV
Minute 67
et seq.

After lengthy and at times heated discussions among the Air Staff as to the next step in the argument with the Commander-in-Chief, D.C.A.S. prepared an official draft letter. This laid down the British and American Air Staff policy, and directed the Commander-in-Chief to attack Schweinfurt in force

/on the

on the first opportunity and to continue to attack it until it should be destroyed. The C.A.S. referred this draft to the Secretary of State, as it might lead to trouble with the Commander-in-Chief. In accordance with the instructions of the Secretary of State it was redrafted as a direct and unqualified order, and despatched on 14th January, 1944.

Ibid
Encl. 70A

Ibid
Encl. 75A

The Commander-in-Chief countered this on 19th January by setting out at length the tactical difficulties he anticipated in this attack. He anticipated that each full scale attack would cost 40 casualties, and he was convinced that the destruction of Schweinfurt was tactically impracticable. He submitted that the target was far more suited to the American day bombing force. The C.A.S. instructed that a reply should be sent to the effect that the prize of success was great enough to justify the losses which he foresaw, provided that weather suitable for the best tactical plan was awaited. A letter in these terms was despatched on 27th January. The preparation of the tactical plan, and the bad weather and moonlight period which followed, meant that the attack could not be carried out until 24th February. A Directive Signal on 28th January confirmed the first priority of Schweinfurt, and laid down five further towns in order of priority for attack. The Jaegar ball-bearing factory at Elberfeld/Wuppertal was to be given first priority for Oboe and G.H. attacks.

Minute 77

Ibid Encl.81A
Signal AX 3.

(4) Attacks on the Industry in February, 1944.

In accordance with the directive signal referred to above, the Jaegar ball-bearing factory at Elberfeld (part of Wuppertal), was attacked on eight occasions between 30th January and 13th February, 1944. On 15th February Bomber Command reported that 77 Oboe Mosquito sorties had been carried out against this target. Only 26 of these had been technically successful, and there were indications of a considerable systematic error, which would have reduced the number of successful bombing sorties still lower. In view of these failures it had been decided to discontinue the attacks until the reliability of Oboe Mark II should have improved, or propagation conditions should become more favourable. According to post-war evidence only one of these attacks, by four Mosquitoes on 7th/8th February, achieved any success against the target factory.

S46368/IV
Encl.89A

U.S.S.B.S.
Anti-Friction
Bearings Report

A new plant had been reported in August, 1943, to be producing ball-bearings. This was the Steyr - Daimler - Puch factory at Steyr, Austria. It was reported that dispersal of equipment from Schweinfurt was taking place to this factory after the American attacks in August and October. No detailed confirmation of this information was obtained until January, 1944, but it was then assessed as a plant of considerable importance. Mediterranean Air Command was requested to attack it, and a successful operation was carried out by the Fifteenth Air Force on 23rd February, 1944.

A.D.I.K. Report
No.479/1943

A46/
II/70/1
12/1/44.

The long discussed attack upon Schweinfurt, the principal centre of the ball-bearing industry, was undertaken by Bomber Command on 24th/25th February. The U.S. Eighth Air Force carried out a heavy attack in the afternoon of 24th February, so that the attacks of the two forces were complementary, as had been envisaged in the Pointblank plan. Two hundred and sixty-six Fortresses undertook this daylight operation in good visibility, successful attack being claimed by 236 of them for the loss of only 11 aircraft. Seven hundred and thirty-four

/aircraft

aircraft were employed in the British raid, over 550 of them being Lancasters. The attack was divided into two phases, with two hours between them. Conditions were cloudless, with good visibility, and both attacks began with very accurate marking of the aiming-points. The backers-up, however, by aiming at the first markers seen, drew the attacks back along the line of approach. The first attack was centred about six miles south eight minutes after zero hour. The second drifted about half as far.

Two large scale diversions were carried out, to draw the fighter defence away from Schweinfurt. One hundred and fifteen aircraft were despatched to lay mines in the Kattegat and Kiel harbour; 179 carried out a special Combined Command bullseye training exercise over the North Sea. These diversions caused a large force of fighters to be gathered and held in the north. Casualties on the Schweinfurt operation amounted to 33 aircraft, or 4.5% of the force, a small proportion for so distant and central a target. The first wave suffered 5.6% casualties, the second only 3.2%. The total sorties (1082) despatched on this night was a record for the period.

The bombing plot of this operation, confirmed by daylight reconnaissance, showed that a very small proportion of the attack fell on the target area, as had been feared by the Commander-in-Chief. Considerable damage was done to the ball-bearing plants, however. The results of the day and night raids could not be distinguished from each other, but daylight reconnaissance showed damage to all the five plants. R.E.8 estimated that the Kugelfischer works lost seven weeks production and the V.K.F. works five weeks. The No.1 factory of the latter appeared to be the only one seriously damaged.

U.S.S.B.S. Anti-Friction Bearings Report

The post-war assessment of these American and British attacks show that much dispersal of production had been carried out since the attack in October 1943. Schweinfurt was only 60% of the target it had been in August 1943. Of the reduced number of machines, 16% were affected, 8.5% being destroyed and 7.5% damaged. The American bomb damage team assessed the cost of these raids at about fourteen million Reichsmarks, as compared with a cost of about eighteen million for the single American raid of 14th October, 1943. This took no account of damage to the town, resulting in incidental cost to the industry in absenteeism and administrative difficulties.

AHB/ID4/63
~~ID/4/65~~
10/2/44
25/2/44

The ball-bearing plant at Erkner, Berlin, assumed increased importance following the damage inflicted on the Schweinfurt, Steyr, Turin, Villar Perosa, Paris and Annecy factories. The latter had been put out of action by agents of S.O.E. The Erkner factory was producing mainly aircraft bearings, and was therefore of special importance. Moreover, when an industry had been as heavily hit as this, a small plant remaining undamaged became of increased importance, as it could maintain supplies of the most essential types to the highest priority users. The U.S. Eighth Air Force therefore put this factory in the first priority for attack. No attack was carried out during February, however.

In addition to the attacks directed specifically against the bearing industry during February, area attacks on Leipzig and Stuttgart affected ball-bearings factories, as mentioned above.(1) In spite of the reduction caused by this heavy /offensive

(1) See Chapter 16 (5).

offensive, however, the rationalisation and dispersal measures described above maintained supplies to the aircraft industry. Moreover, the imports from Sweden, although reduced by Anglo-Swedish agreement, were now taken in carefully selected types for use by the highest priority users alone.

CHAPTER 18

REVIEW OF THE POINTBLANK OFFENSIVE

(1) The Growth of the Offensive and its Cost

The Bomber Command offensive during the period under review reached its peak, in sorties and bomb tonnage dropped per month, in August, 1943. Thereafter the effort was restricted by bad weather. The U.S. VIII Bomber Command continued to expand, and to increase the weight of its attack upon German targets. For the year 1943 the average strength of crews in Bomber Command was just over twice that of the U.S. VIII Bomber Command. The total sorties despatched and aircraft missing on bombing operations compared in about the same ratio. The tonnage of bombs dropped by Bomber Command was approximately four times the figure for the American forces.(1)

AHB. II/69/28

The monthly trend of the offensive is illustrated by the figures given in Appendix 20. A brief review based on these will recall the principal influences upon the Bomber Command effort during this period.

The effort in February, 1943 was the highest since the start of the war. The tonnage of bombs dropped showed an increase of 60% over the previous highest month, and the loss rate, at 2.5% was the lowest since May, 1941. Both these figures were largely attributable to the fact that nearly half of the February effort was directed against the Biscay ports and Italy, whilst much of the rest was against German ports requiring little penetration.

With the opening of the Ruhr campaign in March losses increased to 3.6%. With a steady increase in the proportion of sorties directed against targets in Germany this trend continued.(2) There was a slight check to the loss rate in June, and a very sharp fall in July, owing to the introduction of Window. After this it was a fairly even struggle between the changing tactics of Bomber Command and the efforts of the German defences to counter them. The winter weather increased the loss rate in December and January, 1944, owing to crashes in the United Kingdom on the return of damaged or lost aircraft.

/After a

AHB/104/23A
~~ID/4/23A~~
Encl. 27c.

(1) Comparison of Effort, R.A.F. Bomber Command and U.S.A.A.F. VIII Bomber Command for the year, 1943.

	R.A.F.	U.S.A.A.F.
Average strength of Crews during, 1943.	1,330	601
Total Sorties despatched on Bomb Raids	56,083	27,295
Aircraft missing from Operations	2,177	972
Crew personnel lost on Operations	15,678	9,497
Tons of Bombs Dropped	156,204	40,261

(2)

	Feb.	Mar.	Apr.	May
Percentage of Sorties against German targets:-	49%	73%	75%	87%
Percentage of Aircraft lost:-	2.6%	3.6%	5%	5.3%

After a setback in March, 1943, the effort of the Command, in terms of tons of bombs delivered, created a record for every successive month up to August. The total for this month, 20,149 tons, was a record for the period under review. From September onwards the approach of winter weather, as well as restriction of operations during moonlight periods, and the restricted use of Stirling and Halifax aircraft owing to their rising casualty rate, caused considerable reductions in the monthly effort of the Command.(1) January, 1944 was the only month to show a pronounced improvement, with a record tonnage dropped upon targets in Germany, mainly Berlin.

The relative superiority of the Lancaster over the Stirling and Halifax manifested itself throughout, 1943. In July, for example, 132 tons were dropped for each Lancaster lost. The comparable figures for the Halifax and Stirling were 56 and 41 tons respectively. The relative inefficiency of the latter types increased still further in August, leading to the decision in September, to restrict their operations to the less difficult and hazardous targets.(2) It was not until February, 1944, with the introduction of the Halifax Mark III, that the Lancaster again received more than nominal support against such targets.

To sum up the effort of Bomber Command over the period under review, an aggregate of 74,900 sorties were despatched for the loss of 2,824 aircraft, or just over 20,000 aircrew personnel killed or missing on operations. By February, 1944 the Command had reached the stage where over one thousand aircraft could be despatched in a night.(3) This had not been achieved since the famous "thousand-bomber" raids of 1942, when every resource of the training units had been strained to provide the required number. A few figures will illustrate the task involved in preparing for an operation by a thousand bombers. Over 2,000,000 gallons of petrol, 70,000 gallons of oil and 5,000 gallons of coolant had to be put into the aircraft. 4,500 tons of bombs and 10,000,000 rounds of ammunition might be required.

BCQR No. 8.

The total strength of the Command required to back this force amounted on 14th February, 1944 to 155,510 R.A.F., W.A.A.F., Allied and Dominion personnel. The full effort involved in supporting such a bomber force is incalculable, as the total labour force in the aircraft, weapon and component industries, in airfield construction and maintenance and other supporting industries must be taken into account. The sections which follow attempt an assessment of the contribution of this vast organisation to the Allied cause.

(2) The Aim and its Execution

Before reviewing the offensive from the contemporary and post war points of view, it is necessary to bear in mind once more its aim and development. The overall object was first asserted by the Allies at Casablanca as:-

/"The progressive

(1) See Appendix 16.

(2) See Appendix 16.

(3) On Feb. 15th/16th, 1066 aircraft were despatched.
On Feb. 24th/25th, 1082 aircraft were despatched.

C.C. S.166/1/D
21.1.42

"The progressive destruction and dislocation of the German military, industrial and economic system and the undermining of the morale of the German people to a point where their capacity for armed resistance is fatally weakened."

Some months were devoted to developing the offensive, tactically and technically, and to exploiting Oboe. Meanwhile detailed plans were prepared for the Americans' share, daylight precision attacks, whilst their forces were being built up in the United Kingdom. The aim was restated in the Directive of 10th June, in which priority was given to the attack of the growing German fighter strength as a prerequisite to effective bombing operations.

This Directive has come to be known as the Pointblank Directive. At the time, the Pointblank Offensive was understood to refer to the overall object defined in the Casablanca Directive, as given above. It came to bear the special meaning of attack on enemy fighter strength in the minds of some users, because this was the first priority task laid down in the June Directive. The post-war Thunderbolt Exercise finally awarded the name Pointblank to the June Directive, in contradiction to Air Chief Marshal Harris' Despatch, in which it was used as an alternative title for the Casablanca Directive. This contemporary and post-war confusion of thought must be borne in mind when considering reviews and assessments of the offensive during this period.

This review therefore relates primarily to the period June 1943 to February 1944. The earlier months have been dealt with under the headings of the U-Boat and Ruhr Campaigns. From June onwards the American bomber force joined fully in the attack on Germany, and the attacks of Bomber Command had reached their full weight and concentration. The attack on the Ruhr dams in May had shown the precision which could be attained at night. The Battle of Hamburg at the end of July demonstrated fully the power of the Command. Interrogations of German military and industrial leaders have revealed that such persistent attacks were greatly feared. Speer stated:-

USSBS
Aircraft
Industry
Report
P.71

"The first serious air raid on Hamburg in August, 1943, was extraordinarily impressive. We were convinced that the quick repetition of such an attack on six other German cities would necessarily lead to a lessening of the will to continue armament and war production..... The air raids were not repeated to such an extent, however, and in the meantime the population was able to get accustomed to the air raids and, together with the armament industry, were able to collect valuable experience."

This lends support to the view constantly held by Air Chief Marshal Harris that an adequate bomber force could cause Germany to capitulate by area attack. The British Air Staff supported him in his all-out attack, but believed that careful selection of target centres and precision targets would achieve the object more quickly. The American Staff pinned their faith to the precision bombing of selected objectives by day. Any one of these methods might have produced the desired result, if adequate bomber forces had been provided and the aim pursued without diversion.

/The Bomber

O.R.B.
App.

The Bomber Command Quarterly Review for December 1943 stated that 1943 had long been anticipated as the year of achievement for Bomber Command.

> "Had resources been available for the execution of the Combined Bomber Offensive on the scale as planned it would also have been the year of victory over Germany. As it is, although we have gone a long way and the end is now in sight, the decisive blows have still to be delivered."

It was not until 1943 that the Command was in a position to carry out its long planned policy of true strategic bombing; that is to say, the bombing of selected targets on a scale sufficient to break the industrial capacity and undermine the morale of the enemy. For the success of such an offensive, three main problems had to be solved:-

(i) Lack of sufficient suitable aircraft, aircrews and airfields.

(ii) The difficulty of hitting the target at night in all weathers.

(iii) The problem of countering the growing strength and effectiveness of the enemy's defences.

The first difficulty was being overcome by 1943, with an increasing flow of heavy bombers. The second factor was being seriously tackled. The institution of the Pathfinder Force, their provision with the latest navigation and bombing aids, and with ever-improving types of Target Indicators, produced an accuracy and concentration of bombing never before achieved at night by any air force. The third problem, the countering of the enemy's defences, was a continuous struggle of wits between scientists and tacticians on both sides. The result was that the number of bombers missing for every hundred despatched to Germany was less in 1943 than 1942, whilst the greater loads carried by heavy bombers meant that two and a half times the weight of bombs was dropped for every aircraft lost. The damage to Germany's main industrial cities in the nine months period March to December 1943 was ten times greater than in the preceding 45 months of the war.

D.D.B. Ops
Report
June 1945

During the first two months of 1944, the Command continued to expand in numbers, but more effectively in striking power, owing to the re-equipment of Stirling squadrons with Lancasters. At the same time the very rapid growth of the U.S. heavy bomber forces in the United Kingdom and Italy made it possible to put into effect the plan long envisaged for the day and night bomber forces to carry out tasks complementary to each other. The attack on the German Air Force and its supporting industries became really effective in the combined attacks of February. The experience gained in the accurate location of targets, including the many failures, made possible the extreme accuracy of bombing required for the support of Overlord in the next period.

/(3) Progress

(3) Progress Reports by the A.O.C.-in-Chief, Bomber Command

AHB/IIA/23A
~~ID/4/23A~~
Flag 25

At the end of 1943 a number of reviews and assessments of the effect of the Pointblank offensive were made by Bomber Command and the Air Staffs. In a memorandum to the Prime Ministry on 3rd November the A.O.C.-in-C., Bomber Command gave an impressive review of achievements since March. He assessed 19 German towns as "virtually destroyed" and a further 19 as "seriously damaged," all of them being towns of outstanding service to the enemy war effort. He felt certain that Germany must collapse before his programme, which was more than half completed already, should have proceeded much further.

AHB/IIM/241/3/1586
~~B.C./M.S.~~
~~29964~~
Encl.10B

The following day the A.O.C.-in-C. indicated the yardstick by which he measured the achievements of the bomber offensive even more clearly. In his outline of future intentions submitted for inclusion in the Progress Report to be submitted to the Combined Chiefs of Staff he said:-

> "The primary aim will be to effect destruction of housing and industrial plants complementary to the precision attacks on key factories carried out by VIII Bomber Command."

He then listed the major towns under geographical areas, showing the order of importance attached to the towns within those areas. This priority depended principally upon size and amount of damage already achieved.

Ibid
Encl.15A

On 7th December Air Chief Marshal Sir Arthur Harris forwarded a progress report to Air Ministry to illustrate the achievements of Bomber Command up to the end of October. This achievement was expressed in terms of acreage destroyed per ton of bombs dropped and in comparison with acreage attacked. The acreage referred to was that which was 40% or more built up. Up to the end of October 167,230 tons of bombs dropped on the 38 principal towns attacked had destroyed 20,991 acres or about 25% of the acreage attacked. Of this total 18,641 acres (nearly 22% out of this 25%), had been destroyed by the 102,000 tons dropped during the first ten months of 1943. By 1st April 1944, the closing date of the C.B.O. Plan, 35,750 acres should have been destroyed out of a total target area of 89,000 acres. The population of the towns attacked would be over 75% of the total population of towns in Germany of more than 50,000 inhabitants.

Ibid
Encl.14A
30.11.43

It was made clear in the progress report that the calculations used referred only to the offensive against built-up areas in which results could be accurately measured from vertical photography. They took no account of the effect of direct damage to industries or to areas outside those which were 40% or more built-up. Comparing the progress made during the last ten months with that in the preceding thirty months the increase in the offensive was most striking. The weight of bombs dropped had multiplied by five times, the acres devastated by 24 times. This was attributable to the increased

/size

size of the force and its efficiency. With the stage now reached in the development of radar aids and bombing technique neither of these factors could be expected to continue. The rate of efficiency would fall owing to the devastation already achieved.(1)

C.M.S.268
Encl.22A.
II/70/272(d)
19.12.43.

Air Staff criticisms of this report have been referred to in the previous chapter. The principal complaint was that Bomber Command had not carried out the task allotted to it by the Combined Bomber Offensive Plan, but had aimed its attacks against those German cities containing the largest population. The 38 towns attacked contained 72% of the German population living in large towns. These 25,000,000 Germans living in large towns were less than 33% of the total population of pre-1938 Germany. The C.-in-Cs assumption that the destruction of 40% to 50% of the built-up areas of the 38 towns would cause the enemy to capitulate was therefore challenged. It was considered that a combination of area attack and more precise attack upon towns containing vital industrial objectives, such as Schweinfurt, would produce more speedy capitulation.

AHB/II/4/241/3/586
~~BC/MS29961~~
Encl.25A.

The reply of the C.-in-C. to Air Staff criticisms claimed that de-housing was not an end in itself. De-housing in the neighbourhood of industries, however, was considered the most effective method of disrupting economic life and thereby destroying the system on which the German war effort depended. Attacks on small towns by heavy bombers at night were bound to be unremunerative, in his opinion:-

> "It is surely clear that the destruction of about one third of Berlin including large numbers of high priority factories is of incomparably more value in preparing for Overlord than the destruction of the town of Schweinfurt would be. Yet the annihilation of Schweinfurt, because of its small size and the extreme difficulty of locating it, could not be guaranteed at all and might well require six full-scale attacks."

AHB/II/4/241/3/586
~~BC/MS29961~~
Encl.26A,27A

On 21st January, 1944, the A.O.C.-in-C., of Bomber Command submitted a further paper on "the Progress of the Combined Bomber Offensive against German aircraft production and the towns associated with it". This was designed to dispel the view that Bomber Command had failed to perform its share of the Pointblank programme. Of the 20 towns in Germany laid down as being principally associated with the aircraft industry, 10 had been attacked by Bomber Command. These ten contained 94% of the total population of the 20 towns .26.5% of their built up area had been destroyed, according to P.R.U. assessment. From 1st March, 1943 to Jan. 15th, 1944 46% of the total bomb tonnage dropped on Germany had been aimed at these 10 towns. Of the 33 important German Air Force targets within them, nine had been destroyed by the R.A.F. and five by the U.S.A.A.F. The latter had also destroyed all the G.A.F. targets at three of the towns not attacked by the R.A.F. and half the targets at a fourth.

/Twenty-one

(1) Tables and graphs attached to this report showed details of the effort in tons and the acreage destroyed. These are not included as similar statistics, attached to the report in February, 1944 mentioned later, are given in Appendix 17.

Twenty-one towns not on the G.A.F. list had also been attacked by Bomber Command. Eleven of these contained aircraft component factories, whilst the Ruhr towns provided high-grade steel and other raw materials for the industry. The C.-in-C. claimed that all the towns on the G.A.F. list which were practicable targets for Bomber Command had been effectively attacked. The further activities of the Command had had incalculable effects on the supply of equipment for enemy land and sea forces, which would not have accrued from the attack of the small towns so far neglected. The statistical appendices from which these conclusions were drawn are given in Appendix 13. The actual results obtained upon most of these targets can be found in the table of damage compiled from enemy records, at Appendix 18.

AHB/IIH/241/3/586
~~B.C./MS2996t~~
Encl. 41A

A further report on the progress of the R.A.F. Bomber Offensive, following on that of 30th November summarized above, was presented to Air Ministry on 2nd March, 1944. This was based on an assessment made by the Ministry of Home Security, Department R.E.8. (1) The Bomber Command interpretation of this assessment is reproduced in Appendix 17. It was calculated that Bomber Command's attacks during the period March to December, 1943 had cost the enemy one million man-years, or 36% of the potential industrial effort of the 29 towns attacked in this period. Since the towns attacked contained a high proportion of important industries, it was reasonable to assume that the figure of man-hours lost contained a high proportion of skilled workers' time:-

Ibid
Encl. 41B.

> "This being so, a Lancaster has only to go to a German city once to wipe off its own capital cost, and the result of all subsequent sorties will be clear profit."

(4) Reviews of Economic Effects

The Ministry of Home Security and the Ministry of Economic Warfare periodically issued reviews of the effects of bombing, and of the general economic state of Germany. The reports by the Research and Experiments Department of the former (R.E.8) have been found to be very accurate. The latter Ministry, on the other hand, usually underrated the reserves and recuperative power of German industry.

RE/H76
15.2.44

A review by R.E.8 of the "Economic Effects of attacks in Force on German Targets," during the period March to December 1943, has already been referred to. (2) Bomber Command used it as a basis for their progress report in February, 1944. This assessment reported industrial damage as 4.5% of the estimated total in Greater Germany. Attacks by the R.A.F. alone were estimated to have destroyed or rendered uninhabitable 6% of the total dwelling units in Greater Germany, including 25% of the dwelling units in the towns attacked during the period. Attacks in these months were estimated to have inflicted on German industry a total loss equivalent to over 9% of its potential production in the period. The bulk of the total loss, although not of the loss in certain high priority industries, was achieved by R.A.F. attacks directed against target areas containing 24% of the German industrial population.

/The heaviest

(1) See Section (4) below.

(2) See Section (3) above

The heaviest losses from the combined R.A.F. and U.S.A.A.F. offensive were believed to have been inflicted in the categories of machine tools (59%), anti-friction bearings (20%) single-engine fighter aircraft (17%) and synthetic rubber (10%). The U.S.A.A.F. were mainly responsible for the last three. The losses stated were considered an underestimate because they excluded the effects of damage not covered by reconnaissance, losses due to general administrative disorganization and those caused in undamaged factories by the interruption of supplies from damaged factories.

RE/H119
10.5.44

The next report by R.E.8 carried the assessment of damage up to 31st March, 1944. In this period between 10% and 20% of the area of factory buildings producing fighter aircraft and anti-friction bearings were assessed as seriously damaged. Total industrial losses directly attributable to air attack were put at 7% of capacity in February 1944 compared with 10% in December 1943. The destruction of machine tools continued at a rate requiring the diversion of about half the German machine tool capacity to repair and replacement of damaged tools.

M.E.W. Report
No.72A
3.7.43

M.E.W. issued six-monthly surveys of economic developments in German Europe. The survey covering January to June 1943 stated that the incidence of aerial attack was now seen in all branches of Axis economic activity, and was evidently one of the chief preoccupations of the Axis authorities. The increase in the output of certain armaments, locomotives and other essential war material achieved by the Speer Ministry of Armaments set up in 1942, was believed to have been brought about at the expense of general engineering production.

M.E.W. Report
No.108
29.2.44

The next M.E.W. survey stated that much of the physical damage to industrial premises could still be compensated from an idle surplus of plant capacity, but in the case of civilian housing no such surplus remained. The civilian allocation of industrial output had been reduced to a minimum. The destruction of stocks and the contents of houses had rendered the replacement of civilian necessities essential, and responsibility for their manufacture had been transferred to the Ministry of Armaments and Munitions. The enforced dispersal of German production was stated to be the most striking feature of this period, July to December 1943. Increased exploitation of the industry of the occupied territories was also noted. The planned increase in the output of fighter aircraft was believed to have been reversed, but locomotive production had almost reached its target figure. The production of tanks was thought not to have kept pace with wastage during the last six months. Ball-bearings, radio equipment, machine tools and rubber were believed to have fallen seriously short of requirements.

Ibid.
Page 56

In dealing with the effect of air raid damage specifically this survey stressed the importance of destruction of dwellings. It was estimated that well over four million persons had been displaced during 1943. On 23rd October Speer had publicly admitted the loss of two million rooms by aerial attack, and indicated that potential reserves were not likely to exceed 250,000 rooms. A "Self-Help" plan to build a million two-roomed bungalows, by the labour of the occupier, had been announced.

/The overall

The overall effect of factory damage and absenteeism was estimated to have depressed production by 10%, since the Spring. The U.S. Eighth Air Force attacks on single-engined fighter production were estimated to have produced a decline of 15 - 20%, instead of an increase of 50%, as planned.

M.E.W. Report No. 134 31.8.44

The M.E.W. survey covering the first six months of 1944 stated that the production of operational aircraft fell steadily until March, when it was lower than at any time since mid-1941. (1) This survey concluded that the time had come when Germany could no longer divert her economic difficulties on to her civilian population:-

> "In every field of equipment, from tanks to small arms, from M/T to boots, her inadequacy is now too serious to be concealed. From now on the war will impose upon her a level of wastage beyond the power of her economic structure to sustain."

(5) Assessments by the Allied Air Staffs

CMS 268 Encl.9C and Minutes

In accordance with a request from the Chief of the Air Staff, a first report was prepared in September, 1943, on the progress made in the Combined Bomber Offensive Plan. This covered the period up to 31st August, 1943. In presenting it the D.C.A.S. pointed out that no town associated with fighter production had so far been attacked by Bomber Command. Their major contribution had been the operations against Hamburg and Berlin. He felt that Bomber Command should be asked to give the highest priority to attacks on those towns closely associated with the enemy's fighter industry. The V.C.A.S. backed this up, saying that the Germans were evidently accepting very serious military handicaps in Russia and the Mediterranean, rather than reduce the build up of their fighter defences in Western Germany.

The report emphasized that German Air Force fighter strength on the Western Front had risen from about 700 in January, 1943 to about 1,300 in September. The U.S.A.A.F. had achieved great success in some of its attacks, notably on the Me.109 factories at Regensburg and Wiener Neustadt. Bomber Command had given little assistance, however, and the strength of the U.S.A.A.F. was not being built up fast enough to accomplish the task without such assistance. Unless the build up of the G.A.F. fighter force could be quickly checked there was a real danger that the efficiency of the Allied attacks would fall to a level at which the enemy could sustain them.

Ibid Encl.10A, B.

The D.C.A.S. drew to the attention of the C.A.S. a note prepared by the Director of Bomber Operations urging that all possible effort in the immediate future should be directed to the reduction of German fighter forces. Failure to seize the present opportunity might prejudice the success of Overlord, and in any case would result in heavy casualties.

A prophetic note was added:-

> "It may also result in the failure to demonstrate the power of the strategic air offensive, with consequent and dangerous repercussions upon post-war policy."

/The Combined

(1) This is not borne out by German records, as shown in the next chapter.

AHB/ID4/355
~~ID/4/355~~

"The Combined Bomber Offensive Progress Report" was prepared by the British Air Staff in collaboration with the U.S. Eighth Air Force in November 1943. (1) It covered the period 4th February to 3rd October 1943. In presenting it to the Combined Chiefs of Staff, the Chief of the Air Staff summarised the achievements of the two Air Forces.

AHB/II/70/174/
14.11.43.

German single-engined fighter production had been reduced by some 40% below what the Germans had planned. This was equivalent to a strength of about 750 less than the planned strength. Attacks on factories and industrial areas had seriously affected German capacity for armament manufacture, chiefly in respect of ball-bearings, rubber, electrical equipment, vehicles, machine tools, steel, shipbuilding and heavy industry. The effects on German morale were also considered of tremendous importance. Some 38 German cities, with an aggregate population of 18 millions, had been more or less seriously attacked. Perhaps six million people had been made homeless and were spreading alarm and despondency in the areas into which they had gone. They were crowding into areas as yet unbombed. The replacement of their clothing and moveable goods destroyed was either impossible or could only be done at the direct expense of the war effort.

AHB/ID4/355
~~ID/4/355~~
C.B.O. Report
App.R.

An appreciation by Air Intelligence and the Political Warfare Executive summed up the effect on morale:-

"During the period under review:-

(i) Fear of air attack has been the dominant preoccupation of a large part of the German civilian population, and has contributed to produce a situation in which fear of the consequence of continuing the war is becoming greater than fear of the consequences of defeat.

(ii) Air attacks on Germany have resulted in social disruption on a scale which has greatly impaired the German ability to prosecute the war.

(iii) Though the forces of repression, the hopes of a compromise with one or other of the belligerents, and the favourable climatic conditions of the past three months have so far prevented any general break in morale, it is not reasonable to infer that no such break in morale can occur."

The C.A.S. pointed out that, if the Pointblank offensive had proceeded exactly as planned, the strength of the German fighter force, as then estimated, would have been reduced at November 1st from a possible 2,900 to 2,250. In fact, the rate of increase of German single-engined fighter strength had not been accurately appreciated when the plan was formulated. The actual

/strength

(1) The Report, without its Appendices, is reproduced at Appendix 15.

strength at November 1st was 2,850. Had it not been for the Pointblank campaign the total strength might well have been over 3,500.

Ibid
App. O.

A joint report by the Ministry of Economic Warfare and the Air Ministry Intelligence Branch assessed the overall effects of bombing at 10% of the total war potential, and suggested that 20% might be fatal. The effect on certain industries, such as ball-bearings and rubber, might have brought them near the point of collapse. The damage to fighter assembly factories had resulted in a loss of 880 single-engined fighters. Production in October was under 700 against a planned production of 1,000. (1)

Ibid
Appendix Q

A further effect of the Allied offensive was stressed by the Joint Intelligence Sub-Committee. Whereas at the beginning of the period approximately 50% of the total German fighter strength was employed on the Western front, at the date of the report not less than 70% was used in the defence of the Reich. As a result the Russians had now achieved outstanding air superiority. The enemy had been forced to defend his home front even at the cost of serious military reverses.

S46368/IV
Encl. 67B
4.1.44

The American view of the purpose and progress of strategic bombing was given by General Arnold in his report to the Secretary of War in January, 1944:-

> "It is now plain that for us the beginning has ended, for our enemies, the end has begun." "Our primary concern, simply stated, is to make the coming invasion of Germany as economical as possible by drastically reducing the war potential of the Third Reich and its satellites."
>
> "In view of the high rate of attrition of German fighter aircraft on the western front the near future appears likely to be a crucial period which may determine the survival or destruction of the Luftwaffe as an effective air force."

CMS 268
Encl. 45A
18.3.44.

A progress report on the Bomber Offensive for February, 1944, prepared for the Combined Chiefs of Staff indicates the view held at the end of this period. At the end of January, 1944, the Air Ministry estimate of German Air Force production was 650 S.E. Fighter, 190 T.E. Fighter and 350 Bomber and Reconnaissance aircraft per month. At the end of February, as a result of the "big week", it was estimated that production had been reduced to 245 S.E. Fighter, 55 T.E. Fighter and 210 Bomber and Reconnaissance aircraft per month. In addition large numbers of fighters had been destroyed on the factory airfields and in air fighting. (2) 866 aircraft had been claimed destroyed in combat during February.

D. of I.(O)
2.4.44.

The conclusions of a report on morale effect up to March 1st, 1944, by the Director of Intelligence, gives the contemporary view of this aspect of the effects of the air offensive, which had been so stressed in 1942. Air attack was said to have reduced German morale to an unprecedentedly low level. The prevailing nervous strain had been manifested in a state of general apathy which had seriously

/prejudiced

(1) These figures can be compared with the actual German records given in the next chapter.

(2) Speer reports the destruction of 465 aircraft in factories or on Factory airfields. See next Chapter.

prejudiced the German war effort and was causing grave concern. At the same time the sufferings of the German people had not affected the determination of their leaders, who had nothing to gain and everything to lose from a surrender, to maintain the regime and prosecute the war. Anti-Nazi sentiment was passive, and unlikely to constitute a major threat to the Home Front. The paper concluded:-

> "While the possibility of a sudden overthrow of the German Government from below cannot be excluded, the evidence at present available favours the view that the process will be one of gradual disintegration on the Home Front. The decline of civilian morale, while most important, would thus not be the direct cause of a German collapse."

CHAPTER 19

A POST-WAR ASSESSMENT

(1) Sources and Basis of Assessment

A final assessment of the air offensive can only be attempted in a review of the war as a whole. The period covered by this volume, however, is worthy of review. It saw the gradual defeat of the German Air Force, and the development of the technique which achieved really effective results in the final phases of the war.

Post-war studies of the material effects of bombing cannot often show the precise effect of each attack or even of a limited period. Attempts to evaluate incidental and intangible effects are complicated by many factors; the incompleteness of the evidence, the partiality of witnesses, the opinions of investigators. The conclusions reached are very often not warranted by the evidence available.

This assessment, therefore, attempts merely to give the evidence and the views which have come to light up to the present [1], regarding the effects of the bombing offensive up to February, 1944. The most important sources are the surveys of the effects of bombing carried out by the United States Strategic Bombing Survey Unit and the British Bombing Survey Unit.[2] In addition, extracts are used from translated German documents, and from the interrogations of German leaders such as Albert Speer, the Reichsminister for Armaments and Munitions, and his subordinates, and of high-ranking German Air-Force officers. The Thunderbolt Exercise of August, 1947, which reviewed the Combined Bomber Offensive, also throws much light on the subject of this chapter.

Criteria used to assess results are the effects upon priority target industries - aircraft, tanks, U-boats, - and any more general effects which have been observed and reported. There can be no real assessment of morale effect, as it varied from day to day; or of many aspects which depend on a hypothesis. For example, if rapid expansion of the German fighter industry in 1943 had not been made easy by the existence of surplus plant capacity, the industry might have been virtually eliminated by the Pointblank Offensive, with incalculable consequences. Similarly, if the industry had not been put under Speer's control in February, 1944, as a result of the heavy Anglo-American attacks, the later increase of production might not have been achieved.

There is a lack of evidence from high-level German sources of the indirect effects of the bombing offensive. Its relation to the reverses of the German forces in Russia, North Africa, Sicily, Italy, and even in North-West Europe, cannot be adequately assessed. It is to be hoped that material will come to light on the relation of bomb damage and the dislocation resulting to the supply of men and materials to the active fronts; on the relative importance placed by German leaders upon the home-front against air attack, the Russian and Mediterranean fronts and the Allied preparations for invasion; and on the German man-power problem, as between air-defence and repairs, war and other production, and the armed forces in the field.

/(2) The Effect

(1) Written in January, 1949.

(2) Known as U.S.S.B.S. and B.B.S.U.

(2) The Effect upon German Air Power

U.S.S.B.S. & B.B.S.U. Aircraft Industry Reports.

German aircraft production was under the control of the Air Ministry until February, 1944. Under Goering, the Director of Aircraft Procurement was in charge. This post was held by General Udet until his suicide in November, 1941, and thereafter, by Field-Marshal Milch. Both continually urged an increase in the planned fighter programme, but Hitler, Goering and the General Staff were opposed to any increase in defensive production until late 1942. The latent capacity of the industry was idle until then. As a result of the efforts of Udet and Milch, however, several new plants were erected in Austria and Czechoslovakia.

Between September, 1942, and the end of the war, nine aircraft programmes were produced. The one dated 21st September, 1942, was the first to show any appreciable increase in aircraft requirements. Single-engined fighters were to be increased from 374 in July, 1942, to 865 in July, 1943, and 1,409 in July, 1944.(1) The plans made in August and October, 1943, made very big increases on these figures, 2,822 and 3,327 by July, 1944 respectively. These plans made possible the big expansion of 1944.

Speer Papers No.1.

After the heavy attacks of late February, 1944, Milch came to Speer, the Minister for Armaments, and informed him that March production was expected to be only 30% to 40% of the February figure. He asked Speer to take charge of "defensive" aircraft production, that is day and night fighters. Speer had always been particularly interested in this aspect of Luftwaffe equipment, as he regarded a strengthening of its defensive capacity as indispensible for maintaining war production in general. As a result of this meeting, the "Jaegerstab"(2) was set up, under the direction of Speer and Milch, with Saur as its executive head, on 1st March, 1944.

A.D.I.K. No. 345/1945.

One of the chief difficulties leading to the formation of the Fighter Staff had been the shortage of raw materials. Speer's subordinates, according to Milch, put army supplies before those for the G.A.F. This difficulty was obviated by making the Speer organisation responsible for aircraft production. Measures taken by the new authority to increase production included the mobilisation of all building facilities in the neighbourhood of damaged plants for repair work. Special flying squads were formed, armed with plenary powers, who took off, sometime before a raid was over, to supervise clearance and repair. A thorough policy of dispersal was also put into effect, and the number of aircraft types and sub-types in production was drastically reduced.

Some idea of the effects of the air offensive which led up to these changes of organisation must now be sought. As early as 29th July, 1943, Speer's opinion, given in a Central Planning Office Protocol, was:-

Speer Papers No.62.

> "The situation for us is quite simply that if it is possible to damp down the air attacks, only then can we consider increasing production."....
>
> "For the next six or nine months will bring the decisive turning-point for us".

/With

(1) Twin-engined fighters, - July, '42-59; July '43-177; July '44-335.

(2) Committee for the production of fighter Planes, or Fighter Staff.

With this realisation of the potentialities of the Allied attack began the big push for expansion of aircraft production. The weight of attack delivered late in 1943 and early in 1944 set back production plans by many months and denied the German Air Force some thousands of aircraft when it needed them most.

U.S.S.B.S. Aircraft Industry Report

Dr. Frydag(1) considered that the most severe blow dealt to the aircraft industry by the area bombardment of towns was the enforced dispersal of the electric and instrument manufacturing industries from Berlin to Silesia, which commenced after the heavy raids on Berlin in November, 1943. Speer expressed the view that the Ball-bearing industry would have been knocked out, with very serious general effects, if the first attack of August, 1943, had been followed up and repeated at shorter intervals, or if the attack had been carried out earlier. Seventy per cent to 80% of the German Ball-bearing industry was concentrated at Schweinfurt at the time of the first attack, but dispersal had been initiated, intended ultimately to reduce the share of Schweinfurt to 10%. On 4th February, Speer told Gros-Admiral Doenitz:-

Speer Papers No.11

Ibid. No.6

> "The exceptionally critical situation in the ball-bearing sector does not need to be emphasised. The fact that the production in France has also been heavily hit makes necessary the speedy accommodation in the caves, which are fortunately available there."

Speer Papers No.62

The first effects of the attacks, according to Dr. Wagenfuehr (2), were devastating. Output dropped to about two-fifths within a few months (by April, 1944), recovering only gradually. Consumers managed somehow by mobilising existing stocks. Approximately one half of the pre-raid floor space in bearing factories was destroyed, and another half damaged.

Wagenfuehr.

U.S.S.B.S. Overall Report

Up to March, 1944, many underground and other dispersed factories for the Luftwaffe had already been started. The U.S. Bombing Survey considered that if strategic bombing did nothing but force the dispersal of the aircraft industry, it would have paid its cost. It made necessary a tremendous dilution of supervisory and technical talent. Dr. Frydag estimated that 20% additional indirect workers were required because of dispersal. The Survey concluded that:-

Speer Papers No.75.

U.S.S.B.S. A/C. Industry Report

> "It may well be that more aircraft were lost out of production because of dispersal than because of direct bombing".

Saur has stated that, by the end of February, 1944, when the Jaegerstab was set up, 70% of the original buildings of the German aircraft industry had been destroyed or damaged. The damage to machine-tools was much less. The airframe section of fighter production was the first to be attacked in 1943. Being relatively compact and unprepared for attack, damage was severe. Milch stated that it was possible to maintain the July level of production, but not to increase it as had been hoped. Wagenfuehr estimated that, for the last six months of 1943, 15% of production

B.B.S.U. A/C Industry Report.

/was lost

(1) Frydag was head of the Commission for Airframe Production from 1942.

(2) Wagenfuehr was a German economist, who was head of the Statistical department of the Planning Staff of the Speer Ministry.

was lost through bombing.(1) This would give a figure of about 2,000 aircraft, which is considered accurate. The U.S.S.B. Survey estimated that the planned fighter programme was delayed by three months as a result of the 1943 attacks.(2) The timing of this delay contributed significantly to the victory in the critical air battles of 1944.

U.S.S.B.S. Overall Report

The attacks of January and February, 1944, against factories producing the Messerschmitt 110 were said by Frydag to have destroyed 465 machines which were in the final stages of construction, or standing on the factory airfields.

Speer Papers No.11.

In addition to the direct effects upon the aircraft industry, certain other effects of the bombing offensive must be mentioned. Shortage of fuel was first seriously felt in 1942, when G.A.F. training was restricted on that account. There were further cuts in 1943, and this reduction in training undoubtedly affected the efficiency of the G.A.F. Attacks on airfields, although never very effective, caused a further loss to the G.A.F., and attrition in air combat rose rapidly, as the U.S. forces increased. Loss of production time due to area raids was also not inconsiderable. Absenteeism lasted for some time after a heavy raid. Hupfauer (3) reported the example of a census taken three or four weeks after a heavy raid on Cologne in the summer of 1943:-

B.B.S.U. etc.

Speer Papers No.85.

> "About 75% of the personnel was present in the iron and metal industry, about 68% in the building industry, and often less than 60% in factories which had a majority of female workers"

Speer Papers No.85.

People who were bombed out had to get a permit at the War Damage offices to purchase essential goods. They had difficulty in buying them, as the shops were frequently bombed out also. The works managements took measures to help, which reduced absenteeism later in the war.

/Allied

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(1) Production and reserves of defensive planes during the heavy attacks are given by Dr. Wagenfuehr as follows:-

Wagenfuehr page 38

Month	Production	Reserves
July, 1943	1,109	
August,	986	
September,	982	8,298
October,	1,103	
November,	937	
December,	721	
January, 1944	1,537	5,947
February,	1,028	

Further tables and charts illustrating German aircraft production may be found in the U.S.S.B.S. and B.B.S.U. reports.

(2) Acceptance figures for M.E.109 dropped from 725 in July to 536 in September and 357 in December; for F.W. 190 from 325 in July to 203 in December.

(3) Hupfauer was Chief of Labour Relations in the Speer Ministry.

Allied intelligence estimates of German aircraft production were often very wide of the mark. Many of the factors mentioned above, both direct and indirect, were exaggerated. As the bomber offensive depended upon the estimates, target policy being decided as a result of them, it is useful to note the discrepancy. In the second half of 1942, the average monthly production was 539 less than Allied intelligence estimates. In 1943, the estimates were about right, but in the first half of 1944, production was 941 above the estimate. In the case of single-engined fighters, the Allied estimates lagged behind actual production during 1943 owing to the failure to realise the expansion in this type which had been put in hand.(1)

U.S.S.B.S. Aircraft Report.

The offensive against the German Air Force continued on an increasing scale until complete air supremacy had been attained. The means by which this was finally accomplished are summed up in the report of the United States Strategic Bombing Survey:-

> "To cut off the flow of usable aircraft to Hitler's fighting squadrons, the Combined Bomber Offensive applied every known form of attack. The Royal Air Force bombed cities, and "industrial areas by night to disrupt and demoralise labour and to destroy such factories as might be located in the target area. The U.S. Army Air Forces bombed airfields and factories by day to destroy as many finished aircraft as possible and to cripple further production. At the same time, rail centres, bridges and marshalling yards were under constant attack by both air forces and tons of bombs rained down on oil refineries, synthetic fuel plants and fuel dumps. In the end the total weight was too much."

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(1) Comparison of Allied Intelligence Estimates of German Aircraft Production with Actual Production.

B.B.S.U. Aircraft Report.

Average Monthly figures at Six-month intervals.

Period	Single-Engined Fighters		All Aircraft	
	Allied estimate	Actual Production	Allied Estimate	Actual Production
1st half 1942	410	323	1,820	1,115
2nd half 1942	435	434	1,880	1,341
1st half 1943	595	753	2,030	1,985
2nd half 1943	645	851	2,115	2,172
1st half 1944	655	1,581	1,870	2,811

(3) General Effects

An estimate of the general effects of the air offensive is still more difficult to arrive at than the effect upon a particular industry. An attempt is here made to marshal the considerable evidence available.

B.B.S.U. Overall Report

Area attack consumed most of the energies of Bomber Command. The cumulative total acreage destroyed in heavily built-up areas by March, 1944, was some 26,000 acres, in 43 principal German towns. Yet this destruction did not have the expected economic consequences. The lack of decisive effect was due primarily to the fact that the direct loss imposed could be absorbed by non-essential German productive resources. The indirect effects fell on industries able to bear the burden. An area raid drove down production by as much as 55% in the month immediately following an attack, but recovery was rapid. Direct production loss resulted principally from absenteeism and damage to plant. Indirect loss lay mainly in replacement and repair of plant, buildings and raw materials, and of houses and their contents. Public utilities were usually repaired and available before the other factors had been overcome, according to the United States Survey. This may have been due to their overriding importance, however, resulting in diversion of effort.

U.S.S.B.S. Area Report

U.S.S.B.S. Overall Report

These attacks had a considerable effect on the German war effort, but the effect was never critical. Contemporary German reports show concern that the air raids were undermining morale. This lowered morale was not reflected in a decrease of war production, however. This is illustrated by the figures for war production in certain important groups provided by Dr. Wagenfuehr:-

Wagenfuehr

Group	Monthly Average Production		
	1942	1943	1944
Panzer	130	330	512
Motor Vehicles	120	138	130
Tractors	124	210	238
Planes	133	216	264
Warships	142	181	162
Ammunition	167	247	297
Weapons	137	74	313

This is sometimes taken as the measure of the failure of the bomber offensive. As the United States Survey points out, however, the attacks had the effect of making Germany call on its economic reserves. "They took up the slack". The proportion of armament production to civilian production rose from 25% in mid-1942 to 42% in mid-1944. Moreover, as the attacks grew in intensity, it became increasingly necessary to divert war effort from the fighting fronts for the protection of the Reich itself. The home anti-aircraft defence forces alone numbered 600,000 in 1943 and 900,000 in 1944, without taking into account A.R.P. workers, fire services, repair gangs and other commitments. The United States Survey calculated that the strength of the artillery provided for the German armies might have been almost doubled if it had not been necessary to provide anti-aircraft guns for the defence of the home front against air attack

Wagenfuehr

"Thunderbolt" page 46.

A few examples from certain target systems or industries will further illustrate the effects achieved during this period. U-boat losses resulting from bombing during the period May 1943 - March 1944 amounted to 25 U-boats

/according

B.B.S.U. Overall Report Page 91.

according to the B.B.S.U. The same source provides a statistical comparison between the actual and potential output of a number of groups of armaments:-

Year and Quarter	Tanks Actual	Tanks Potential	Motor Vehicles Actual	Motor Vehicles Potential	Aircraft Actual	Aircraft Potential	Naval Construction Actual	Naval Construction Potential
1943.3rd,	367	390	166	175	229	233	171	186
" 4th,	411	485	159	170	213	255	156	176
1944.1st,	465	565	173	185	227	280	154	177
" 2nd,	558	631	167	195	300	320	129	141

The conclusion is that "in 1943, air attacks only delayed the armaments programme in four categories of production - aircraft, tanks, motor vehicles and U-boats" - some 5% of potential. The more important effects were reflected in 1944. The head of the power department in the Speer Ministry stated that from March 1943 onwards air attacks caused a decrease in electric power supplies. The closely-laced high-tension net made it possible, however, to switch over to emergency supplies.

Speer Papers No. 93

Ibid. No. 35 (Supplement)

The campaign against the Ruhr provides a good example of the effects of area bombing. Dr. Rohland(1) stated that to the greater part of the population, the mass attacks launched in the spring of 1943 came as a complete surprise. The results "could not be clearly judged because on the one hand no experience about reconstruction facilities was available, and on the other hand, because many of the effects overlapped, as for instance destruction of plants, loss in manhours through destruction of workers' homes, exodus of the population, increase of persons reporting sick, difficulties of communications, etc. To this was added in May, 1943, the destruction of the Moehne Dam which led to a considerable stoppage of production in all spheres of industry. Nor must the psychological effect of the extraordinary success of the enemies' attacks be overlooked".

This dislocation led to the formation of the "Ruhr Staff" by Speer and to the mobilisation of all available forces to prevent the collapse which threatened. In summing up, Dr. Rohland stated that the actual loss of production achieved was in no case proportioned to the destruction. It was his opinion, however, that a concentric and systematic air attack would have achieved, in 1943, a considerably more decisive influence on the war.

Speer Papers No. 35.

Speer said that production in the Ruhr was always endangered when one of the fundamental factors which conditioned it was affected. The first serious threat to production followed the attack on the Dams in May, 1943. The pumping stations were flooded and choked with mud, and the water supply to the mines and blast furnaces was therefore stopped. If the Sorpe Dam had been destroyed instead of the Eder, Ruhr production would have suffered the heaviest blow. Repairs to the Moehne Dam were rushed through in time to catch the autumn rains. The attack gave the Germans "a big scare".

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(1) Head of the Main Committee for the Iron Producing Industry in the Speer Ministry.

Dr. Schrieber[1] said that the vast disruption of the Ruhr water supply caused a serious loss of production in the first few days, but within 8 to 14 days this had been overcome. The attacks on Krupps plant hit the main assembly shops, but in a short time, when the heavy overhead gantries were repaired, it was possible to start work again even though there were no roofs. The serious damage inflicted on the extensive workers' settlement of Krupps was more decisive. It made it very difficult for a time to keep the people together. The same was true of Cologne and other towns in the Ruhr. The raids later in 1943 were more severe. In the winter the gas supply situation was difficult, and very heavy damage was caused to the coking plants and gas mains. This adversely affected the continuous running of heating furnaces, forges, etc.

Zone Handbook No. 5.

By November, 1943, the most severely devastated town in the Ruhr was Remscheid, with 83% of its built up area destroyed. Wuppertal, a city four times the size, came next, 74% destroyed. Most of the other large towns were from 40% to 60% destroyed. Dortmund had 35% of its built-up area damaged in two raids, and a few days after the second attack the town was flooded as a result of the breaching of the Moehne Dam. The direct moral effect of the raids was found to wear off after even a short period of quiet, yet for a time the loyalty of the Ruhr was sorely tested.

Speer Papers No. 80.

One of the effects of this campaign was to stimulate the dispersal of industries to safer locations. Dispersals had already begun in 1942, mainly to east and central Germany. In most cases, production was transferred with all the equipment and mobile labour to a similar factory, - mostly engineering works, - in the evacuation area. A large number of natural caves, particularly in the Saar and Lorraine area, were inspected by factory engineers of the Armaments Industry in the summer of 1943. This was ordered by Speer, so that the caves might be equipped in the same manner as had been done in China during the Japanese advance.[2] Even caves in limestone quarries belonging to blast furnaces and champagne cellars were examined. At that time the Germans had no conception of the extent of destruction which could be caused by bombing. Thus many more underground dispersals were planned than were, in fact, carried out. Only a few were ever constructed or reached full production.

(4) Conclusions

Speer Papers No. 2.

Speer considers that the gradual building-up of the Allied night air offensive contributed to what he describes as its initial failure. The steady increase in the weight of attacks served as a "training" for the Germans, both as regards defence methods, A.R.P. and repair organisation. The civilian population also got hardened to the raids in a gradual way. "Shock effects" were produced by the first thousand bomber raid on Cologne, and especially by the series of attacks on Hamburg in the summer of 1943. After the latter attacks, Speer had voiced the view that if another six German cities were similarly devastated, he would not be able to maintain armaments production. He changed his view, however, when he saw the speed with which Hamburg industry recovered from the attacks, which came as a surprise to him.

(1) Head of the Armament Supply Office in the Speer Ministry.

(2) Colonel Preu, in charge of this work, had spent more than a year at Chiang Kai Shek's headquarters.

The purpose of the night attacks directed exclusively against city centres had been incomprehensible to Speer; their effects on industry were very slight. He considers that area bombing alone would never have been a serious threat. He emphasises that civilian morale was excellent throughout, and resulted in rapid resumption of work after attacks. He admits, however, that after a series of attacks like that on Berlin in autumn, 1943, fatigue effects made their appearance and labour discipline began to flag.

U.S.S.B.S. Overall Report

The United States Bombing Survey records a report from Munich, during March 1944, that "Morale has reached a low point never before observed since the beginning of the war". Criminal behaviour was most conspicuous in the largest and most heavily-bombed cities. "Bombing thus succeeded in lowering psychological morale but its effect upon behaviour was less decisive". The effect upon morale was cumulative, and was felt principally after mid-1944.

A brief assessment as to what generally the strategic bomber offensive had achieved by the spring of 1944, was given in the Thunderbolt exercise:-(1)

> "Above all, it resulted in a state of favourable superiority in the European theatre generally, without which Overlord could not succeed. It had thrown Germany completely on the defensive in the air. She had heavily reduced her bomber production in order that maximum resources could be devoted to fighters and defensive equipment. Her fighters and flak were deployed not on the critical battle fronts, or to oppose a possible landing, but they were spreadeagled throughout Germany in a vain attempt to defend vital targets at home. Nearly three quarters of a million men were tied down to these defences and probably a greater number were engaged on A.R.P. and repair work. To crown all, a great many of the German industrial centres were in ruins and seriously disorganised".

U.S.S.B.S. Overall Report Page 9.

The United States Bombing Survey adds to this claim that, "In the fierce battles over Germany in the early months of 1944, the air war was won. It was not finished, but its outcome was no longer in doubt".

Air superiority had been won, and complete freedom of movement was assured to the allied forces and denied to the enemy.(2)

B.B.S.U. Overall Report

This review has concentrated on the positive achievements of the Combined Bomber Offensive. Only in a broad review of the war as a whole is it possible to assess the contribution of the bomber forces. The British Bombing Survey concludes that the air offensives of this period failed in their objective. It is wise not to be dazzled by the overwhelming scale of attack in the final months of the war, however. The operational limitations and the defects of economic intelligence during this period must be borne in mind. The /attack upon

(1) By Air Chief Marshal Sir Norman Bottomley, formerly Deputy Chief of the Air Staff.

(2) Air Marshall Sir James Robb at Thunderbolt, page 73.

attack upon industrial areas, if those areas had contained the vital industries they were reported to contain, might have been effective. The attack upon the aircraft industry, if the industry had not been capable of rapid expansion, would certainly have been effective. Both these offensives played their part in absorbing German resources and in geographically dispersing production, thus preparing the ground for the final overwhelming assault of 1944/1945.

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THE STRUCTURE OF BOMBERS COMMAND IN 1943

CHAPTER I - PLANNED EXPANSION

(1) Expansion Policy

Under conditions of mass production it takes some two years for plans to result in planes, and the same period is required to turn raw recruits into operational aircrew or qualified technical staff. So the decisions made in 1941 produced the bombing effort we have to consider in 1943. These have been dealt with in earlier volumes, so a summary will suffice.

W.P.(40)352
C.O.S.(40)683
W.P.(41)69

Between the time that France fell and Russia and America came into the war, the bomber force appeared to be the only hope of victory for the British Empire. The total manpower available would not allow the maintenance of an army on the continental scale in addition to a huge navy and mercantile marine, a large air force and the vast industrial backing needed to maintain them. Therefore, the decision was made to give priority to the bomber force. The provision of a front-line strength of 1,600 heavy bombers by the summer of 1942 was approved. This was increased to 4,000 when Lend/Lease began, with all the resources of American production to draw upon.(1)

A.D.I.(K) 12/46(K.92)

The entry of Russia into the war on 22nd June, 1941, relieved Great Britain of the main weight of the German bombing effort, since only one Geschweder was left in the West. The aircraft industry and training programme, were, therefore, less delayed. This was offset, however, by the diversion of both American and British aircraft to supply Russia. The entry of America in December, 1941, meant a still greater loss of aircraft supplies. The American President laid down the principle that "all possible American aircraft should be manned by American crews".

By 1942, therefore, Target Force "E" was found to be far too optimistic owing to the shortage of aircraft. In addition, a landing on the continent was once more a practical proposition with the aid of America.

C.W.E./E/35 31.6.42.

Target Force "F", in June, 1942, made a redistribution of the strength of the Royal Air Force to the detriment of Bomber Command, and to the benefit of fighters and the Tactical Air Force. It also instituted a strategic reserve, designed to be available where required. 2,600 heavy bombers was the force approved under this target. As a result of the serious loss of supplies from America, as well as production difficulties at home, it was soon found that this was still too optimistic.

E.R.P.203
C.W.E/E/40
A.C/13(42)
19/8/42

Target Force "G", approved by the E.R.P. Committee in July, 1942, aimed at an increased proportion of new and better types of aircraft to compensate for the reduced expansion. A total of 2,500 front-line bombers was now aimed at, providing 125 heavy bomber squadrons for Bomber Command, by December, 1943. This force was planned on a strategic basis, taking into account the United States forces /expected

(1) Target Force "E" - May, 1941.

expected to be available in England, and not adhering closely to expected production of aircraft, although it was more realistic than previous target forces. A.M.S.O's estimate was 84 Heavy and 19 Medium Squadrons by December, 1943.

Loose Minute M.378/2 17/9/42

In September, 1942, the Prime Minister, being disappointed with the failure to realise successive target figures, demanded that there should be 50 fully operational Heavy and Medium Squadrons by the end of the year. To comply with the Prime Minister's demand, various short term measures, including drawing on aircraft reserves, had to be taken at the expense of the long term plan. By these means a total of 51 Squadrons was attained by the end of the year, but only 44 of these were fully operational. The rest were delayed by lack of aircraft or training. A strength equivalent to 53 operational Squadrons was, however, attained in February, 1943, by the date at which this narrative opens, as a result of this Fifty Squadron Plan.

M.66/3 Feb. 1943.

The plan was regarded as a failure by the Prime Minister. In a minute to the S. of S. he said:-

> "No doubt there are always very good reasons for failure, but I am surprised to note among them the Fifty Squadron Plan. Considering what sacrifices were made for it in other directions, one had hoped for a large and substantial expansion, as promised, from the end of the year".

Although the plan was not achieved by the date called for, it yet served a useful purpose. It drew renewed attention to the importance of Bomber Command expansion and, by the screening of the Command from the innumerable outside demands habitually made upon it, it achieved an immediate increase in striking power, fully effective by February, 1943.

(2) The Manpower Crisis and Target Force "H"

M.377/2 17.9.42.

The serious shortage of manpower in the United Kingdom which made itself felt during 1942 resulted in drastic cuts in the expansion programme. By April 1942 the proportion of the total adult population in the Services and Munitions was already higher than at the peak of the first World War. And in September, the Prime Minister called for drastic cuts in the estimates of all the Services. The manpower required had been secured up to this time by a system of competition between the Services and Industry. A "Committee on Manpower" was now set up under the Lord President to allocate it between them. Only half their total demands could be met.

W.P.(42)539 20.11.42.

A.C.28(43) 9.4.43.

The Air Council during September and October, 1942 accepted Target Force "G" as a basis for administrative planning up to June, 1943. It became evident by the end of the year, however, that further expansion was to be severely limited by shortage of manpower. Heavy reductions were made in the manpower allocations both to Air Ministry and the Ministry of Aircraft Production. The latter produced a new aircraft programme on 1st January, 1943, and a new agreement for the supply of American aircraft, the Arnold Evill agreement in December 1942 replaced the Arnold-Towers-Portal agreement of June 1942. In these

/circumstances

E.R.P.235
29.12.42
C.W.E./E/47.

circumstances it was necessary to prepare a new programme, and Target Force "H" was drafted. This represented an attempt to reconcile strategical requirements as nearly as possible with the numbers of aircraft and personnel likely to be available.

Ops 1 Folder 84.

A.C 29(43) in S.6. Folder 118A.

The aircraft position was now the principal limiting factor. Owing to the new manpower cuts the aircraft industry could not maintain the supplies promised, which were already below requirements. The construction of aerodromes at this time was ahead of schedule. The supply of trained aircrew was now adequate, apart from the bottle-neck at the O.T.U. stage owing to shortage of aircraft. And the A.M.P. and A.M.S.O. estimated that the deficiency in trained airmen and airwomen could be prevented from affecting the operational output, by cutting down personnel in trades such as domestic, police and defence in favour of the technical trades.

The new Expansion Programme based upon Target Force "H" was finally approved by the Air Council on 13th April, 1943.(1) According to this programme 39 additional heavy and medium bomber squadrons were due to form in Bomber Command during 1943. In addition, a very large expansion was expected in the heavy bomber groups of the United States Eighth Air Force.

(3) The Limit of Expansion

In July, 1943, Target Force "H" was revised slightly in order to economise in ground personnel whilst maintaining expansion. The establishment of Bomber Command squadrons was increased from a Unit Equipment of 18 to 20 aircraft per squadron. Shortly after this, Bomber Command requested the abolition of medium bombers in front-line squadrons in favour of heavies. These two measures represented the culminating effort for the expansion of the bomb-carrying capacity of Bomber Command.

/On 23rd September,

C.W.E/E/47
25/3/43.

(1) The details of the bomber force planned were as follows:-

Class	Establishment	1943			1944				1945
		Jun.	Sep.	Dec.	Mar.	Jun.	Sep.	Dec.	Mar.
Heavy Bomber	16 + 2								
Halifax		23	24	31	32	33	35	35	35
Lancaster		22	27	34	41	42	46	55	58
Stirling		13	13	17	17	17	16	16	16
Total		58	64	82	90	92	97	106	109
Medium Bomber	16 + 2	12	12	12	15	15	16	19	16
Total		70	76	94	105	107	113	125	125

M.P.C.(43)
7th Meeting.

On 23rd September, 1943, the Minister of Labour outlined the manpower situation, pointing out that commitments were now so vast that a vital decision must be faced. An assumption had to be made as to when the war was likely to end, so that the flow of manpower to the training organisation might be stopped, and the organisation itself progressively rolled up. Only by such a decision could the planned expansion be maintained into 1944 and early 1945. As the Prime Minister pointed out, the country's total manpower could not be increased. In fact it was already dwindling. "All that could be done was to make within that total such changes as the strategy of the war demanded".

W.P.43(490)
1.11.43.

There were two broad alternative assumptions which could be made about the duration of the war:-

(a) That the maximum effort had to be made in 1944 and that Germany would be defeated at the end of that year. On this assumption there could be a great saving in munitions and trained men as well as a substantial cut in the training and ancillary organisations.

(b) That the war with Germany would continue well beyond the end of 1944. In that event the fact would have to be faced that the Forces and munitions industries had been built up to levels which it was impossible to maintain over a prolonged period. Planning would have to commence immediately for a progressive reduction in the scale of the war effort.

M.P.43(1)
8.11.43.

The Prime Minister favoured alternative (a), and a Cabinet Committee was set up to examine its implications. Manpower demands were to be worked out on this assumption. The R.A.F. requirements were cut from 107,000 men and women to a possible 70,000. The Air Council were therefore faced with three possible courses.

A.C.79(43)
29.11.43.

(i) To proceed with the expansion programme, on the assumption that war would continue indefinitely. This would involve a deficiency of 37,000 at the end of 1944, approximately 3% of establishment.

(ii) To cut the expansion programme so as to eliminate this deficiency without any contraction of the training organisation.

(iii) To proceed with the expansion programme as planned until the Autumn of 1945, at the same time reducing the training organisation so that by that date the numbers of aircrew completing their training would be no more than required for the Japanese war.

M.17(43)
7.12.43.

It was felt there was little likelihood of the war with Germany extending into 1946, so the third course was decided upon. The effect of a reduction in the training organisation would not be felt for 18 months.

W.P.44(58)
Jan.1944.

In January, 1944, the Cabinet Committee which had been appointed the previous July to enquire into R.A.F. establishments issued its report. This did not confirm the Prime Ministers unfavourable impression of the waste of manpower in the R.A.F. They found that over

/25%

25% of the strength of the R.A.F. in the United Kingdom were employed on the servicing and repair of aircraft and equipment. 3070 man-hours per month were spent on the maintenance of a heavy bomber.

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CHAPTER 2

THE PROGRESS OF EXPANSION

(1) Composition, February, 1943

When this period opens, in February, 1943, Bomber Command had reached a strength of 51 operational squadrons of heavy and medium bombers, and 11 of light bombers. This force was composed of the following types of aircraft.

S.84814
Encl.35B

Heavy	-	Lancaster	17 Squadrons
		Halifax	11 "
		Stirling	7 "
Medium	-	Wellington	16 "
Total Heavy and Medium			51 Squadrons
Light	-	Ventura	3 Squadrons
		Boston (A20)	3 "
		Mitchell (B25)	2 "
		Mosquito	3 "
Total Light			11 Squadrons

The normal unit equipment of a squadron was 18 aircraft (16.I.E. + 2.I.R.). Six heavy squadrons, however, had three flights with a unit equipment of 27 aircraft, one squadron (No.115) had only one operational flight, and the three Polish Wellington squadrons were under strength, and were normally reckoned as equivalent to only two. The operational strength in heavy and medium bombers was therefore equivalent to 52½ standard squadrons, the total unit equipment being 954 aircraft (excluding non-operational flights).

Ibid
Encl.278

The light bombers of No. 2 Group were about to be re-organised, the intention being to have 6 Mitchell, 5 Boston and 4 Mosquito squadrons. The Ventura squadrons were to re-equip with Mitchells as soon as aircraft were available. One of the Mosquito squadrons, No. 109, which had been attached to the Pathfinder Force since its inception, was now incorporated in No. 8 (P.F.F.) Group.

The detailed composition of Bomber Command on 18th February 1943, is shown in Table I, and changes after this date are examined below.

TABLE I. ORDER OF BATTLE

(1) OPERATIONAL SQUADRONS - 18TH FEBRUARY, 1943

Unit Opl.	Unit Non-Opl.	Location	Aircraft I.E.+ I.R.	Aircraft Type	Aircraft On Unit Charge	Remarks
No. 1 Group		**Bawtry**				
12		Wickenby	16 + 2	LANCASTER	20	
				Wellington II		
101		Holme	16 + 2	LANCASTER	17	
103		Elsham Wolds	16 + 2	LANCASTER	17	
				Halifax	1	
460 (RAAF)		Breighton	16 + 2	LANCASTER	21	
166		Kirmington	16 + 2	WELLINGTON III	19	
199		Ingham	16 + 2	WELLINGTON III	17	
				" X	3	
300 (Pol)		Hemswell	16 + 2	WELLINGTON III	8	The three
				" X	2	POLISH
301 (Pol)		Hemswell	16 + 2	WELLINGTON IV	14	Sqnds. are
305 (Pol)		Hemswell	16 + 2	WELLINGTON IV	10	operating
						to 10+ 2
						estab't.
	100	Grimsby	16 + 2	LANCASTER	20	Forming
No. 2 Group		**Huntingdon**				
88(a)(c)		Oulton	16 + 2	BOSTON III(A.20)	17	
107(a)		Gt.Massingham	16 + 2	BOSTON III(A.20)	16	
226(a)		Swanton Morley	16 + 2	BOSTON III(A.20)	18	
105		Marham	16 + 2	MOSQUITO	20	
139		Marham	16 + 2	MOSQUITO	20	
				Blenheim V	13	
21		Methwold	16 + 2	VENTURA (B.34)	20	
464 (RAAF)		Feltwell	16 + 2	VENTURA (B.34)	22	
487 (RNZAF)		Feltwell	16 + 2	VENTURA (B.34)	20	
98		Foulsham	16 + 2	MITCHELL (B.25)	19	
180		Foulsham	16 + 2	MITCHELL (B.25)	20	
No. 3 Group		**Exning**				
15(b)		Bourn	24 + 3	STIRLING	22	
75(N.Z.)		Newmarket	16 + 2	STIRLING	17	
90		Ridgewell	16 + 2	STIRLING	15	
149(b)		Lakenheath	16 + 2	STIRLING	19	
214(b)		Chedburgh	16 + 2	STIRLING	15	
218		Downham Market	24 + 3	STIRLING	20	
115(½)	115(½)	Ridgewell	16 + 2	LANCASTER	2	Re-equipping.
		East Wretham		Wellington	15	One Flt.Opl. on Wellington.

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(a) Squadrons trained in use of gas spray

(b) Squadrons trained for gas bombing - Authority S.4392/A.C.A.S.Ops/26/11/42

(c) Earmarked for reinforcement of Northern Ireland on Alert No. 1 or at the request of the War Office.

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TABLE 1

Unit Opl.	Unit Non-Opl.	Location	Aircraft I.E.+ I.R.	Aircraft Type	Aircraft On Unit Charge	Remarks
No. 3 Group (Contd.)						
		Exning				
138 (Special)		Tempsford	15 + 2	HALIFAX	18	These Sqdns. are under the control of A.C.A.S.(I)
161 (Special)		Tempsford	7 + 0	LYSANDER	9	
			5 + 0	HALIFAX	5	
			1 + 0	HUDSON	1	
			2 + 0	HAVOC	2	(Det.on loan
			2 + 0	(ALBERMARLE (HUDSON	2	(to C.C.at (ST. EVAL
192 (Special)		Gransden Lodge	1 + 0	HALIFAX	2	
			8 + 3	WELLINGTON X	12	
			3 + 0	MOSQUITO	3	
				WELLINGTON IC	2	
No. 4 Group		York				
10		Melbourne	16 + 2	HALIFAX	23	
51		Snaith	24 + 3	HALIFAX	25	
				Whitley	2	
76		Linton-on-Ouse	16 + 2	HALIFAX	21	
77		Elvington	16 + 2	HALIFAX	20	
				Whitley	1	
78		Linton-on-Ouse	16 + 2	HALIFAX	19	
102		Pocklington	16 + 2	HALIFAX	17	
158		Rufforth	24 + 3	HALIFAX	25	
				Wellington II	1	
196		Leconfield	16 + 2	WELLINGTON X	17	
429 (RCAF)		East Moor	16 + 2	(WELLINGTON III	12	
				(" X	4	
466 (RAAF)		Leconfield	16 + 2	WELLINGTON X	15	
	431 (RCAF)	Burn	16 + 2	WELLINGTON X	20	
No. 5 Group		Grantham				
9		Waddington	16 + 2	LANCASTER	17	
44 (RHOD)		Waddington	16 + 2	LANCASTER	19	
49		Fiskerton	16 + 2	LANCASTER	18	
50		Skellingthorpe	16 + 2	LANCASTER	17	
57		Scampton	16 + 2	LANCASTER	19	
61		Syerston	16 + 2	LANCASTER	19	
97		Woodhall Spa	16 + 2	LANCASTER	20	
106		Syerston	16 + 2	LANCASTER	21	
207		Langar	16 + 2	LANCASTER	23	
467 (RAAF)		Bottesford	16 + 2	LANCASTER	19	

/No. 6 Group

Unit Opl.	Unit Non.Opl.	Location	Aircraft I.E.+ I.R.	Aircraft Type	Aircraft On Unit Charge	Remarks
No. 6 Group		Allerton				
R.C.A.F.						
405		Beaulieu	16 + 2	HALIFAX	20	Temporarily detached to Coastal Command
408		Leeming	16 + 2	HALIFAX	18	
419		Middleton St. George	16 + 2	HALIFAX	20	
420		Middleton St. George	16 + 2	WELLINGTON III " X	14 1	
424		Topcliffe	16 + 2	WELLINGTON III " X	16 1	
425		Dishforth	16 + 2	WELLINGTON III	21	
426		Dishforth	16 + 2	WELLINGTON III " X	19 1	
427		Croft	16 + 2	WELLINGTON III " X	15 2	
428		Dalton	16 + 2	WELLINGTON III Wellington X	14 6	
No. 8 P.F.F. Group		Wyton				
7		Oakington	24 + 3	STIRLING	24	Lodger unit on 3 Grp. Station
35		Gravely	24 + 3	HALIFAX	27	
83		Wyton	16 + 2	LANCASTER	21	
156		Warboys	16 + 2	LANCASTER Wellington III	21 3	
109		Wyton	18 + 3	MOSQUITO Wellington 1C	22 1	Including training. Flt. of 2 + 1 Mosquito

TRAINING UNITS, 18th February, 1943

No. 1 Group		Bawtry				
1520 B.A.T. Flight		Holme	6 + 2	OXFORD	8	
1481 (Bomber) G.F.		Lindholme	6 + 0	WHITLEY	6	
				Lysander	5	
			6 + 0	DEFIANT	2	
			1 + 0	TIGER MOTH	1	
			7 + 3	MARTINET	11	
1503 B.A.T. Flight		Lindholme	4 + 1	OXFORD	5	
1656 Conversion Unit		Lindholme	12 + 0	LANCASTER	17	
				Manchester	5	
			20 + 0	HALIFAX	21	
Air Bomber Training Flight		Lindholme	6 + 2	OXFORD	8	
1662 Conversion Unit		Blyton	12 + 0	LANCASTER	10	
			20 + 0	HALIFAX MANCHESTER	- -	

ANNEX
SECRET

TABLE 1

Unit	Location	Aircraft I.E.+ I.R.	Aircraft Type	Aircraft On Unit Charge	Remarks
No. 2 Group	Huntingdon				
1508 B.A.T. Flight	Horsham St. Faith	4 + 1	OXFORD	7	
1515 " "	Swanton Morley	6 + 2	OXFORD	8	
1519 " "	Feltwell	6 + 2	OXFORD	9	
		2 + 1	MITCHELL		
1482 (Bomber) G.F.	West Raynham	1 + 0	TIGER MOTH	1	
		6 + 2	MARTINET	4	
		3 + 1	VENTURA	4	
			Defiant	3	
			Blenheim	2	
			Lysander	6	
1655 Training Unit	Marham	4 + 2	BLENHEIM	5	
		6 + 3	MOSQUITO	10	
No. 3 Group	Exning				Detachments are attached to No. 3 Grp.. Squadrons
1504 B.A.T. Flight	Exning	4 + 1	OXFORD	6	
1521 " "	Stradishall	6 + 2	OXFORD	7	
1483 (Bomber) G.F.	Marham	2 + 0	DEFIANT	3	Lodger Units on a No. 2 Group Station
		1 + 0	TIGER MOTH	1	
		8 + 0	WELLINGTON	11	
		7 + 3	MARTINET	7	
			Lysander	5	
Air Bomber Training Flight	Marham	6 + 2	OXFORD	8	
1657 Conversion Unit	Stradishall	32 + 0	STIRLING	27	
1651 " "	Waterbeach	32 + 0	STIRLING	33	
1 B.D.U.	Gransden Lodge	3 + 0	WELLINGTON	4	
		4 + 0	HALIFAX	4	
		1 + 1	LANCASTER	1	
		1 + 1	STIRLING	1	
		1 + 0	PROCTOR	1	
No. 4 Group	York				
1502 B.A.T. Flight	Driffield	4 + 1	OXFORD	5	
1484 (Bomber) G.F.	Driffield	5 + 0	WHITLEY	5	
		8 + 0	DEFIANT	12	
			Lysander	3	
		1 + 0	TIGER MOTH	1	
		7 + 3	MARTINET	9	
Air Bomber Training Flight	Driffield	6 + 2	OXFORD	9	
1652 Conversion Unit	Marston Moor	32 + 0	HALIFAX	33	
1658 " "	Riccall	32 + 0	HALIFAX	32	
1663 " "	Rufforth	32 + 0	HALIFAX	-	Forming

/No. 5 Group

Unit	Location	Aircraft I.E. + I.R.	Type	On Unit Charge	Remarks
No. 5 Group	Grantham				
1506 B.A.T. Flight	Waddington	6 + 2	OXFORD	8	
" "	Coningsby	6 + 2	OXFORD	9	
1518 " "	Dunholme Lodge	6 + 2	OXFORD	8	
1485 (Bomber) G.F.	Fulbeck	4 + 0	DEFIANT	4	
		8 + 0	MANCHESTER	7	
		1 + 0	TIGER MOTH	11	
		6 + 2	MARTINET	6	
			Lysander	1	
Air Bomber Training Flight	Fulbeck	6 + 2	OXFORD	8	
1654 Conversion Unit	Wigsley	12 + 0	LANCASTER	16	
		20 + 0	(MANCHESTER	19	
			(HALIFAX	-	
1660 Conversion Unit	Swinderby	12 + 0	LANCASTER	16	
		20 + 0	(MANCHESTER	18	
			(HALIFAX	12	
1661 Conversion Unit	Winthorpe	12 + 0	LANCASTER	16	
		20 + 0	(MANCHESTER	14	
			(HALIFAX	-	
No. 6 Group	Allerton				
1512 B.A.T. Flight	Dishforth	6 + 2	OXFORD	9	
1505 " "	Middleton St. George	6 + 2	OXFORD	8	
1659 Conversion Unit	Leeming	32 + 0	HALIFAX	23	
No. 91 Group	Abingdon				
10 O.T.U.	Abingdon	8 + 2	ANSON	11	
		40 + 14	WHITLEY	58	
		1 + 0	DEFIANT	1	
		4 + 1	LYSANDER	3	
Special Flight	Abingdon	20 + 6	WHITLEY	34	
		1 + 0	LEOPARD MOTH	-	
15 O.T.U.	Harwell	40 +14	WELLINGTON	53	
		1 + 0	DEFIANT	1	
		4 + 1	LYSANDER	3	
19 O.T.U.	Kinloss	40 + 14	WHITLEY	57	
		8 + 2	ANSON	15	
		1 + 0	DEFIANT	1	
		4 + 1	LYSANDER	2	
20 O.T.U.	Lossiemouth	40 + 14	WELLINGTON	53	
		1 + 0	DEFIANT	1	
		4 + 1	LYSANDER	2	
			Anson	4	
21 O.T.U.	Moreton-in-the Marsh	12 + 4	ANSON	17	
		40 + 14	WELLINGTON	53	
		1 + 0	DEFIANT	1	
		4 + 1	LYSANDER	3	
22 O.T.U.	Wellesbourne Mountford	40 + 14	WELLINGTON	47	
		1 + 0	DEFIANT	1	
		4 + 1	LYSANDER	3	

/23 O.T.U.

ANNEX
SECRET
TABLE 1

Unit	Location	Aircraft I.E.+.I.R.	Type	On Unit Charge	Remarks
No. 91 Group (Cont'd)	Abingdon				
23 O.T.U.	Pershore	40 + 14	WELLINGTON	59	
		1 + 0	DEFIANT	1	
		4 + 1	LYSANDER	3	
24 O.T.U.	Honeybourne	40 + 14	WHITLEY	54	
		8 + 2	ANSON	10	
		1 + 0	DEFIANT	1	
		4 + 1	LYSANDER	2	
1501 B.A.T. Flight	Abingdon	4 + 1	OXFORD	6	
1516 " "	Hampstead Norris	6 + 2	OXFORD	8	- To move to
1443 Flight	Harwell	2 + 0	WELLINGTON	1	UPPER
			Anson	2	HEYFORD
1446 F.T. Flight	Moreton-in-the-Marsh	2 + 0	WELLINGTON		w.e.f. 23/2/43
No. 92 Group	Winslow Hall				
11 O.T.U.	Westcott	40 + 14	WELLINGTON	50	
		1 + 0	DEFIANT	1	
		4 + 1	LYSANDER	3	
			Anson	2	
12 O.T.U.	Chipping Warden	40 + 14	WELLINGTON	54	
		1 + 0	DEFIANT	2	
		4 + 1	LYSANDER	3	
			Anson	2	
13 O.T.U.	Bicester	36 + 12	BLENHEIM	46	
		1 + 0	DEFIANT	1	
		4 + 1	LYSANDER	-	
		8 + 2	ANSON	9	
			Albemarle	1	
14 O.T.U.	Cottesmore	40 + 14	WELLINGTON	51	
		1 + 0	Defiant	1	
		4 + 1	LYSANDER	2	
			Anson	4	
16 O.T.U.	Upper Heyford	40 + 14	WELLINGTON	58	
		1 + 0	DEFIANT	2	
		4 + 1	LYSANDER	2	
			Anson	4	
17 O.T.U.	Upwood	18 + 6	BLENHEIM	33	Detachment
		4 + 1	ANSON	5	STEEPLE
					MORDEN
		1 + 0	DEFIANT	1	
		4 + 1	LYSANDER	2	
26 O.T.U.	Wing	40 + 14	WELLINGTON	57	
		1 + 0	DEFIANT	1	
		4 + 1	LYSANDER	2	
			Anson	5	
29 O.T.U.	North Luffenham	40 + 14	WELLINGTON	49	Detachment
		1 + 0	DEFIANT	1	at
		4 + 1	LYSANDER	2	Brunting-
			Anson 3		thorpe

/307 F.T.U.

Unit	Location	Aircraft I.E.+ I.R.	Type	On Unit Charge	Remarks
No. 92 Group (Cont'd)	Winslow Hall				
307 F.T.U.	Bicester	7 + 0	BLENHEIM	8	
1505 B.A.T. Flight			Oxford	5	Disbanded
1511 " "	Upwood	6 + 2	OXFORD	8	
1517 " "	Chipping Warden	6 + 2	OXFORD	8	
1473 Flight	Finmere	1 + 0	LEOPARD MOTH	1	
		3 + 1	WELLINGTON	4	
		6 + 2	ANSON	6	
			Whitley	1	
Flight	Bicester	4 + 0	ANSON	4	
		2 + 0	MASTER	2	
			Oxford	3	
E. D.U.	Westcott	3 + 0	WELLINGTON	4	
No. 93 Group	Egginton Hall				
18 O.T.U. (Polish)	Bramcote	20 + 7	WELLINGTON	37	Detachment at
		1 + 0	DEFIANT	-	Finningley
		4 + 1	LYSANDER	3	
25 O.T.U. (Polish)			Wellington	1	Disbanded
			Lysander	1	
27 O.T.U. (Polish)	Lichfield	40 + 14	WELLINGTON	55	
		4 + 1	LYSANDER	4	
		1 + 0	DEFIANT	2	
			Anson	2	
			Albermarle	2	
28 O.T.U. (Polish)	Wymeswold	40 + 14	WELLINGTON	56	
		1 + 0	DEFIANT	1	
		4 + 1	LYSANDER	2	
30 O.T.U. (Polish)	Hixon	40 + 14	WELLINGTON	63	
		1 + 0	DEFIANT	1	
		4 + 1	LYSANDER	3	
81 O.T.U. "	Whitchurch Heath	30 + 10	WHITLEY	46	
		1 + 0	DEFIANT	1	
		6 + 2	ANSON	8	
		4 + 1	LYSANDER	5	
1507 B.A.T. Flight	Finningley	4 + 1	OXFORD	5	
1513 " "	Bramcote	6 + 2	OXFORD	8	

/(2) Light

(2) Light Bombers

S.5714
Encl.151A

The future policy regarding No. 2, the light bomber Group, was uncertain at the beginning of this period. It had been decided, however, to re-equip the squadrons, and this was begun in March, 1943. The last Blenheim squadron had just re-equipped with Mosquitoes, and the Ventura was now to be abandoned in favour of the Mitchell. There were at this time 10 squadrons in No. 2 Group, and one Mosquito squadron in No. 8 (P.F.F.) Group. A Dutch squadron, No. 320, was transferred from Coastal Command, and re-equipped with Mitchells, in March and a French squadron, No. 342 (Lorraine) Squadron, was formed on Bostons in April. The supply of Boston aircraft did not permit of its earlier formation.

S.84814
Encl.69A

It was finally decided to transfer No. 2 Group to Fighter Command for inclusion in the Tactical Air Force. The two Mosquito squadrons, Nos. 105 and 139, were retained, and transferred to No. 8 (P.F.F.) Group. No. 2 Group was transferred with the remainder of its squadrons on 1st June, 1943. Its history from that date onwards belongs to the story of the Tactical Air Force.(1)

(3) Heavy and Medium Bombers, February - August, 1943

The outcome of the Prime Minister's "50 - Squadron Plan" for the short-term expansion of Bomber Command has been shown. The equivalent of 52½ squadrons of heavy and medium bombers were operational by mid February, 1943. After this, expansion continued as aircraft became available, since the aircrew position was not unsatisfactory. The method adopted as a rule was to add a third flight to a squadron, and then break it off to form a new squadron on the same airfield. This enabled the build-up to be carried out in easy stages.

Six squadrons had been expanded to three flights by mid February:-

Nos. 15 and 218 (Stirling) in No. 3 Group
Nos. 51 and 158 (Halifax) in No. 4 Group
Nos. 7 (Stirling) and 35 (Halifax) in No. 8 (P.F.F.) Group.

During the next six months the Command was expanded by three means:-

(a) The addition of third flight

(b) The formation of new squadrons

S.84814
Encl.35B
II/H1/27

(c) An increase in aircraft and aircrew establishment

Third flights were added to the following squadrons by May:-

Group	Squadron	Type
1	101,103,460,12,100	Lancaster
3	75,90,149,214	Stirling
4	10,76,77,78,102	Halifax
5	57, 467	Lancaster
8	97, 156	Lancaster

/Meanwhile

(1) See A.H.B. Monograph "Tactical Air Support"

L.M.2654/D. of O. 7.10.42

S.5714 Encl.152A Ibid. Encl.159A

Meanwhile No. 115 was still operating at half-strength on Wellingtons, although established at 18 u.e. Lancasters. The three Polish squadrons in No. 1 Group were re-organized. They had been under strength, operating at 12 u.e. Wellingtons. No. 300 Squadron was now brought up to full strength, No. 301 was withdrawn and placed on a "number only" basis, and it was decided to re-equip No. 305 with Mosquitoes. This decision was reversed in April and No. 305 remained on Wellingtons at half strength (9 U.E.).

S.84814 Encls.44A, 52A, 58A.

Three new squadrons were formed by mid May:-

Nos. 617 and 619 (Lancaster) in No. 5 Group. (No. 617 was formed for special attacks on the Mohne, Eder and Sorpe Dams).
No. 432 (R.C.A.F.) (Wellington X) in No. 6 Group.

O.R.B. App. A.O.A.Conf. 21.4.43

This was countered, however, by the loss of three Wellington Squadrons, Nos. 420, 424 and 425, which were despatched overseas in May.

L.M.986/ D. of O. 8.4.43

The Air Ministry agreed in April to a proposal which Bomber Command had been pressing for some time: that the establishment of heavy and medium squadrons should be increased as follows:-

Two-flight Squadrons -

Aircraft - from 16 + 2 to 16 + 4
Aircrew - from 21 to 22 (+ C.O.)

Three-flight Squadrons

Aircraft - from 24 + 3 to 24 + 6
Aircrew - from 32 to 33 (+ C.O.)

with corresponding increases in Maintenance personnel. This increase was to be put into effect gradually, as supplies became available.

S.84814 File

The only expansion in the period May to August was the formation of four new squadrons. Two new Canadian squadrons, Nos. 433 and 434, should have formed on Wellingtons and Halifaxes respectively, in No. 6 (R.C.A.F.) Group in June, but No. 433 was postponed until September. The third flights of Nos. 149 and 214 Squadrons were consolidated into a new squadron, No. 620, on Stirlings in No. 3 Group in the same month. In early August Nos. 622 and 623 Stirling Squadrons were formed from the third flights of Nos. 15 and 218 Squadrons, respectively, in No. 3 Group.

A number of squadrons were authorised to increase their unit equipment to the new scale approved in April, and several were re-equipped from Wellingtons to Heavy Bombers. These changes can be seen by reference to the Order of Battle for mid August given in Table 2.

/Table 2

ANNEX
SECRET

TABLE II. ORDER OF BATTLE

OPERATIONAL SQUADRONS - 19TH AUGUST, 1943

Unit		Location	Aircraft				Remarks
Opl.	Non-Opl.		I.E.	I.R.	Type	On Unit Charge	
No. 1 Group. Bawtry							
Binbrook Base. (25.4.43)							
460	(RAAF)	Binbrook	24	3	Lancaster I & III	27	
12		Wickenby	"	"	"	23	
100		Grimsby	"	"	"	25	
103		Elsham Wolds	"	"	"	26	
101		Ludford Magna	"	"	"	23	
166		Kirmington	16	2	Wellington X	17	
300	(Polish)	Ingham	16	2	"	20	
	305 "	"	8	1	"	-	Withdrawn to be transferred to TAF w.e.f. 15.9.43
No. 3 Group. Exning							
Mildenhall Base. (1.3.43)							
15		Mildenhall	24	6	Stirling	20	
622(½)	622(½)	"	16	4	"	9	
149		Lakenheath	16	4	"	20	
199		"	16	4	"	20	
115		Newmarket	16	4	Lancaster	19	
Stradishall Base. (13.4.43)							
90		Wratting Common	16	4	Stirling	30	
214		Chedburgh	16	4	Stirling	17	
620		"	16	4	"	19	
218		Downham Market	16	4	"	23	
623½	623(½)	" "	16	4	"	12	
	196	Witchford	16	4	"	20	Re-equipping
					Wellington X	2	
75	(N.Z)	Mepal	24	6	Stirling	30	
138	(Special Duty)	Tempsford	13	2	Halifax II & V	15	These squadrons are under the control of A.C.A.S.(I)
			3	0	Liberator	-	
161	" "	"	7	3	Lysander	10	
			6	0	Halifax V	7	
			4	0	Hudson	3	
					Havoc	2	
192	" "	Feltwell	7	2	Wellington X	9	
			2	0	Mosquito IV	2	
			2	0	Halifax V	2	

/No. 4 Group, York

G.225497/DEW/11/49.

Unit Opl.	Unit Non-Opl.	Location	Aircraft I.E	Aircraft I.R.	Aircraft Type	Aircraft On Unit Charge	Remarks
No. 4 Group. York							
Pocklington Base. (1.3.43)							
102		Pocklington	24	6	Halifax II	27	
10		Melbourne	"	"	" "	"	
77		Elvington	"	"	" "	29	
76		Holme	"	"	Halifax V	29	
78		Breighton	"	"	" "	30	
51		Snaith	"	"	" "	32	
Driffield Base. (4.6.43)							
466	(RAAF)	Leconfield	16	2	Wellington X	19	
196		"	"	"	"	"	
158		Lissett	24	6	Halifax V	34	
No. 5 Group. Grantham							
Scampton Base. (10.5.43)							
57		Scampton	24	3	Lancaster I&III	23	
	617	"	16	4	"	15	
44	(Rhodesia)	Dunholme Lodge	16	2	"	14	
49		Fiskerton	16	2	"	13	
9		Bardney	16	2	"	15	
61		Syerston	"	"	"	12	
106		"	"	"	"	16	
207		Langar	"	"	"	15	
467	(RAAF)	Bottesford	24	3	"	20	
619		Woodhall Spa.	16	2	"	11	
50		Skellingthorpe	16	4	"	21	
No. 6 Group. Allerton							
Linton Base. (18.6.43)							
408		Linton	16	4	Lancaster II	16	
					Wellington X	2	
426		"	16	4	Lancaster II	20	
					Wellington III	1	
					" X	1	
427		Leeming	16	4	Halifax V	21	
	429	"	"	"	Halifax	22	
434		Tholthorpe	"	"	Halifax V	17	
	431	"	"	"	Halifax V	5	Re-equipping
419		Middleton-St.-George	"	"	Halifax II	19	
428		"	"	"	Halifax V	18	
432		Skipton-on-Swale	"	2	Wellington X	18	
	433	East Moor	16	4	Halifax	-	Formation delayed until 25/9.

ANNEX
SECRET

TABLE II

Unit		Location	Aircraft				Remarks
Opl.	Non-Opl.		I.E.	I.R.	Type	On Unit Charge	
No. 8 Group. (P.F.F.)		Huntingdon					
35		Graveley	24	6	Halifax II	29	
405	(R.C.A.F.)	Grandsden Lodge	16	4	"	17	
					Lancaster	5	
7		Oakington	24	6	Lancaster I&III	29	
					Stirling	11	
83		Wyton	16	4	Lancaster I&III	25	
97		Bourn	24	6	" "	34	
156		Warboys	"	"	" "	34	
105(½)	105(½)	Marham	16	2	Mosquito IX	8	
					" IV	9	
109		"	24	6	" IX	6	
			2	1	" IV	25	
139		Wyton	16	2	" IX	-	
					" IV	19	

TRAINING UNITS - 19TH AUGUST, 1943

No. 1 Group. Bawtry.						
Lindholme Base. (1.7.43)						
1656 Con. Unit	Lindholme	16	0	Lancaster	16	
		16	0	Halifax	17	
1662	Blyton	16	0	Lancaster	18	
		16	0	Halifax	16	
1667	Faldingworth	16	0	Lancaster	17	w.e.f. 7.8.43
		16	0	Halifax	13	
1481 B. Gunnery Flt.	Binbrook	8	0	Wellington	18	
		1	0	Tigermoth	-	
		7	3	Martinet	12	
1520 B.A.T. flight	Holme	6	2	Oxford	7	
No. 3 Group. Exning.						
Stradishall Base. (13.4.43)						
1657 Con. Unit	Stradishall	32	0	Stirling	42	
Mildenhall Base. (1.3.43)						
1678 Con. Unit	Little Snoring	8	0	Lancaster	7	
No. 4 Group. York.						
Driffield Base. (4.6.43)						
1484 B. Gunnery Flt.	Leconfield	5	0	Whitley	6	
		6	0	Defiant	14	
		1	0	Tiger Moth	1	
		7	3	Martinet	10	
				Anson	1	
Pocklington Base. (1.3.43)						
1652 Con. Unit	Marston Moor	32	0	Halifax	33	
1658 " "	Riccall	"	"	"	31	
1663 " "	Rufforth	"	"	"	30	

Unit	Location	Aircraft I.E.	Aircraft I.R.	Aircraft Type	Aircraft On Unit Charge	Remarks
No. 5 Group. Grantham						
Swinderby Base. (1.3.43)						
1660 Con. Unit	Swinderby	16	0	Lancaster	14	
		16	0	Halifax	10	
				Manchester	11	
1654 " "	Wigsley	16	0	Lancaster	16	
		16	0	Halifax	9	
1661 " "	Winthorpe	16	0	Lancaster	17	
		16	0	Halifax	-	
				Manchester	12	
1485 Br. Gun. Flt.	Fulbeck	8	0	Wellington	12	
		1	0	Tiger Moth	1	
		6	2	Martinet	9	
				Defiant	4	
1514 Bat. flight	Coningsby	6	2	Oxford	8	
1668 Con. Unit	Balderton	8	0	Lancaster		To increase to full strength 15.9.43.
		8	0	Halifax		
No. 6 Group. (R.C.A.F.) Allerton						
Topcliffe Base. (1.3.43)						
1659 Con. Unit	Topcliffe	32	0	Halifax	32	
1666 " "	Dalton	16	0	"	32	
1664 " "	Croft	32	0	"	15	
1679 " Flt.	East Moor	8	0	Lancaster II	16	
1691 Br. Gun. Flt.	Dalton	7	3	Martinet	10	
No. 8 Group (P.F.F.) Wyton.						
P.F. NTU.	Upwood/Warboys	8	0	Lancaster	13	
		4	0	Halifax	7	
1409 Met. Flt.	Oakington	6	1	Mosquito	6	
1499 Bomber G.F.	Ipswich	5	1	Martinet	6	Lodger Unit on F.C. Station.
1507 BAT flight	Gransden Lodge	6	2	Oxford	8	
1655 MTU	Marham	2	0	Mosquito IV	9	
		2	0	Mosquito III	5	
		4	2	Mosquito IV	(special)	
		6	2	Oxford	6	
No. 91 Group. Abingdon.						
10 O.T.U.	Abingdon	40	14	Whitley	61	
		8	2	Anson	12	
		4	0	Martinet	4	
15 "	Harwell	40	14	Wellington	56	
		4	0	Martinet	4	
19 "	Kinloss	40	14	Whitley	59	
		8	2	Anson	11	
		4	0	Martinet	4	
20 "	Lossiemouth	60	21	Wellington	55	
		6	0	Martinet	4	

ANNEX
SECRET
TABLE II

Unit	Location	Aircraft I.E.	Aircraft I.R.	Aircraft Type	Aircraft On Unit Charge	Remarks
No. 91 Group. (Continued)						
21 O.T.U.	Moreton-in-the-Marsh	40	14	Wellington	51	
		4	0	Martinet	3	
				Anson	2	
				Lysander	1	
22 "	Wellesbourne Mountford	40	14	Wellington	48	
		4	0	Martinet	4	
23 "	Pershore	40	14	Wellington	44	
		4	0	Martinet	4	
				Lysander	1	
24 "	Honeybourne	40	14	Whitley	53	
		8	2	Anson	9	
		4	0	Martinet	4	
310 F.T.U.	Harwell	2	0	Anson	2	
				Wellington	10	
311 "	Moreton-in-the-Marsh	2	0	Anson	2	
				Wellington	10	
1501 BAT flt.	Stanton Harcourt	4	1	Oxford	6	
1516 " "	Pershore	6	2	Oxford	9	
1681 Flt.		6	0	Tomahawk	2	
1682 "	Abingdon	6	0	"	4	
No. 92 Group. Winslow Hall.						
11 O.T.U.	Westcott	40	14	Wellington	52	
		4	0	Martinet	4	
				Lysander	1	
12 "	Chipping Warden	40	14	Wellington	53	
		4	0	Martinet	4	
				Defiant	1	
14 "	Market Harborough	40	14	Wellington	63	
		4	0	Martinet	4	
16 "	Upper Heyford	40	14	Wellington	50	
		4	0	Martinet	4	
				Anson	2	
17 "	Silverstone	40	14	Wellington	51	
		4	0	Martinet	4	
26 "	Wing	40	14	Wellington	51	
		4	0	Martinet	4	
				Lysander	1	
				Anson	3	
29 "	Bruntingthorpe	40	14	Wellington	51	
		4	0	Martinet	4	
				Anson	1	
1517 BAT flt.	Chipping Warden	6	2	Oxford	8	
E.D.C.U.	Westcott	2	0	Wellington	3	
1683 flt.	Bruntingthorpe	6	0	Tomahawk	3	
1684 "	Wing	6	0	"	6	

Unit	Location	Aircraft				Remarks
		I.E.	I.R.	Type	On Unit Charge	
No. 93 Group.	Egginton Hall					
18 O.T.U.	Finningley	30	10	Wellington	35	
		4	0	Martinet	4	
27 "	Lichfield	40	14	Wellington	55	
		4	0	Martinet	4	
28 "	Wymeswold	40	14	Wellington	48	
		4	0	Martinet	4	
30 "	Hixon	40	14	Wellington	52	
		4	0	Martinet	4	
81 "	Tilstock	40	14	Whitley	56	
		8	2	Anson	11	
		4	0	Martinet	4	
82 "	Ossington	40	14	Wellington	43	
		4	0	Martinet	3	
83 "	Peplow	30	10	Wellington	9	
		4	0	Martinet	4	
1521 Flt.	Wymeswold	6	2	Oxford	7	
1685 "	Ossington	6	0	Tomahawk	2	
1686 "	Hixon	6	0	"	5	

/(4) Expansion,

(4) Expansion, August 1943 to February 1944.

In the second half of the period under review expansion continued with the formation of new squadrons, increases in unit equipment, and the re-equipment of Wellington squadrons with heavy bombers. In mid-August, 1943, Bomber Command contained:-

AHB/
II H1/27

23 Lancaster Squadrons

15 Halifax "

11 Stirling "

5 Wellington "

3 Mosquito "

3 Special Duty (mixed) Squadrons.

This nominal total of 57 Squadrons (excluding the S.D. Squadrons) amounted to the equivalent of 67 standard size squadrons (see Table II). It can be seen that the vast majority of these were now heavy squadrons. The three Mosquito squadrons were for the special purposes of the Pathfinder Force.

In September three squadrons were formed: No. 433, whose formation had been postponed in June, and Nos. 513 and 514 in No. 3 Group. The former was equipped with Stirlings, the latter with Lancasters. It had now been decided to re-equip No. 3 Group eventually with Lancasters. As a result No. 513 Squadron was disbanded again in November. One squadron, No. 625 (Lancaster) was formed in No. 1 Group in October.

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In November there was an unusually large expansion in the Command. Five new Lancaster squadrons were formed from existing third flights:-

From 3rd Flight of Squadron No.	New Squadron No.	Group No.
12	626	1
100	550	1
103	576	1
57	630	5
467 (R.A.A.F.)	463 (R.A.A.F.)	5

In addition, one new Mosquito squadron was formed:

139	627	8

The three Canadian squadrons, Nos. 420, 424 and 425, which had been detached to North West Africa, returned, and finally four squadrons, Nos. 141, 169 and 239 on Mosquitoes, and No. 515 on Beaufighters, were transferred from the A.E.A.F. to Bomber Command to form part of No. 100 Group, the new Group formed to take over all radio counter-measures.

/In December

BC/O.R.B./Admin
1/12/43.

In December, Nos. 196 and 620 Stirling Squadrons were transferred to No. 38 Group A.E.A.F., No 623 Stirling Squadron was disbanded, and No. 586 started to form on Fortresses in No. 100 Group. Its formation was cancelled in January, 1944, and No. 214 Stirling Squadron took its place, transferring from No. 3 Group and re-equipping with Fortresses. Three new squadrons were formed in January, Nos. 578 and 640 on Halifaxes in No. 4 Group, and No. 692 on Mosquitoes in No. 8 Group. The final composition of the Command in February, 1944, including changes in establishment and equipment, can be seen in Table III below.

By the end of the period under review it will be seen that Bomber Command had re-equipped almost entirely with heavy aircraft. The last of the main force medium squadrons, No. 300 (Polish) Squadron, was in the course of re-equipment to Lancasters. Nos. 1 and 5 were now Lancaster Groups, No. 3 was being re-equipped with them from Stirlings, No. 4 was entirely and No. 6 mainly equipped with Halifaxes. The following summary will illustrate the increase in the bomber force, compared with its composition in February, 1943, shown above (sub-section (1)):-

A.H.B./
II.H1/27

Heavy	-	Lancaster	35½ Squadrons
		Halifax	21 "
		Stirling	5 "
Medium	-	Wellington	½ "
Total Heavy and Medium			62 Squadrons
Light	-	Mosquito	5 Squadrons

The standard squadron equipment was by this time 20 aircraft (16 I.E. + 4 I.R.), and on this basis Bomber Command had now an operational strength of 70 heavy squadrons, ½ a medium squadron, and approximately 5 Mosquito squadrons in No. 8 (P.F.F.) Group. In addition, it contained the Special Duty squadrons in Nos. 3 and 100 Groups, which are not included in the above figures, but are dealt with below (see Chapter III (5) and (6)).

/Table III

ANNEX
SECRET

TABLE III. - ORDER OF BATTLE

OPERATIONAL SQUADRONS - 24TH FEBRUARY, 1944

Unit		Location	Aircraft				Remarks
Opl	Non-Opl.		I.E.	I.R.	Type	On Unit Charge	
No. 1 Group. Bawtry.							
14 Base. (16.12.43)							
101		Ludford Magna	24	6	Lancaster I&III	29	
12		Wickenby	16	4	" "	19	
626		"	"	"	" "	19	
11 Base. (25.4.43)							
460 (R.A.A.F.)		Binbrook	29	6	" "	30	
625		Kelstern	29	6	" "	21	
100		Grimsby	16	4	" "	19	
13 Base. (1.12.43)							
103		Elsham Wolds	16	4	" "	19	
166		Kirmington	24	6	" "	30	
576		Elsham Wolds	16	4	" "	19	
550		N.Killingholme	16	4	" "	21	
300 (Polish)½		Ingham	8	1	Wellington X	8	
300(Polish)½		"	8	1	Lancaster I&III	4	Re-equipping
No. 3 Group. Exning.							
31 Base. (1.3.43)							
15		Mildenhall	16	4	Lancaster I&III	21	
622		"	16	4	Lancaster	19	
149		Lakenheath	16	4	Stirling	18	
199		"	16	4	"	19	
115		Witchford	24	6	Lancaster II	24	
75 (N.Z.)		Mepal	24	6	Stirling	32	
90		Tuddenham	"	"	"	30	
218		Downham Market	16	4	"	20	
514		Waterbeach	24	6	Lancaster II	26	
138 (Special)		Tempsford	14	2	Halifax II & V	19	
161 "		"	7	3	Lysander	7	
			6	0	Halifax V	6	
			5	0	Hudson I/III	7	
No. 4 Group. York							
41 Base. (1.3.43)							
10		Melbourne	24	6	Halifax II	25	
102		Pocklington	24	6	Halifax II	23	
77		Elvington	24	6	Halifax V	23	
					Halifax II	6	
43 Base. (4.6.43)							
158		Lissett	16	4	Halifax III	17	
					" II	1	

Unit		Location	Aircraft				Remarks
Opl.	Non-Opl.		I.E.	I.R.	Type	On Unit Charge	
No. 4 Group. (Continued)							
	76	Holme	24	6	Halifax III	28	
51(½)	51(½)	Snaith	24	6	" "	29	
					Halifax II	1	
466 (R.A.A.F.)		Leconfield	16	4	Halifax III	18	
					Halifax II	3	
578		Burn	16	4	Halifax III	19	
640		Leconfield	16	4	" "	17	
78		Breighton	24	6	" "	26	
					II	2	
No. 5 Group. Swinderby.							
53 Base. (14.11.43)							
(467 (R.A.A.F.)		Waddington	16	4	Lancaster I&III	17	
(9		Bardney	"	"	" " "	19	
(50		Skellingthorpe	"	"	" " "	17	
(61		Coningsby	"	"	" " "	19	
(463 (R.A.A.F.)		Waddington	"	"	" " "	19	
52 Base. (10.5.43)							
(44 (Rhodesia)		Dunholme Lodge	"	"	" " "	21	
(49		Fiskerton	"	"	" " "	16	
54 Base. (7.12.43)							
(617		Woodhall Spa.	"	"	" " "	18	Special Tasks.
(106		Metheringham	"	"	" " "	19	
(619		Coningsby	"	"	" " "	20	
57		East Kirkby	"	"	" " "	19	
		" "	"	"	" " "	18	
207		Spilsby	"	"	" " "	18	
No. 6 Group. Allerton.							
62 Base. (18.6.43)							
(408		Linton-on-Ouse	16	4	Lancaster II	20	
(426		" " "	"	"	"	22	
(420		Tholthorpe	"	"	Halifax III	19	
(425		"	"	"	"	19	
(432		East Moor	"	"	"	20	
					Lancaster II	1	
424		Skipton-on-Swale	"	"	Halifax III	19	
427		Leeming	"	"	"	17	
					" V	1	
433		Skipton-on-Swale	16	4	Halifax	22	
419		Middleton St. George	"	"	Lancaster X	1	Op. on Halifax II
					Halifax II	13	
428		"	"	"	"	17	
429		Leeming	"	"	"	-	" V
					" V	18	
431		Croft	"	"	" "	16	
434		"	"	"	" "	16	

/No. 8 Group.

ANNEX
SECRET
TABLE III

Unit Opl.	Unit Non-Opl.	Location	Aircraft I.E.	Aircraft I.R.	Aircraft Type	Aircraft On Unit Charge	Remarks
No. 8 Group. (P.F.F.) Huntingdon.							
35		Gravely	24	6	Halifax III	28	
					" II	9	
7		Oakington	"	"	Lancaster I&III	30	
83		Wyton	16	4	" "	23	
97		Bourn	24	6	" "	30	
156		Warboys	"	"		30	
405	(R.C.A.F.)	Gransden Lodge	16	4	" "	23	
105		Marham	16	2	Mosquito IX/XVI	15	
					Mosquito IV	2	
109		"	24	6	" IX/XVI	22	
					" IV	8	
139		Upwood	16	2	" IV/XX	10	
					" IX	5	
627		Oakington	"	"	" IV	8	
692(½)	692(½)	Gravely	"	"	" IV/XX	5	Forming
No. 100 Group. (Special Duties) Bylaugh Hall.							
141		West Raynham	16	2	Mosquito II	18	
	169	Little Snoring	16	2	" "	14	
					Beaufighter	3	
	239	West Raynham	16	2	Mosquito II/V	17	
192		Foulsham	6	1	Wellington X	8	
			3	0	Mosquito IV	3	
			8	2	Halifax III&V	12	
515		Little Snoring	16	2	Beaufighter	10	
	214	Sculthorpe	16	2	Fortress	21	

TRAINING UNITS - 24TH FEBRUARY, 1944

No. 1 Group. Bawtry.

11 Base. (25.4.43)

(1656 Con. Unit		Lindholme	32	0	Halifax	34	
(1662 "	"	Blyton	"	"	"	32	
(1667 "	"	Sandoft	"	"	"	27	
1481 Br. Gun. Flt.		Binbrook	8	0	Wellington	10	
			1	0	Tiger Moth	1	
			9	3	Martinet	13	
1687 Br. Def.Tr.Flt.		Ingham	4	2	Spitfire	-	
			9	3	Hurricane	-	
1 L.F.S.		Hemswell	18	0	Lancaster	25	Temporary strength = 24+0 1flt. at Lindholme.

/No. 3 Group.

Unit	Location	Aircraft I.E.	Aircraft I.R.	Aircraft Type	Aircraft On Unit Charge	Remarks
No. 3 Group. Exning.						
31 Base. (1.3.43)						
1 BDU	Newmarket	7	1	Halifax	9	
		3	1	Lancaster	5	
		1	0	Stirling	1	
		1	0	Mosquito	1	
		1	0	Spitfire	1	
		2	0	Beaufighter	2	
		1	0	Proctor	1	
1688 B.D.T.F.	Newmarket	4	2	Spitfire	-	
		9	3	Hurricane	-	
		6	2	Martinet	13	
		1	0	Tigermoth	-	
12 Base. (13.4.43)						
1657 Con. Unit	Stradishall	36	0	Stirling	38	
1653 " "	Chedburgh	36	0	"	33	
1519 BAT Flt.	Feltwell	6	2	Oxford	7	
1651 Con. Unit	Wratting Common	36	0	Stirling	34	
1678 " "	Waterbeach	12	0	Lancaster	11	
3 L.F.S.	Feltwell	18	0	Lancaster	8	Temporary strength = 9+0
No. 4 Group. York.						
42 Base. (1.3.43)						
1652 Con. Unit.	Marston Moor	34	0	Halifax	30	
1658 " "	Riccall	32	0	"	30	
1663 " "	Rufforth	32	0	"	35	
1520 BAT Flt.	Holme	6	2	Oxford	7	
1689 B.Def.T.Flt.	"	4	2	Spitfire	-	
		9	3	Hurricane	-	
		6	2	Martinet	12	
		2	0	Oxford	-	
		1	0	Tiger Moth	9	
				Defiant	9	
No. 5 Group. Grantham						
51 Base. (1.3.43)						
1660 Con. Unit	Swinderby	36	0	Stirling	32	
				Lancaster	2	
1654 " "	Wigsley	36	0	Stirling	30	
				Lancaster	1	
1661 " "	Winthorpe	36	0	Stirling	28	
				Lancaster	1	
52 Base. (10.5.43)						
1514 BAT Flt.	Fiskerton	6	2	Oxford	8	
1690 B.D.T.F.	Syerston	4	2	Spitfire	-	
		9	3	Hurricane	-	
		6	2	Martinet	11	
		1	0	Tigermoth	1	
5 L.F.S.	Syerston	18	0	Lancaster	21	Temporary strength = 21 + 0

ANNEX
SECRET
TABLE III.

Unit	Location	Aircraft I.E.	Aircraft I.R.	Aircraft Type	Aircraft On Unit Charge	Remarks
No. 6 Group. (R.C.A.F.) Allerton.						
61 Base. (1.3.43)						
1659 Con. Unit	Topcliffe	32	0	Halifax	30	
1664 " "	Dishforth	32	0	"	29	
1666 " "	Wombleton	32	0	"	20	Lancasters held against Halifaxes.
				Lancaster II	12	
1695 B.D.T.F.	Dalton/Dishforth	4	2	Spitfire	-	
		9	3	Hurricane	-	
		6	2	Martinet	12	
		2	0	Oxford	2	
No. 8 Group. Huntingdon.						
P.F.N.T.U.	Upwood/Warboys	9	0	Lancaster	9	
		9	0	Halifax	8	
1409 Met. Flt.	Wyton	6	1	Mosquito IX/XVI	6	
1655 T.U.	Marham	6	3	" IV	11	
		5	2	" III	7	
		6	2	Oxford	8	
1696 B.D.T.F.	Gransden Lodge/Ipswich	4	2	Spitfire	-	
		5	1	Hurricane	-	
		5	1	Martinet	6	
No. 91 Group. Abingdon.						
10 O.T.U.	Abingdon	40	14	Whitley	54	
		6	2	Anson	10	
		4	0	Martinet	5	
15 "	Harwell	40	14	Wellington	46	
		4	0	Martinet	4	
19 "	Kinloss	40	14	Whitley	51	
		8	2	Anson	10	
		4	0	Martinet	5	
20 "	Lossiemouth	60	21	Wellington	77	
		6	0	Martinet	7	
21 "	Moreton-in-Marsh	40	14	Wellington	60	
		4	0	Martinet	5	
22 "	Wellesbourne Mountford	40	14	Wellington	51	
		4	0	Martinet	5	
23 "	Pershore	30	10	Wellington	42	
		4	0	Martinet	5	
24 "	Honeybourne	40	14	Whitley	48	
		8	2	Anson	7	
		4	0	Martinet	5	
311 F.T.U.	Moreton-in-Marsh	2	0	Anson	3	
				Wellington	11	
1516 BAT Flt.	Pershore	6	2	Oxford	8	
1681 Flt.	"	7	0	Tomahawk	8	
1682 "	Abingdon	6	0	"	5	

/No. 92 Group.

Unit	Location	Aircraft I.E.	Aircraft I.R.	Aircraft Type	Aircraft On Unit Charge	Remarks
No. 92 Group.	Winslow Hall.					
11 O.T.U.	Westcott	40	14	Wellington	46	
		4	0	Martinet	5	
12 "	Chipping Warden	40	14	Wellington	50	
		4	0	Martinet	5	
14 "	Market Harborough	40	14	Wellington	62	
		4	0	Martinet	4	
16 "	Upper Heyford	40	14	Wellington	52	
		4	0	Martinet	5	
17 "	Silverstone	40	14	Wellington	55	
		4	0	Martinet	5	
26 "	Wing	40	14	Wellington	50	
		4	0	Martinet	5	
				Anson	1	
29 "	Bruntingthorpe	40	14	Wellington	53	
		4	0	Martinet	5	
84 "	Desborough	40	14	Wellington	47	
		4	0	Martinet	4	
1517 BAT flt.	Chipping Warden	6	2	Oxford	8	
E.C.D.U.	Westcott	1	0	Wellington	2	
		1	0	Beaufighter	1	
1683 Flt.	Market Harborough	6	0	Tomahawk	4	
1684 "	Wing	"	"	"	6	
No. 93 Group.	Egginton Hall.					
18 O.T.U.	Finningley	40	14	Wellington	50	
		4	0	Martinet	5	
27 "	Lichfield	40	14	Wellington	56	
		4	0	Martinet	5	
				Anson	1	
28 "	Wymeswold	40	14	Wellington	52	
		4	0	Martinet	5	
30 "	Hixon	40	14	Wellington	53	
		4	0	Martinet	5	
82 "	Ossington	40	14	Wellington	50	
		4	0	Martinet	4	
83 "	Peplow	30	10	Wellington	39	
		4	0	Martinet	4	
1521 BAT flt.	Wymeswold	6	2	Oxford	8	
1685 flt.	Ossington	6	0	Tomahawk	9	
1686 "	Hixon	6	0	"	6	
No. 100 (SD) Group.	Bylaugh Hall					
1692 RD Flt.	Little Snoring	6	2	Beaufighter	9	
				Defiant	6	
1694 TT Flt.	West Raynham	4	1	Martinet	-	Forming

/(5) The Supply

(5) The Supply of Aircraft

The expansion of Bomber Command during this period depended directly upon aircraft supplies. Other difficulties were encountered, but were kept under control by adjustments of organisation. New squadrons were formed as aircraft became available. It is therefore necessary to review the supply position, in so far as it affected the operational strength of the Command. Changes in operational requirements, due to experience and improvements in tactics also had an effect on the supply of aircraft during 1943.

The principal aircraft with which the bomber force was equipped during this period are shown in the table below - - -

- - -Of these aircraft, the Lancaster and Mosquito had already proved themselves as fully satisfactory. There were only minor modifications and additions to them during this period. The only complaint of Bomber Command was that supplies were never sufficient. As a result, the other inferior types had to be accepted.

Production of the three types of heavy aircraft had originally been planned on a similar scale. When the Lancaster proved far superior to the other two, the productive capacity employed on the latter could not immediately be switched to the Lancaster. The process of conversion, especially tooling, would have caused too great a dislocation of supplies had it been carried out all at once.

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By the end of 1942 it had been decided to change over Stirling production to Lancaster as quickly as possible. The appalling state of the Stirling squadrons at that time has been described in the previous Volume. Modifications were incorporated which enabled the balance of Stirling production to be employed on operations throughout the year 1943. There were many complaints of their higher casualty rate, owing to a lower ceiling and less speed than the Lancaster. But it was not until late in 1943 that No. 3 Group began gradually to re-equip with Lancasters.

The faults which had become apparent in the Halifax during 1942 have been dealt with in the previous Volume. Flame from the exhaust, faulty undercarriages, and a tendency to go out of control during evasive action were the principal complaints. The inadequate speed had been improved by degrees, and the ceiling was better than that of the Stirling. The under-carriage faults of the Halifax V had been overcome by March 1943. Thereafter the supply of these aircraft was satisfactory. The Halifax III was introduced in November, 1943, to improve the ceiling and performance. Trouble was experienced with the air intake and the carburation of this mark, however, which delayed supplies.

AHB/
ID4/233
21.12.43

In December, 1943, a comparison was made between the Halifax and the Lancaster, in their operational performance to date. In losses the Halifax exceeded the Lancaster by 56% (Halifax 5.33%, Lancaster 3.41%). In tonnage dropped per aircraft attacking the Lancaster exceeded the Halifax by 75%. Against heavily defended areas the Halifax performance was relatively worse. The operational ceiling of the Halifax was about 18,000 feet, whilst that of the Lancaster was 21 to 22 thousand feet, and the speed of the Lancaster was superior.

/By the end

By the end of the period under review, therefore, the Stirling was obsolescent, the Halifax was becoming so, and the Wellington had been replaced, and relegated to a training role. The Lancaster was carrying the main burden of the bombing of Germany, as the increased fighter resistance encountered rendered the use of the other types prohibitive in cost. They were employed mainly on minelaying and short range targets. It had by this time been agreed by all concerned that every effort should be made to switch all heavy bomber production resources to the Lancaster. This process, however, would take some two years to complete. For the year 1943, total Lancaster production had been raised from the planned 1668 aircraft to 1843. For 1944 it was hoped to raise the increase to 489 over the previously planned total.

A.H.B/
ID4/233
21.12.43.
CAS/Misc./60
Ibid 26.2.44.

/TABLE IV.

TABLE IV

BOMBER AIRCRAFT, 1943

HS.67669/Pt.4/
DGE stats
March, 1947.

Type	Mark	Engines	Reason for Change of Mark.
Lancaster	I	Merlin XXII or XXIV	
"	II	Hercules VI or XVI	Engine
"	III	(Packard) Merlin XXVIII	"
Halifax	I	Merlin X	
"	II	Merlin XX, XXII or XXIV	Engine and Messier u/c
"	III	Hercules XVI	Engine
"	V	Merlin XX, XXII or XXIV	Dowty u/c
Stirling	I	Hercules II or XI	
"	III	Hercules VI or XVI	Engine
Wellington	IC	Pegasus XVIII	
"	II	Merlin X	Engine
"	III	Hercules IV or XI	"
"	IV	P & W Wasp R 1830	"
"	X	Hercules VI or XVI	"
Mosquito	I	Merlin XXI or XXIII	P.R/Bomber
"	IV	"	Bomber
"	IX	Merlin LXXII	Engine
"	XVI	1 Merlin 72 1 Merlin 73 or 1 Merlin 76 and 1 Merlin 77	Pressure Cabin
"	XX	Packard Merlin XXXI or XXXIII	Canadian Built.

CHAPTER 3

RE-ORGANISATION

(1) Bomber Command in February, 1943.

At the beginning of this period Bomber Command was organised into seven operational and three training Groups. Owing to the recent decisions regarding the Base system and the Pathfinder Force, described below, the location of the operational groups and the stations they controlled was in a state of flux. The position in mid February, 1943, is shown in Table V below. The detailed composition of the Command has been shown in Table I.

The operational groups contained, in addition to operational squadrons, Heavy Conversion Units and other miscellaneous training units. These are dealt with in the section on "Training" below, together with the Operational Training Units.

Apart from the development of the Base System and of the Pathfinder Force, the re-organisation of the Command during the period under review consisted mainly of a re-allocation of aerodromes as between Groups. All these developments, as well as the formation of No.100 Group in December, 1943, are dealt with in the sub-sections below.

TABLE V - THE BOMBER GROUPS, FEBRUARY 1943.

Group	Location		No. of Aerodromes	
	Actual	Planned	Actual	Planned
(Operational)				
1	Bawtry (Nr. Doncaster)	Bawtry	11	15
2	Huntingdon	Bylaugh Hall (Nr. East Dereham)	9	14
3	Exning (Nr. Newmarket)	Exning	13(1)	11(2)
4	York	York	15	15
5	Grantham	Moreton Hall (Nr. Swinderby)	17	15
6	Allerton Hall (Nr. Knaresborough)	Allerton Hall	7	11
8(PFF)	Wyton	Huntingdon	3	6
(O.T.U.)				
91	Abingdon	Abingdon	17	17
92	Winslow	Winslow	16	18
93	Egginton	Egginton	10	15

(2) The Base System

See Vol.IV Part I, 3(iv) S.82201.MIN. 11.

During 1942 the actual and projected growth of the Bomber Groups began to render their operational and administrative control difficult. Each Group was intended eventually to control about 20 operational squadrons on 10 aerodromes, with five further aerodromes occupied by Heavy Conversion and other miscellaneous Units. It had been decided in 1941 that these aerodromes should be divided into "Clutches" of three, one being the parent and centralising as much administration as possible, for the sake of economy.

(1) Two to be handed over to the U.S.A.A.F.
(2) Including two for S.D. Squadrons and B.D.U.

Ibid. 1A

On 26th June, 1942, Bomber Command put forward the suggestion that these "Clutches" of three aerodromes should be organised as a subordinate formation to be called a "Base"; each "Base" to be commanded by an Air Commodore, with a Group Captain commanding each of the three stations. This suggestion was considered by the Air Ministry, and deferred in August, 1942, until the growth of the Command should justify it. The question was revived by an official request from the C. in C., Bomber Command on 21st December, 1942, for the introduction of Base Commanders. After considerable further discussion the system was approved by the Secretary of State on 14th February, 1943.

Ibid. Min. 30.

It was agreed that three "Bases" should be organised immediately, those chosen being Mildenhall, with its satellities Lakenheath, Newmarket and East Wretham, in No. 3 Group; Pocklington with Melbourne and Elvington, in No. 4 Group; and Topcliffe, with Dishforth and Dalton, in No. 6 Group. Further bases would be approved as each "Clutch" reached a figure of 72 I.E. aircraft, or 3 Heavy Conversion Units. Under the latter arrangements, two further bases at Marston Moor and Swinderby were approved immediately.

Ibid. 36A.

Ibid. 42A.

By the institution of the Base System it was hoped to economise in both administrative and technical personnel. This became more than ever necessary as the critical manpower situation became more apparent during 1943. In October, therefore, an entirely new servicing organisation was introduced in the operational squadrons. It was modelled on the system which had gradually been evolved in the Operational Training Units.

L.M. 2487/D. of 0. 1.10.43.

The new organisation was as follows:-

(a) Servicing was centralised under the Chief Technical Officer in a Servicing Wing. These Wings formed part of the Station establishment.

(b) Servicing personnel in Squadrons were limited to those required for daily servicing, e.g. refuelling, re-arming and daily inspections. Disciplinary and administrative control of these Daily Servicing Sections remained with the Squadron Commander, but technical control came under the C.T.O.

(c) Certain major servicing, (e.g. minor inspections, minor repairs, etc.) was undertaken by Servicing Echelons under the C.T.O.

(d) The balance of major servicing was allocated as follows:- On stations within a Base - by the Base Major Servicing Section.

On Stations not within a Base - by a Station Major Servicing Section.

By this system the servicing echelon attached to a squadron was numbered to correspond, preceded by 9000, e.g.

No. 9 Squadron - No. 9009 Servicing Echelon

No. 207 " - No. 9207 " "

/By the end

By the end of the period under review 16 full bases had been set up, in addition to one of a reduced size comprising only 48 I.E. aircraft and commanded by a Group Captain. Soon afterwards, in March 1944, proposals were made to incorporate the remainder of the Bomber Command stations in the base system. The progressive organisation of the Bases can be seen in the Orders of Battle above.

Ibid./114A.

(3) The Pathfinder Force

BC/S.27724 Encl.70A. CS.12848/41 Encl.43A.

The formation of the Pathfinder Force on August 15th, 1942, has been described in the previous volume of this narrative. On 25th January, 1943, the Force was organised as a separate Group, No.8 (PFF) Group, under the command of Air Commodore Bennett. At this date it contained the five squadrons with which the Force had originally been equipped, including No.109, which up to then had been on loan from No.2 Group. They were located as follows:-

Station	Squadron	Affiliated to	Aircraft	U.E.
Wyton (H.Q.)	83	5 Group	Lancaster	18
	109	2 "	Mosquito	18
Warboys	156	1 "	Wellington III	18
Gravely	35	4 "	Halifax	27
Oakington	7	3 "	Stirling	27

The first three stations were transferred to No.8 Group, but Oakington remained in No.3 Group, with No.7 Squadron on a "lodger" basis. No.156 Squadron was re-equipping with Lancasters, and Nos.7 and 35 Squadrons had third flights for the training of crews in the use of H2S equipment

The Pathfinder Force had been formed to improve the accuracy of bombing by the following means:-

(a) The best crews were supplied from all squadrons.

(b) They were equipped with every aid to navigation and bombing available.

(c) They were specially trained in target location.

(d) They preceded the main force, and marked the target by means of flares and ground markers.

No.8 (PFF) Group was therefore given every priority in crews, aircraft and equipment. As experience was gained of further equipment needed, its production was pressed on by every means. The development and use of this equipment is dealt with in the narrative.

AHB II/HI/27

During 1943 the Pathfinder Group expanded and re-equipped with the rest of the Command. No.156 Squadron was re-equipped with Lancasters during January and February. It continued to be supplied with crews by No.1 Group, which was also re-equipping. In April a third flight was added to it, and in the same month two new squadrons were transferred to No.8 (PFF) Group; No.405 (R.C.A.F.) Squadron from No.6 Group, and No.97 from No.5 Group. In May a third flight was added to the latter. No.1409 Meteorological Flight, with a U.E. of 10 Mosquito IV's was added to No.8 (PFF) Group in March. It was formed by the reversion of No.521 Squadron Coastal Command, to a one-flight basis.

BC/S.27764 Encl.118

Ibid./Encl. 127AA

/When

When No. 2 Group was transferred to Fighter Command in June, two of its Mosquito squadrons, Nos. 105 and 139, were taken over by the Pathfinder Group, together with their station, Marham. No. 109 Squadron then had a third flight of Mosquitoes added to it. In July No. 7 Squadron re-equipped from Stirlings to Lancasters. No. 405 Squadron re-equipped from Halifaxes to Lancasters in August and September. The only further change in the strength of the force during this period was the formation of No. 627 Squadron in November from the third flight of No. 139 Squadron.

Owing to the need to obtain the best and most experienced crews for the Pathfinder Force, it had been granted a special establishment (see previous Volume), each post being upgraded one step in rank. By this means aircrews who joined the Force did not lose by it, and every effort was made by Bomber Command to enable them to keep any acting ranks after leaving the Force. Continual requests were put up by the A.O.C. in C. during 1943 for the upgrading of the A.O.C. Pathfinder Group to Air Vice Marshal to come into line with the other Groups. It was not until 1944 that this final step was achieved.

(4) The Provision of Aerodromes

During this period of rapid expansion in the operational strength of Bomber Command, the availability of aerodromes was one of the principal limiting factors. As has been seen in the previous Volume, the planned total of aerodromes had been drastically curtailed by the manpower crisis at the end of 1942. The re-organisation of Bomber Groups which was taking effect during this period involved the transfer of a number of aerodromes between Groups, to complete the planned layout of the Command, as new squadrons were formed and new aerodromes became available.

It had been decided during 1942 to increase the accommodation at all heavy bomber stations to accommodate two squadrons, each with a unit equipment of 18 aircraft. This was being carried out. In addition runways were being built at most of the remaining grass aerodromes in the Command. This meant that many of these aerodromes were out of commission for long periods. The handing over of those aerodromes allocated to the United States Bomber Forces also deprived the Command of many of its stations. The changes in the layout of Bomber Command involved by these factors can be seen in Map I.

BC/S. 21717/VI Encl. 122A.

This scarcity of aerodromes during 1943 meant a very careful choice of squadrons for expansion to three flights. These had to be located on a station whose accommodation had been raised to that level. The subsequent break-off of the third flight to form a new squadron had also to be planned to coincide with an increase in the technical and living accommodation of the station.

Ibid. Encl. 149A, 154A, 160A.

No. 3 Group was the worst situated of the bomber groups as regards aerodromes in early 1943. The formation of No. 8 Group had deprived No. 3 Group of three of its aerodromes, and others had been transferred to No. 2 Group. With the expansion of No. 8 Group, still more stations were transferred to it - Oakington, Bourn and Gransden Lodge. This left No. 3 Group so short that great difficulty was found in accommodating the Stirlings supplied in April, May and June, 1943. The A.O.C. reported on 27th April that all airfields in the Group were up to the limit of their accommodation until a new airfield became available on 1st July. Congestion in the group continued until Foulsham was transferred from No. 2 Group on 1st September.

BC/S. 27724/II Encl. 81A. BC/S. 21717/VI Encl. 179A. Ibid. VII Encl. 49A.

Nos. 4 and 6

Nos. 4 and 6 Groups had to carry out a number of transfers of squadrons and airfields between them, in order to conform to the planned areas allotted to them. Temporary difficulties occurred in phasing these transfers to suit both groups. The rate of expansion of the Canadian group, No. 6, had political repercussions with the Canadian authorities, who did not realise the difficulties involved.

Ibid Encl. 176A

To sum up - the supply of airfields during this period was always barely sufficient. It was only by constant calculations, improvisations, and juggling of squadrons that the Command and Groups were able to absorb the aircraft supplied to them. By these means, however, the airfield situation was prevented from affecting the bomber effort to any serious extent.

(5) Special Duty Squadrons.

There were certain units within Bomber Command during this period which, although operational, did not carry out bombing missions. Their task does not therefore come within the scope of this narrative but is dealt with in the appropriate monographs on "Special Duty Operations", and "Radio Counter-measures". Their existence is noted here, however, to complete the picture of the operational organisation of the Command.

WP(40)271

The two "Special Duty" Squadrons in No. 3 Group, Nos.138 and 161, had been allotted in 1941 and 1942 respectively as the air arm of the "Special Operations Executive". This had been formed in 1940 to contact, co-ordinate and assist the resistance groups in enemy-occupied country. The duties of those two squadrons therefore consisted in dropping by parachute both agents and supplies, and landing in enemy-controlled territory to pick up the former. The squadrons were operationally controlled direct from Air Ministry, A.C.A.S.(I).

COS(43)142(O)

In March, 1943, the Chief of Staff's directive to S.O.E. laid down that sabotage should be pursued with the utmost vigour and it "should as far as possible be co-ordinated with the aims of our Bombing Policy, and full advantage should be taken of bombing cover for the execution of sabotage operations".

In November and December, 1943, the A.O.C. in C., Bomber Command ordered the suspension of all S.D. operations on learning of extensive enemy penetrations into the S.O.E. organisation in Holland and other countries. The ban was later raised as far as Denmark was concerned, whilst an investigation was carried out into the extent of the penetration elsewhere.

These two squadrons were equipped with a variety of aircraft to suit the tasks they undertook. No. 138 Squadron had a unit equipment of 17 Halifaxes in February, 1943, to be used for dropping agents and supplies. A few Liberators were substituted later in the year for some of the Halifaxes, to give a longer range. No. 161 Squadron was equipped with Hudsons and Lysanders for picking up agents in enemy territory, and also Halifaxes and a few Havocs.

/(6) Radio

(6) Radio Counter-Measures and No. 100 Group

In addition to the two Special Duty Squadrons engaged in S.O.E. work, there was a third in No. 3 Group at the beginning of our period. This was No. 192 Squadron, employed in the investigation of Radio Counter-Measures by the enemy, and the efficacy of our own measures. This squadron had been formed in January, 1943, by the expansion of No. 1474 Flight, which had been engaged on these tasks for some months. It was equipped with 2 Halifaxes, 11 Wellington X and 3 Mosquitoes. The method used was for these aircraft to mingle with the main bomber stream, using special apparatus capable of locating, detecting and analysing all forms of radio signals.

100 Group/MS105/ Air Encl. 1A, 1B.

With the rapid developments in radio and radar during the year 1943, the work of this squadron increased in importance. It was finally decided to unite the various units engaged in Radio Counter-Measures into a Group within Bomber Command. No. 100 (S.D.) Group was formed on 3rd December, 1943. In addition to No. 192 Squadron, it took over No. 80 Wing,(1) which was responsible for jamming enemy signals from a chain of ground stations, and three night fighter squadrons, Nos. 141, 169, and 239, whose role was to support the bomber stream by attacking the enemy fighters which attempted to molest it. These squadrons were provided with "Serrate" equipment, which enabled them to home on the A.I. transmissions of enemy fighters, and to attack them by the use of their own A.I equipment. In addition, an Intruder squadron, No. 515, was transferred, and No. 214 Squadron was re-equipped with Fortresses (B.17), and transferred from No. 3 Group to No. 100 (S.D.) Group, on 17th January, 1944. Its role was to interfere with enemy signals from the air with special apparatus.

For details of the activities of these units, reference should be made to the Signals Narrative of the Air Historical Branch.

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(1) No. 1473 Flight, employed on similar duties to No. 192 Sqn., under the control of No. 80 Wing, was transferred with the latter on 12th December. On 1st February, 1944, it was disbanded and absorbed into No. 192 Sqn.

CHAPTER 4

THE SUPPLY OF TRAINED AIRCREW

(1) The Flow of Aircrew

The supply of aircrew during this period of expansion was adequate to man the available aircraft. The training organisation had been built up with great foresight, at considerable cost to the earlier operational effort, as has been seen in previous volumes of this narrative. By mid-February, 1943, the return of aircraft and aircrew for Bomber Command shows the following satisfactory figures:-

Consol: Form G 18.2.43.

Aircraft Established	Aircraft Strength	Aircraft Established	Aircraft Strength	Aircraft Available with crews.
984	1083	1265	1195	620

In addition there were 197 crews converting in squadrons.

On 26th February the total deficit or surplus in crew categories was as follows:-

S.84814 Encl.35B.

Pilots	Navigators	Air Bombers	WO/A Gns	Air Gunners	Flt.Engineer
-186	+312	-61	+358	+257	+91

This deficiency in pilots allowed for the old establishment of six spare pilots per squadron. It had been decided on 15th February to alter this to allow for one spare crew, plus the C.O., in place of the six spare pilots.

Ibid Encl.28A

With changes in policy and in aircraft equipment adjustments had to be made, sometimes at short notice, in crew categories. To provide the extra crew members required for heavy bombers special units had been set up for their conversion. Air Bomber Training Flights of 8 U.E. Oxford aircraft converted WO/A Gns to Air Bombers. These flights were disbanded on March 15th, 1943, as their purpose had been fulfilled. Flight Engineers were provided by passing Fitters II through the Flight Engineers School at St. Athan. The length of this course had to be varied to meet requirements, being reduced by as much as two weeks in June, 1943, in order to speed output. Heavy Bomber pilots were provided by means of Heavy Conversion Units, which are dealt with later under "Training".

S.5714 Encl.150A.
S.84814.Encl.63A.

In April, 1943, there was a deficiency of 108 effective crews in Bomber Command. This was due to a temporary increase in the casualty rate, and to the increase in squadron establishment from 20 to 22 crews. This deficiency was overcome by a temporary increase in intake to the O.T.Us and H.C.Us, made possible by the summer weather. The O.T.U. intake was increased from 16 to 18 crews per fortnight, the H.C.U. intake from 32 to 36 or even 40 crews per month. There was a slight deficiency in pilots in June, which was made up by adding two spare pilots to each intake for a time.

Ibid Encl.77A.

As a result of these measures, the strength of the Command was built up during the summer to provide against increased wastage and reduced output of trained crews which generally occurred in the winter. At the end of August, for example, 1405 operational crews were held against an

Consol: Form G

/establishment

establishment of 1282. At the end of October 1507 were held against an establishment of 1391. As this surplus still remained in January, 1944, authority was obtained on 18th January for an increase in aircrew establishment from 11 to 14 crews per flight, which more than absorbed the balance. It was claimed by Bomber Command that this would allow for a more economical use of the 10 U.E. aircraft of the flight, and a consequent increase in the operational effort of the Command.

S.84814 Encl.91A.

The full story of the Empire Air Training Scheme which supplied aircrew to the Operational Commands can be found in the Air Historical Branch Narrative on Training. This also contains an account of the Operational and Conversion training carried out by Bomber Command. A brief outline of the latter is included in the sections below.

Minutes of Aircrew Allocation Committee.

The flow of aircrew from the Empire Scheme arriving in Great Britain were sent from Reception Centres to Advanced Flying Units. In the Pilots A.F.Us a minimum of approximately 40 hours flying, including 5 hours by night was given to twin engine pilots. This was necessary owing to the long period since they had last flown, spent in transit and in despatch and reception centres. The Observers A.F.U. course was about four weeks for Navigators and Bomb aimers. Air Gunners and Wireless Operator/Air Gunners were sent to A.F.Us if the flow was sufficient to permit it. Owing to the addition of an extra mid-gunner to heavy bomber crews there was a shortage of this category during most of 1943. Training was speeded up by increasing the proportion carried out in ground turrets.

The intake of aircrew into Operational Training Units had to be as regular and steady a flow as possible in order to make full use of their training facilities. The weekly meetings of the Aircrew Allocation Committee at the Air Ministry adjusted this flow as necessary. The P.R.C's and A.F.U's were used as the pools at which any category of aircrew surplus to requirements could be retained. In the case of a deficiency, which was more common, the courses at these centres were reduced in length. In some cases, notably that of Air Gunners, it was necessary to post them direct from the P.R.C. to the O.T.U.

This problem of adjusting the supply of aircrew to the O.T.U's was complicated by the intake of special categories. A number of ex-flying and navigation instructors were fed into Bomber Command during this period, for whom crews had to be found at the O.T.U., whilst second tour personnel had to be absorbed and crewed up, usually at the conversion stage of training. Finally every effort was made at this time to form complete crews of personnel of the same Dominion, in order to feed them into Canadian and Australian Squadrons, in accordance with agreements made with those Dominion Governments. All this meant constant adjustments in the intake figures both to Operational and Conversion Units.

(2) Operational Training Units (O.T.U's)

The purpose of an O.T.U. was to train aircrew, on an operational type of aircraft, for the particular role allotted to them. In the case of a Medium Bomber O.T.U. they were trained, principally on Wellingtons, for night operations on Medium and Heavy Bombers. The exercises included long night cross-country flights, practice bombing and photography, and the use of operational equipment. At

/the O.T.U.

the O.T.U. the various categories of aircrew - pilot, navigator, bomb aimer, wireless operator, air gunner - hitherto trained separately, were teamed up to form complete crews. The instructors were drawn principally from ex-operational aircrew who had completed one or more tours of operations.

S.84814
Encl. 31A.

By 1943 the Operational Training Units of Bomber Command were organised into three Groups, Nos. 91, 92 and 93. In mid-February these Groups contained the equivalent of 18¼ standard (54 U.E.) medium bomber O.T.U's and 1½ (48 U.E.) light bomber O.T.U's. The details of these can be seen in Table I. In addition there was a small Mosquito Training Unit administered by No. 2 Group.

The output of the Medium O.T.U's was expected to be 383 aircrews during March, 1943. To conform to the expansion programme of Bomber Command to the end of the year, the output required would be 383 in March, rising to 528 in June, 491 in September, and 622 in December.

LM955/D. of O.
4.4.43.

To meet this programme it was decided to raise the number of Medium O.T.U's to 24 by September. This was begun by recasting the Polish O.T.U., No. 18, as British with one Polish Flight, at ¾ strength in March, by increasing No. 81 O.T.U. to full size in April, and by converting No. 17 O.T.U. from light to medium bombers in May, and increasing it to ¾ size.

The planned expansion beyond this point of 19½ O.T.U's by June underwent many changes owing to non-availability of airfields at dates specified, and will be dealt with in the next section. It was necessary to calculate requirements well in advance, as it took some three months from the date of formation for an O.T.U. to reach its planned output.

S.84814
Encl. 31C

Ibid Encl. 40B

The output of the two Light Bomber O.T.U's, Nos. 13 and 17, was more than was required to supply the planned light bomber squadrons, as an additional Light O.T.U. had been opened in Canada. The output of the latter would require a month's acclimatisation course, and instruction in operational technique in Europe. It was decided that No. 13 O.T.U. could be expanded to undertake this, training crews for both Mitchells and Bostons. No. 17 O.T.U. was therefore converted to a medium role. No. 1655 Mosquito Training Unit was also absorbed by No. 13 O.T.U., which was provided with an extra satellite on 1st May, 1943. It then included Bicester as parent station, with Finmere and Turweston as satellites, and counted as 1½ O.T.Us in size.

Ibid Encl.57A

With the transfer of No. 2 Group to Fighter Command on 1st June, No. 13 O.T.U. was also transferred to support it. No. 1655 Mosquito Training Unit was then re-formed and came back to Marham on 1st July, to supply the two Pathfinder Mosquito squadrons there with crews.

(3) The Development of O.T.U's

By June 1943, the Bomber Command O.T.U's numbered 19½, as seen in the last section. Four of them were equipped with Whitley aircraft, the remainder with Wellingtons. It had been planned to add 1½ during June but only one, No. 82, was actually opened. A revised programme of O.T.U. expansion was issued on 21st June:-

/Existing

L.M.1699/D.of O. 21/6/43

Existing O.T.U's.		$20\frac{1}{2}$
July	No. 17 O.T.U. to expand to full size	$+\frac{1}{4}$
	No. 83 O.T.U. to form at $\frac{3}{4}$ size	$+\frac{3}{4}$
August	No. 20 O.T.U. to expand to $1\frac{1}{2}$ size	$+\frac{1}{2}$
September	No. 84 O.T.U. to form at full size	+ 1
	No. 18 O.T.U. to expand to full size	$+\frac{1}{4}$
Sept/Oct	Leicester East (No.25 O.T.U.) to form at $\frac{3}{4}$ size	$+\frac{3}{4}$
	TOTAL	24

L.M.2509/D.of O 4/10/43 and L.M.2606/D.of O 14/10/43

This programme depended upon the necessary airfields, including satellites, being ready according to schedule. It was carried out with only minor modifications up to the end of September. The proposed O.T.U. at Leicester East was cancelled in October, as it became unnecessary owing to the good crew position.

AIIb 1 IIIC/40

B.C./S.23336/4 Encl.7A

The output of a full sized O.T.U. with a Unit Equipment of 54 operational aircraft was calculated as 32 crews per month in summer, and 22 in winter. To allow for the loss of flying time due to bad weather in winter, it had been the custom to lengthen courses from 8 to 12 or more weeks, and to reduce intakes from every fortnight to once in three weeks. Bomber Command proposed early in this year that intakes should be fortnightly throughout the year, the course being standardised at 2 weeks ground training and 8 weeks flying. The number of aircrew per intake could then be regulated according to the time of year from 16 in summer to 12 in winter. There were lengthy discussions on this proposal, the chief points of argument being as follows:-

Ibid Encl.18A 95A, 108A, etc.

Advantages:-

(a) The training of a smaller number in winter would be more intensive, and courses would not drag out as they had in the past.

(b) If an entry had to be dropped, it would be a loss of a fortnight only, instead of 3 weeks.

Disadvantages:-

(a) The number of good flying days during 8 weeks in winter might be insufficient.

(b) Instructors would have to give more lectures to smaller courses in winter.

Ibid Encl.110A

Ibid Encl.125A

It was finally agreed in July that the length of courses should remain the same throughout the year, at eight weeks flying preceded by two weeks ground training. The normal fortnightly intake was to be 16 crews in summer, falling to 11 in winter. (The intake had been raised to 18 during May and June). The winter period was to begin on 7th September, 1943, and end on 7th February, 1944. For H.C.U. intakes the winter period would begin and end one month later. This meant that during October and November there would be summer outputs from O.T.U's but winter intakes to H.C.U's. It was decided to build up this pool to 100 surplus aircrews per Group, in order to allow for the period of return to summer intakes in March, and to permit of a full effort in the favourable operational conditions of the spring.

/These

These efforts to build up a surplus against the winter were crowned with such success that O.T.U. training had to be slowed down in November. Owing to bad weather in October which prevented full H.C.U. outputs, and owing to the reorganisation of H.C.U's during November (see Section (4)), the operational Groups reached more than the full number of surplus crews which they were planned to receive during the winter. Bomber Command urgently requested in October, the cancellation of all entries to O.T.U's on 30th November and 7th December, 1943, and asked that crews due to output on and after those dates might be held an extra fortnight. It was undesirable to back up crews awaiting conversion any further, owing to the long period off flying between the O.T.U. and H.C.U. In December it became necessary to ask O.T.U's to delay the transfer of each course to the operational Groups until four weeks after completion of training. A fortnight of this was to be spent on leave, the final fortnight in 4 or 5 hours extra flying, to keep them in flying practice. The O.T.U's were thus holding seven courses at a time, five under training, one on leave, and one awaiting posting.

Ibid
Encl.173A,
177A.

Ibid
Encl.181A

As a result of this surplus aircrew production the number of O.T.U's ceased to expand, and began to decrease, after October, 1943. On 15th November No.23 O.T.U. was reduced to $\frac{3}{4}$ size. The effective date of reduction was later postponed to 15th January, 1944, owing to the slow clearance of trainees. On 1st January, 1944, No.81 O.T.U. was transferred to No.38 Group, in the Allied Expeditionary Air Force, to supply crews for the Stirling squadrons recently transferred to that Group. In December, 1943, Bomber Command had proposed to form a Heavy Bomber O.T.U. as an experiment, to eliminate one stage in the training process. This idea was not proceeded with, but was the subject of discussion for some time to come.

B.C./O.R.B.
B.C./S23616/III
Encl.121A

S84814
Encl.89A

Ibid
Encl.89C

The Bomber Command O.T.U's remained at the equivalent of 22 until the end of this period, February 1944. The detailed lay-out at this date is shown in Table III. During February it was decided to reduce the number of O.T.U's, owing to the large surplus of crews still awaiting conversion to heavy aircraft. The normal period of waiting between the O.T.U. and H.C.U. courses at this time was about two months. The necessary reduction took effect in March, and is covered in the next Volume of this narrative.

B.C./S23616/III
Encl.157A

B.C./S21717/VIII
Encl.112A

(4) Heavy Conversion Units (H.C.U's).

With the introduction of four engined Heavy Bombers, training units became necessary to convert pilots from twin-engined to four-engined flying, and to accustom crews to the use of their equipment. The Conversion Flights formed for this purpose began to amalgamate into Heavy Conversion Units in October, 1942. By February 1943, eleven Conversion Units were established with a Unit Equipment of 32 aircraft each. In the case of the Lancaster H.C.U's 20 of these were Halifaxes or Manchesters, in order to save Lancasters for the front line. The details can be found in Table II. The H.C.U's were administered by the Operational Groups throughout this period.

/The planned

L.M.119/D.of O. 26/1/43

The planned output of a standard (32 U.E.) Conversion Unit was 32 crews per month. To provide the crews required for expansion it was planned to increase the number of H.C.U's as follows :-

L.M.818/D.of O. 24.3.43

	Halifax	Lancaster	Stirling	Total
Existing H.C.U's	4	5	2	11
May, 1943	5½	5	2½	13
August, 1943	6	6	3	15
November, 1943	6	7	3	16

The Lancaster H.C.U's were to be equipped with 16 Lancasters and 16 Halifax/Manchesters.

L.M.1422/D.of O. 18.5.43

L.M.1995/D.of O. 21.7.43

L.M.1942/D.of O. 14.7.43

This programme was carried out up to July with minor modifications. Lancaster Conversion Flights of 8 aircraft each were added in Nos. 3 and 6 Groups in April, owing to the decision to equip some of their squadrons with Lancaster II's. In August an additional Lancaster H.C.U. (No.1668) was opened at half-strength. At 19th August the H.C.U. position was as follows, counting the two Lancaster Flights as half an H.C.U. :-

Halifax 5½, Lancaster 7, Stirling 3, Total 15½.
(See Table II)

A new programme was prepared in view of the planned increase in Lancaster squadrons. By this 5½ Halifax and 3 Stirling H.C.U's were to be retained, while the Lancaster H.C.U's were to increase to 8½ by the end of the year. In the event owing to an altered policy, the number of H.C.U's did not alter by February, 1944, although their composition altered materially.

B.C./S21717/VII Encl.195A

B.C./S21717/VIII Encl.92A

B.C./O.R.B. 21.11.43

The increasing wastage rates of Stirlings and Halifaxes relative to Lancasters, was causing serious concern. With the superior load it carried, the Lancaster was a vastly more economical aircraft to use on operations. As a result, it was decided in November 1943, to re-equip No.3 Group with Lancasters, and to use Stirlings in H.C.U's for pre-Lancaster training in Nos. 3 and 5 Groups. Halifaxes were to fill a similar role in No. 1 Group. To effect this, considerable adjustments had to be made in H.C.U's, and Lancaster Finishing Schools were formed in Nos. 1, 3 and 5 Groups to convert Stirling and Halifax - trained crews to the Lancaster. The principal changes were as follows :-

No. 1668 Lancaster H.C.U. was disbanded
No. 1653 Stirling H.C.U. was formed at 32 U.E. in No. 3 Group.

The following H.C.U's re-equipped from 16 Lancasters and 16 Halifaxes :-

Group	H.C.U.	Location	New Unit Equipment
1	1656	Lindholme	32 Halifax II
1	1662	Blyton	32 Halifax II
1	1667	Faldingworth	32 Halifax II
5	1654	Wigsley	37 Stirling I/III
5	1660	Swinderby	37 Stirling I/III
5	1661	Winthorpe	37 Stirling I/III

/The aircraft

The aircraft establishment of Nos. 1651 and 1657 H.C.U's, which, with No. 1665, had been raised to 36 Stirlings on 1st October was reduced once more to 32. No. 1665 H.C.U. was transferred to No. 38 Group, A.E.A.F. on 1st December, to supply crews to Nos. 196 and 620 Squadrons, which were also transferred.

Ibid 1.12.43

On 21st January, 1944, No. 1679 Lancaster Conversion Flight was disbanded. It had been decided to equip No. 6 Group with Halifax III. The diminishing commitment for Lancaster training was undertaken by No. 1666 H.C.U., which was raised to full strength, temporarily holding sufficient Lancasters, against its Halifax establishment, to carry out this task. On February 18th the aircraft establishment of the Stirling H.C.U's was standardised at 36 Stirlings. The final layout of Conversion Units in Bomber Command on 24th February, 1944, was as follows :-

(Details may be found in Table III) :-
H.C.U's - Halifax 9, Lancaster ½, Stirling 6, Total 15½
Lancaster Finishing Schools (18.U.E.) - 3

L.M. 2488/D. of O. 1.10.43

The Servicing Organisation of the H.C.U's was reorganised in October 1943, on the model of that in use in O.T.U's. All servicing was centred in a Servicing Wing under a Chief Technical Officer. This comprised a Daily Servicing Squadron, and a Repair and Inspection Squadron. Major servicing was divided between the latter and the Base or Station Major Servicing Section.

(5) Other Training Units.

In addition to O.T.U's and H.C.U's a number of other training units had been found necessary in Bomber Command by 1943. A short summary of the development and purpose of these is given below, to complete the picture of the Bomber Command training system. Fuller details can be found in the Air Historical Branch Training Narrative. (See also Tables I, II and III).

(a) (Bomber) Gunnery Flights. ((B) G.F.).

These flights were formed in 1942 as Target Towing and Gunnery Flights, the name being later changed to (Bomber) Gunnery Flights. In February, 1943, Nos. 1 to 5 Groups each had one of these flights, numbered 1481 to 1485 respectively. They were established with a few operational aircraft, together with Defiants for fighter affiliation attacks and Martinets or Lysanders for target towing. On 31st March, 1943, No. 1499 (B) G.F. was formed at Wyton in No. 8 (PFF) Group, to provide gunnery training to aircrews posted direct from O.T.U's. On 30th June No. 1691 (B) G.F. was formed to provide the same training for No. 6 (R.C.A.F.) Group. The details of the establishments provided for them altered with variations in training methods. On 15th February, 1944, these flights were disbanded and replaced by (Bomber Defence Training Flights (see below).

B.C./O.R.B. 31.3.43

Ibid 15.2.44

/(b) Air

(b) Air Bomber Training Flights (A.B.T.F.).

Ibid
15.3.43.
L.M.547/D. of O.
3.3.43.

These were formed in June 1942, and attached to Nos. 1481, 1483, 1484, and 1485 (Bomber) Gunnery Flights for the purpose of training Wireless Operator/Air Gunners for temporary employment as Air Bombers. They were disbanded on 15th March, 1943, their task being accomplished. Specially trained Air Bombers were by then being supplied.

(c) (Bomber) Defence Training Flights. ((B).D.T.F.).

Two of these flights were formed in each of the O.T.U. Groups on 6th June, 1943, to train crews in defensive tactics. They were equipped with six Tomahawks. On 15th February, 1944, the (Bomber) Gunnery Flights were disbanded and one of these (B) D.T.F's formed in each operational Group to replace them. They were equipped with Spitfire, Hurricane and Martinet aircraft.

(d) Mosquito Training Unit (M.T.U)

This has already been referred to in the section on O.T.U's. No. 1655 M.T.U. carried out a similar role to an O.T.U. for the Mosquito squadrons. At the beginning of the period the Unit Establishment was nine Mosquitoes and six Blenheims. The latter were used owing to the shortage of Mosquito aircraft. On 18th March, the Mosquito element was increased to 13 aircraft. On 1st May, the M.T.U. moved to Turweston and was incorporated in No. 13 O.T.U. It reformed on 1st June, at Finmere with 20 Mosquitoes and 8 Oxfords. It was administered by No.92 Group until 1st July, when it moved into No.8 Group at Marham and was reduced by 10 Mosquitoes. On 19th September the establishment was amended to 16 Mosquitoes and 8 Oxfords, at which it remained for the rest of this period.

(e) P.F.F. Navigation Training Unit (N.T.U.).

L.M.733/D. of O.
B.C./O.R.B.
21.3.43.

This Unit was formed on 21st March, 1943, for the purpose of training aircrews of the Pathfinder Force in P.F.F. technique, and in the use of the special equipment used by P.F.F. squadrons. It was located at Oakington under the operational control of No.8 (P.F.F.) Group, with an initial U.E. of four Stirlings, 4 Halifaxes and eight Lancasters. In August, the Stirlings were deleted, as there were now no Stirling aircraft in the Group. On 9th September the establishment was amended to nine Halifaxes and nine Lancasters. This was based on a monthly wastage of three crews per squadron. In addition, eight reserve navigators were required monthly. A total of 12½ flying hours was given for training replacement crews, and 25 hours for reserve navigators.

Ibid
5.9.43.

(f) Beam Approach Training Flights (B.A.T.)

B.A.T. Flights had been in existence in Bomber Command for some years. In February, 1943, there were 20 of these flights distributed amongst the Operational and Training Groups. They were

/equipped

equipped with about six to eight Oxford aircraft, and gave short courses to selected pilots in Beam Approach procedure. With the use of Gee for landing aircraft under bad weather conditions, the number of B.A.T. Flights in the Command was considerably reduced during the year. Some were transferred to other Commands, five were disbanded on 9th August, 1943, and two more in November. By February, 1944, there were only six B.A.T. Flights left in the Command, one in each Group except Nos. 1, 6 and 8. No. 8 Group had one Oxford attached to each station for Beam approach training.

Ibid
L.M. 2103/D. of O.
6.8.43.
B.C./O.R.B.

Ibid
27.11.43.

(g) Ferry Training Units (F.T.U.)

These units were for the purpose of training crews to ferry aircraft overseas. No. 307 F.T.U. was re-equipped from Blenheim to Boston aircraft on 13th March, 1943. On 30th April No. 1443 Ferry Training and Development Flight was renamed No. 310 F.T.U., and No. 1446 F.T. Flight was renamed No. 311 F.T.U. These two were re-equipped on 7th July from Wellingtons to Ansons. They were located at Harwell and Moreton-in-Marsh respectively, the two overseas O.T.U's. On 11th July No. 312 was formed at Wellesbourne Mountford, but it was found to be unnecessary and disbanded again on 28th July. Owing to the reduced overseas commitment No. 310 F.T.U. was also disbanded on 17th December, 1943.

(h) Night Vision Training School (N.V.T.S.).

A central N.V.T.S. was formed at Upper Heyford on 25th April, 1943, with 15 Unit N.V.T.S's distributed throughout the Command, to improve the night vision and use of the eyes at night of bomber aircrews. Two more were added during the year.

(i) Night Bomber Tactical School

This school was formed at Headquarters, Bomber Command, on 17th August, 1943. Its function was to give tactical instruction to H.C.U. Instructors, Operational Squadron personnel, Group Tactical Officers, O.T.U. Flight Commanders and Fighter Wing Commanders. Eight to ten pupils were taken for one week's course.

(j) Bombing Development Unit.

This unit, although not strictly speaking a training unit, is included here as it was a non-operational unit of the Command. In February 1943, it had a Unit Equipment of three Wellington, four Halifax, two Lancaster, two Stirling and one Proctor aircraft. Its purpose was to carry out trials and experiments with any new bombing or navigational equipment produced for the Command. Its establishment and equipment varied accordingly. On 7th December, 1943, it was reorganised on a two-flight basis, owing to the increase in its commitments regarding various types of Radar equipment. Fighter type aircraft were added for use in tactical trials. It then consisted of a Development Flight and a Radar Training Flight.

B.C./O.R.B.
7.12.43

CHAPTER 5

NEW EQUIPMENT

(1) Development of Technical Aids

The new technical aids with which the bomber force had been provided by 1943 were of even more importance to the success of its operations than the expansion in its size. They were the result of three years experience, during most of which aircrews had no assistance other than their own eyesight in locating their target. The introduction of radio aids revolutionized bombing technique and efficiency. Only one chapter is devoted to them here, however, as they are fully dealt with in specialized narratives, to which reference is made. Their operational use is frequently referred to later in this narrative.

The rapid development of radio aids during the year 1942, has been described in Volume IV. By February, 1943, Bomber Command was already using three such aids-Gee, Oboe and H2S - in addition to radio counter-measures against the enemy defences. All these were developed and expanded during the period under review, and an additional bombing device, G.H., was introduced in October/November, 1943.

The Pathfinder system took advantage of these navigational and bombing aids at the earliest moment. The aircraft first equipped were used to lead the main force to the target, and to mark the aiming points. This necessitated a rapid development in methods of target marking. Coloured flares, ground and sky markers were produced.

The bomber force could now be concentrated both in time and space, to produce the maximum effect with the minimum losses. It had long been proved that saturation of the defences - both fighter, A.A. and searchlights - was the secret of economy. With this concentration, moreover, radio counter-measures could be taken. Specially - equipped aircraft, as well as ground stations, were used to jam the signals of enemy fighters and their control, and to screen the bomber force from radio identification for as long as possible.

Finally, the technical development of bombs as a result of experience put the final touch to the efficacy of the bomber force. Bombs of increased size and efficiency were now available. Special weapons were produced for special tasks such as Dam - busting, and the increased use and improved performance of incendiary bombs had a devastating effect upon the German war potential.

(2) Gee and Gee - H

~~O.S.13530~~
~~"How Gee Works"~~

The first radar navigational aid available to Bomber Command was Gee, which was first used operationally on 8th March, 1942. It provided an aircraft with a fix from the intersection of two position lines. These were obtained by measuring at the aircraft the difference in time between the receipt of two pulses of radio energy, each of which had been transmitted by separate fixed ground stations synchronised with each other. These position lines were

/read off

AHB/IIH/241/3/484
~~BC/S.26282~~
File

read off from a lattice chart carried in the aircraft. The development of Gee to 1943 has been dealt with in Volume IV.

A.H.B. Signals Narrative "Gee"

The ground stations consisted of a chain of one "master" and two or more "slaves" to cover each section of enemy territory. In February 1943, the Eastern, Southern and Northern chains had been set up. A South Western chain was added in September, 1943.

The Mark I Gee receiver was in use at the beginning of the period. Owing to its limited range of frequencies, it could be easily jammed, and was already of little use on the Eastern chain except for homing. The changeover to Mark II equipment was accomplished between February and April, 1943. This enabled the operator to change frequencies, and so operate different chains, whilst airborne. A target frequency (XF) was introduced in April. An aircraft could change to this when it reached the target area, a system which remained undetected by the enemy until June, 1943.

Ibid "Gee - H"

Gee - H was a development of Gee combined with H, a system which had been shelved in 1940, because it could only be used by a small number of aircraft. An aircraft equipped with Gee - H had all normal Gee facilities with an additional transmitter. This sent pulses to two ground beacons, which repeated them back to the aircraft. The time taken was measured, and converted to miles, giving a fix whose error was only about 200 by 400 yards under operational conditions. Thee Gee - H lattice chart incorporated range circles from the ground beacons. The navigator had merely to set up two co-ordinates given to him at briefing.

It was decided to instal Gee - H in those aircraft unsuitable for H2S equipment, namely Lancasters with 8,000 lb bomb doors. In addition No. 139 Mosquito squadron of No 8 (PFF) Group was equipped, and first used the device operationally on 7th/8th October, 1943.(1) The Lancasters first used it for blind bombing on 3rd/4th November.

(3) Oboe

Oboe used the standard Beam approach system of aural indication to guide a pilot along his course - dots on one side of the track, dashes the other side. These were transmitted by a ground station called the "Cat", and the return pulses from the aircraft transmitter were received by the "Mouse" station, which plotted the position of the aircraft along its track. The point of bomb release was signalled to the navigator, with an accuracy of the order of 60 ft by 200 ft.

T.R.E. Memo Oboe - How it Works.

A.H.B. Bomber Narrative Vol.IV.

The development of Oboe during 1942 has been dealt with in the preceding Volume. It was first used operationally on 20th December, 1942. Up to January, 1943, the oboe-equipped Mosquito squadron, No. 109 (PFF), was used in blind-bombing attacks, to gain operational experience. On 1st January, 1943, and thereafter, it was used to mark the bomb-release point for the main force.

/The chief

(1) An unsuccessful operational trial was carried out on 4th/5th October, against Aachen.

The chief drawbacks to the use of "Oboe" were its restricted range and the fact that only one aircraft could be handled by each pair of cat and mouse stations per 10 minutes. Also, the aircraft was required to fly straight and level for this period on its approach to the target, to enable the bomb-release point to be accurately assessed.

A46/
I.D 4/178

It was hoped to improve the range by the use of "repeater" aircraft stationed half-way to the target, and experiments were carried on during 1943. Success was not achieved, however, owing to technical faults. (Experimental operations were carried out on a single channel only). It was finally decided in November to await the introduction of the Mark II Oboe equipment in 1944. The second difficulty was dealt with by increasing the number of "cat" and "mouse" stations to provide sufficient marker aircraft. Whilst the risks entailed by the straight and level approach were decreased by the use of the fast and high flying Mosquito aircraft.

Ibid

Although jamming of Oboe Mark I by the enemy was expected, it did not take place until November, 1943, and then not to a serious extent. Only one Oboe Mosquito was lost up to this time over enemy territory, in May, 1943, and it was presumed the equipment was destroyed. Meanwhile Mark II Oboe was developed on a much higher frequency. This would make it more difficult to jam, so that it could replace the Mark I, when interference with that should render it ineffective. The development of Oboe ground stations and the technical improvements achieved are described in the signals narrative.

A.H.B. Signals Narrative Oboe

By June, 1943, No. 109 Squadron had expanded to three flights of oboe equipped Mosquitoes, the third being a training flight. On 1st July, No. 105 was added as a second Oboe squadron. The third flight of No. 109 Squadron was incorporated in No. 1655 Mosquito training unit, to train crews for both squadrons. These two squadrons continued to provide the Oboe force for the Command throughout this period. By September, 1943, No. 105 Squadron was beginning to equip with the Mark II version, but it was not until January, 1944, that the Mark II "Album Leaf" type began to be used as standard equipment.

(4) H2S

H2S was the first system of radio aid to navigation and bombing which was entirely independent of ground stations. All the apparatus was in the aircraft itself. Its principle was the same as the A.S.V. used to locate enemy shipping and especially U-boats. It was found that radar impulses transmitted from an aircraft gave back varying reflected impulses from water, open country and built-up areas. These differences were by degrees defined to such an extent that it was possible to identify coastlines, rivers, towns and even individual factories by the type of reflection they produced on the Cathode Ray tube Scanner.

By this means targets and navigational pinpoints could be identified in total darkness or through cloud. This system was, moreover, not limited by range, since it was entirely independent of ground assistance. Its operation, however, required far greater experience than did Oboe, and its effectiveness was not so immediate. A considerable period of experience and improvement of the definition of the reflected picture was required before it became accurate and reliable.

B Ops 1 Folder "Oboe and H.2S Results".

H2S was first used operationally as a target marking device on 30th/31st January, 1943. Bomber Command had already requested that H.2S should be supplied as standard equipment to all bomber aircraft. "The ease with which targets have been identified and attacked", says a Bomber Command report on 9th February, 1943, "proves that if this device were introduced into as many heavy bombers as possible, it would greatly increase destructive power of the bomber force and considerably reduce the restriction imposed on operations by adverse weather conditions".

C.30305/46 Pt.1 Encls. 164B, 169B.

The supply of H.2S sets was insufficient to meet the demands of Bomber and Coastal Commands. In March, 1943, the demand and supply position was reviewed, and a programme up to September was laid down. It was hoped to complete the equipment of the six Heavy PFF Squadrons by 31st July, and fit five Lancaster and two Halifax squadrons of the main force by 30th September. This production rate was speeded up by May so that an additional 50 Halifaxes could be promised for August.

Ibid Encl. 236A

On 24th September, 1943, it was reported that there was a deficiency of 35 sets on the target figure laid down. By this date further experience had shown certain weaknesses in the existing equipment. The most important were insufficient accuracy, and the difficulty of interpreting H2S responses under operational conditions. In October, therefore, the C.in.C. of Bomber Command pressed for the introduction of 3 centimetre H2S (Mark III). This gave much improved definition on the scanner. It had been arranged to equip 3 PFF squadrons by the end of the year. The C.in.C. asked for six to be equipped with Mark III A, which incorporated a roll-stabilised barrel scanner, to avoid distortion of the picture, and an improved indicator. In spite of Coastal Command agreeing to Bomber Command's priority over their claims to 3 cm ASV, production delays resulted in only 15 reaching the Pathfinder squadrons by the end of January, 1944. By then Mark III had conclusively proved its operational superiority.

Ibid Encl. 247A

AHB/ ID4/175A 3/11/43

PFF Monthly Summary, Jan. '44.

AHB/ ID4/175A

By the end of the period, mid-February, 1944, the total of H2S equipment fitted to Bomber Command aircraft was:- Stirling 74, Halifax 407, Lancaster 694. Of this total of 1175 sets, 491 had been lost, and 591 were held in units at that date. All the heavy Pathfinder squadrons were equipped, and eighteen of the Main Force squadrons, in addition to some training units.

(5) Warning Devices

In addition to the use of Radar as a navigational and bombing aid, equipment was devised to give warning of attack by enemy aircraft. Three types were developed and used during 1943 - Fishpond, Monica and Boozer.

AHB/ ID4/175A

Fishpond consisted of an extra indicator unit fitted to an H2S installation. This gave visual warning of the presence of other aircraft below the horizontal plane of the aircraft to which it was fitted. It was a short range presentation on a Cathode Ray viewer of the H2S picture. Any aircraft seen had to be identified by its actions, e.g., a rapid approach from below.

/Monica Mark

914/R2
Monica

Monica Mark I was a similar device independent of the H2S set, which gave tail warning only. It covered approximately 60° in elevation and 120° in azimuth. Its range coverage was from about 3000 ft. to 500 ft.

Boozer was an interrogator set, used to identify the transmissions of enemy A.1. An enemy fighter equipped with A.1. could be identified by its response. With the introduction of devices for jamming the enemy A.1., especially Window, the enemy fighters were forced to abandon the use of their A.1. sets. Boozer was then no longer effective.

(6) Radio Counter - Measures. (R.C.M.).

See Signals Narrative Vol. VIII, Pt. II.

The jamming of the enemy defensive radio network had long been proposed, and the means devised. Up to 1942, however, it had been considered inadvisable. Any method used could be copied by the Germans, to the detriment of the fighter defence of Great Britain. By 1942, the preponderance of air power was sufficiently on the side of the Allies to risk the initiation of these measures. A chain of ground stations was first set up, to interfere with enemy signals by the use of high-powered transmitters on the same frequencies. Later, aircraft were equipped with transmitters and sent over enemy territory to carry on this interference. The use of Tinsel and Mandrel jamming transmissions was begun by bomber aircraft in December 1942.

See Chapter III (6)

The importance of this "radio war" became obvious in 1943. This led to the growth described in Chapter III above, culminating in the formation of a special Group in Bomber Command, No. 100 Group, to take charge of all radio counter-measures. Finally, Window, the most effective of all these counter-measures in aiding the bomber force, began to be used in 1943.

Window was the code name given to small strips of metal-coated paper. These, when dropped from aircraft in quantity, simulated a large force of aircraft on a radar installation. This enabled a small force of Mosquitoes to decoy the enemy fighters to one area, while the main force went to another. Alternatively at some point on the main force route, a small decoy force could carry on, dropping Window, while the main force turned away to bomb a target to the side.

C.O.S.(43) 227(O)

The importance attached to the use of Window is illustrated by a note by the Air Staff to the Chiefs of Staff Committee on 1st May, 1943:-

"By the use of Window we should expect to save, during the 8 months from 15th May, 1943, some 455 bombers and their crews. This would not only sustain the strength of our bomber force but would also increase the average of its experience and therefore of its efficiency. This would still further reduce losses and greatly increase morale.

The Window idea is so simple that the enemy could very soon use it against us even if he had not thought of it before we used it. If he uses it, we must expect our own night defence, at home and overseas, to be reduced temporarily to about 20% of its present efficiency".

ID4/186

It was finally decided to postpone its use until after Operation Husky, the invasion of Sicily, as this might have been affected by the enemy's use of Window. It was first used in operations, therefore, on 24th/25th July, 1943, in an

/attack

attack on Hamburg. It was at once evident that it caused confusion in the German ground control stations. The sky appeared to them to be full of aircraft. There was an immediate fall in the loss rate of Bomber Command, and the enemy had to reorganise his night fighter control system.

The German ground stations could now only give very general information and instruction to their night fighters and these had to go back to a more primitive "catseye" technique, often without the aid of their A.I. installations. It was thus an easier matter to jam the instructions by powerful transmitters. To add to their difficulties false instructions were transmitted by the ground stations in the British Isles. And finally, at the end of this period, night fighters were sent out with Serrate sets, which homed on enemy fighters, and attacked them.

Table VI - Warning Devices and Countermeasures in use, 1943

Code Name	Description and Purpose	Date of Introduction.
Shiver	Modulated I.F.F., against Wurzburgs	Oct. 1942.
Mandrel	Air and ground jamming sets, against FREYAS	4 per Sqdn. Dec. 1942.
Tinsel	Aircraft transmitter used for jamming H.F/R.T.	Dec. 1942.
Boozer	A.I. interrogator in aircraft	Late 1942.
Ground Grocer	Transmitter at Dunwich, to jam A.I.	April, 1943.
Window	Metallised paper to simulate aircraft on Radar receivers	July 24th, 1943.
Ground Cigar	Transmitter at Sizewell, to jam VHF/RT	July 30th, 1943.
Airborne Cigar or A.B.C.	Ditto in No. 101 Squadron aircraft.	Oct. 7th, 1943.
Corona	Transmitter to jam running commentary or transmit false messages.	Nov. 1943.
Monica Fishpond	Warning devices in aircraft, showing approach of hostile.	Late 1943.
Dartboard	High-power transmitter, to jam Stuttgart transmitter musical codes.	Dec. 1943.
Drumstick	To jam W/T transmissions (Restrictions imposed on use of I.F.F.	Jan, 1944. Jan, 1944).

(7) Target Markers

See Volume IV

The early tactics of the Pathfinder Force used large numbers of 4.5 in. reconnaissance flares to find and mark the target, followed by incendiary bombs to maintain the marking. This use of flares, was found to dazzle the bomb-aimer, especially in hazy conditions, whilst the wide scatter and the drift of the flares made it difficult to choose the centre point at which to aim. Incendiaries also suffered from scatter effect, as well as being easily imitated by the enemy, and not being visible through cloud.

C.S.16502
Encl. 135A

This early experience led to the demand for hooded flares and target marker bombs. Three hooded flares were produced during 1942 - a 5.5 in. with an umbrella shade, the American M.26 of a similar type, and the 4.5 in. cylindrical shield type. The two former gave incomplete shading, but the latter gave excellent results. In its early form, with a 12 in. shield, it took up too much stowage space. A folding version was evolved with a collapsible asbestos hood of 7 in. diameter, so that a cluster of four could be stowed in a 500 lb. bomb stowage.

Ibid
Encl. 75A

Target marker bombs were developed in 4000 lb., 2000 lb., and 250 lb., casings. The first two were found to be uneconomical, and development was concentrated upon the 250 lb., version. These were produced with red, green, yellow and white candles, and were first used on the night of 16th January, 1943 against Berlin. To counter enemy imitation, a large variety of fillings were later used, including shortened 4 lb. incendiaries, multiple flashes, and delays to lengthen the time of burning. The various types of these are given in Table VII, whilst the course of development of all these weapons is described in the A.H.B. "Armament" Narrative.

Ibid
Encl. IIIA

To overcome the handicap of clouds covering the target, and obscuring ground markers, sky markers were developed. These were required with the introduction of blind bombing devices. A large variety were evolved during the year 1943. The following are the most important:-

(a) A 4.5 in. flare dripping magnesium, which burnt with a white flame to about 500 ft. below the flare.

(b) Coloured 4.5 in. flares, red, green, red with green stars, green with red stars, red with yellow stars, and green with yellow stars.

(c) Cluster projectiles containing 4.5 in. flares with varying delays, or combinations of the above sky markers. A full list of the various types in use can be found in Table VII.

A rocket-propelled flare was requested by the PFF, but after a long period of experiment was abandoned as impracticable in the form in which it was required. A tracer flare was devised, which consisted of a pyrotechnic candle attached to the tail of a marker bomb, giving a Meteor effect. This enabled the bomb aimer to trace the course of the bomb, and drew the attention of other aircraft crews to it.

/ One of

Ibid
Encls. 75A, etc.

One of the most important factors in the production of these flares and sky markers was the successful development of a barometric fuze (No. 860). This made it possible to ignite them at any required level, without any tactical limitation of the aircraft as to the height of release. It also made possible the chain effect obtained from clusters, by igniting each flare at a different height.

Ibid
Encl. 212A.

In September, 1943, a 1000 lb. T.I. bomb was introduced to replace eventually, the 250 lb. varieties. The efforts of the enemy to simulate existing markers made it necessary to introduce still more complexity into the patterns of pyrotechnic used. The 250 lb. T.I. in all its varieties (see Table VII) continued to be the standard marker bomb throughout this period. A 1000 lb. version was used in addition containing 200 candles, divided into 35 non-delay and 33 each with a delay of $2\frac{1}{2}$, 5, 7, 9 and 11 minutes. A total burning time of 12 minutes was thus achieved. Larger clusters of sky markers were also developed towards the end of the period.

TABLE VII P.F.F. SPECIAL WEAPONS, 1st OCTOBER, 1943

Official Service Nomenclature	Description	Colloquial Name
GROUND MARKERS		
Bomb, a/c, Target Identification 250-lb No. 2 Mark I (Followed by colour, Red, Green, Yellow	Filled 60 coloured candles each burning for 3 mins (4 candles contain explosive units)	No. 2 T.I. Red No. 2 T.I. Green No. 2 T.I. Yellow
Bomb, a/c, Target Identification 250-lb No. 4 Mark I (Followed by colour Red, Green or Yellow	Filled 20 candles with no delay (4 candles contain explosive units) 20 candles with $2\frac{1}{2}$ minute delay. 20 candles with 5 min. delay.	No. 4 T.I. Red No. 4 T.I. Green No. 4 T.I. Yellow
Bomb, a/c, Target Identification 250 lb No. 9 Mark I (Followed by colour, Red, Green or Yellow)	Filled with 60 candles each having a delay of $2\frac{1}{2}$ mins	No. 9 T.I. Red No. 9 T.I. Green No. 9 T.I. Yellow
Bomb, a/c, Target Identification 250-lb No. 10 Mark I (Followed by colour Red, Green or Yellow)	Filled with 60 candles each having a delay of 5 mins	No. 10 T.I. Red No. 10 T.I. Green No. 10 T.I. Yellow
Bomb, a/c, Target Identification 250-lb No. 8 Spot Fire Mark I Red	Filled cotton wads saturated in solution of strontium perchlorate dissolved in alcohol. Time of burning 15-20 mins. giving a deep red steady glow.	No. 8 T.I. Red
Bomb, a/c, Target Identification 250-lb No. 7 Multi-flash Mark I Red (or other colour)	Filled 210 Flash units functioning successively with intervals averaging 1.5 secs. continuing for approximately 5 mins. Bomb normally dropped in salvo.	No. 7 T.I. Red (or other colour)
Bomb, a/c, Target Identification 250-lb No. 11 Photoflash Mark I	Filled Standard shortened 4.5 in. Photoflash and sand ballast	No. 11 T.I. Photo
Bomb, a/c, Target Identification 250-lb No. 12 Photoflash Mark I Red, Green or Yellow	Filled Standard Shortened 4.5 in. Photoflash and 40 $2\frac{1}{2}$ minute delay candles	No. 12 T.I. Photo Red No. 12 T.I. Photo Green No. 12 T.I. Photo Yellow
Bomb, a/c, Target Identification 250-lb No. 13 Photoflash Mark I Red, Green or Yellow.	Filled Standard Shortened 4.5 in. Photoflash and 40 non delay candles	No. 13 T.I. Photo Red No. 13 T.I. Photo Green No. 13 T.I. Photo Yellow

G.225497/DEW/11/49.

Official Service Nomenclature	Description	Colloquial Name
GROUND MARKERS (Cont'd)		
Bomb, a/c, Target Identification 250-lb No. 15 Mark I (followed by colours, Red, Green or Yellow)	Filled 30 Non-delay Candles and 30 Non-delay Candles containing explosive units	No. 15 T.I.X. Red No. 15 T.I.X. Green No. 15 T.I.X. Yellow
Bomb, a/c, Target Identification 250-lb No. 16 Mark I (followed by colour, Red, Green or Yellow	Filled 60 candles incorporating successive delays giving a total burning time of 12 minutes (Route marker)	No. 16 T.I. Red No. 16 T.I. Green No. 16 T.I. Yellow
Bomb, a/c, Target Identification 1000-lb Mark I (followed by colours Red, Green or Yellow)	Filled on the same general lines as the 250-lb T.I. Forms not yet determined	No. 20 T.I. Red No. 20 T.I. Green No. 20 T.I. Yellow
SKYMARKERS		
Flare Target 4.5in. Mark I Red Flare Target 4.5in. Mark I Green	Coloured flare burning steadily for approximately 3 minutes.	Red Flare Green Flare
Flare Target 4.5in. Mark I Red with Green stars	Flares with primary colour burning for approximately 3 minutes ejecting 7 stars at 20 sec. intervals each burning for 8 secs.	Red Green Star Flare.
- do - Green with red stars - do - Red with yellow stars - do - Green with yellow stars		Green Red Star Flare. Red Yellow Star Flare. Green Yellow Star Flare.
Flare, Aircraft, Skymarker, 30-lb Mark III white Drip	Bright White flare dripping molten magnesium producing a tail of up to 1000 ft. in length.	White Drip Skymarker
Bomb, a/c, Target Identification 250-lb No. 14 Skymarker Mark I (followed by colours, Red, Green or Blue.).	Filled 25 Candles. Each on a 38 in. parachute burning for 4 minutes in the air.	No. 14 T.I. Red No. 14 T.I. Green No. 14 T.I. Blue

Official Service Nomenclature	Description	Colloquial Name
CLUSTER PROJECTILES		
Cluster, Projectiles, aircraft 18in. 270-lb No. 1 Mark 1/A accommodating 7 x 4.5in. flares.	Cluster Projectile containing 7 x 4.5in. Reconnaissance flares disintegrating at 6,000 ft. and flares opening. 2 Mark VI (4 min. delay) at 6,000 ft. and 2 Mark V (2 min. delay) at 4,000 ft. and 3 Mk.IV (no delay) at 2,000 ft. All flares therefore ignite at 2,000 ft. giving continuity of burning over approximately 7 - 8 mins. Employing one 860 fuse.	C.P. No. 1 Recco.
	Cluster Projectile containing 7 x 4.5in. coloured skymarker flares disintegrating at required height and ejecting flares each fitted with delay igniters giving a successive delay in functioning, thereby producing a vertical chain effect. Employing one 860 fuse.	C.P. No. 1 Chain.
Cluster, Projectile, aircraft, 12in.,140-lb No. 2 Mark 1A accommodating 4 x 4.5in. flares.	As above but containing 4 x 4.5in. flares for Mosquito Stowage.	C.P. No. 2 Recco. C.P. No. 2 Chain.
Cluster, Projectile, aircraft. 18in.,400-lb. No.3 Mark IA accommodating 4 x 7in. Hood Reconnaissance flares.	Cluster Projectile containing 4 x 7in. Hooded Flares, disintegrating at the required operational height. Employing one No. 860 fuse.	C.P. No. 3
AIR BURST FUSES.		
Fuse, Aircraft Flare, Nose No. 860 Mk. II (Nose fusing)	Barometrically operated, functioning at a predetermined height above sea level at a barometer pressure of 1012 millibars. Selective settings based on a 4.5in. Flare T.V.	860 A etc.
Fuse, Aircraft Flare No. 867 Mk. 1/a (Tail Fusing)	Barometrically operated functioning at a predetermined height above sea level at a barometer pressure of 1012 millibars housed in the tail and operates independently of height of release and T.V. of Store.	867
Fuse, Time, Aircraft Flash, No. 848 Mk. V.	Operated by selective delay capsule functioning at a pre-determined height below the aircraft.	848

(8) Bombs and Bombsights.

Many of the weapons used early in the war were found to be inefficient and uneconomical when photographic cover was available to assess their effects. By 1943 the results of experience, in the shape of new and better bombs, were becoming available. A brief description of those introduced during this period is given below. A full list of the bombs used is in Table VIII, whilst the story of their development and production can be found in the Armament Narrative prepared by Air Historical Branch.

Bomber Command Return of Bomb Expenditure 1943.

Up to February, 1943, the majority of bombs used had been of the General Purpose type - 40, 250, 500, 1000, 1900 and 4000 lbs. The 2,000 and 4,000 lb. High Capacity bombs were introduced in 1941, and used as aircraft capable of carrying them became available. The Medium Capacity series of bombs was developed to replace the G.P., which was obsolescent by 1943. The first M.C., of 500 lbs. weight, was introduced in mid 1942, the remainder, 1000, 2000, and 4000 lbs., in early 1943. Larger High Capacity bombs were produced by joining together sections of the 4,000 lb. H.C. The 8,000 lb. H.C., was introduced in 1942, and the 12,000 lb. H.C. in October 1943. The Lancaster had to be specially modified to carry it.

A special H.E. bomb of 9,100 lbs., weight was designed for the "Chastise" operation to breach the Mohne, Eder and Sorpe dams. This bomb, invented by Mr. Wallis, of Vickers, had a thin case, with a very high charge-weight ratio, and was designed to spin on entry to the water of the reservoir. This bomb was given the name "Upkeep", and was only used on 16th May, 1943, for the highly successful "dam-busting" operation.

The 4 lb. incendiary used from the beginning of the war remained the most efficient and generally used incendiary bomb during this period. An explosive charge had been added to a small proportion of these bombs in 1942 as a deterrent to fire fighters. And during 1943, they were incorporated in a cluster projectile to give better trajectory for aiming, and more economical stowage in the bomb bays. The 30 lb., 250 lb., and 4000 lb., incendiary bombs were relatively inefficient and seldom used.

A minute from Lord Cherwell to the Prime Minister dated 16th September, 1943, gives the relative efficiency of these different types of bombs as assessed by photographic investigation of German cities as follows:-

AIR/ID4/252

Estimated Acres of Damage per ton of Bomb

4 lb. Incendiary 30 lb. "	$3\frac{1}{4}$
8,000 lb. H.C.	$1\frac{3}{4}$
4,000 lb. "	$1\frac{1}{2}$
2,000 lb. "	$1\frac{1}{4}$
1,000 lb. M.C.	$\frac{3}{4}$
500 lb. "	$\frac{3}{4}$
1,000 lb. G.P.	$\frac{1}{2}$

In agreeing with this estimate the Chief of the Air Staff commented that fire damage was not only some three times as widespread per ton dropped as damage caused by H.E., but was also of a more lasting character. It had been

/planned

planned to use a percentage of two thirds incendiary to one third H.E. in bomb loads. Bomber Command had so far been forced to use a 50/50 ratio owing to the uneconomical stowage of incendiaries in most aircraft up to this time. With modifications to incendiary containers, and the new incendiary cluster projectiles it was hoped soon to achieve the aim of two thirds to one third.

The Mine in use during this period was unaltered except in fusing and minor modifications. It was the original magnetic mine of approximately 1500 lbs. weight, first used in 1940. The case had since been strengthened and the fusing improved, so that it could be laid from a higher level where necessary.

BC/S29972

Despatch by A.O.C. in C.

The Course Setting Bombsight was still the standard sight in use by Bomber Command at the beginning of this period. The Automatic Bombsight (ABS) had been supplied to No. 5 Group. During 1942, the new Mark XIV was in full production, and it came into general operational use during 1943. Another new sight, the Stabilised Automatic Bombsight (S.A.B.S.) was supplied to No. 5 Group during the spring of 1943. This was an improved version of the A.B.S., stabilised against the pitch and roll of the aircraft.

AP. 1730A

BC/S29972
Encl. 58A

The Mark XIV Bombsight consisted of a sighting head and a computor box. The latter automatically computed the data necessary for setting the bombsight, from the aircraft instruments. The two great advantages of the Mark XIV over the C.S.B.S. were the tactical freedom it gave, being accurate in a slight climb, dive or turn as well as straight and level; and the fact that all its settings could be made in advance on the ground, leaving the bomb-aimer free to concentrate upon his objective. It was only necessary to correct for any error which might be found in the pre-set meteorological wind. Any alterations in height, course or air speed were automatically allowed for by the sight. The Mark XIV was fitted to some 75% of the Halifaxes and Stirlings, and 40% of the Lancasters in Bomber Command by July 1943. The C. in. C. stated at this time that "the provision of the Mark XIV sight has increased the effectiveness of the bomber offensive out of all recognition". By January, 1944, the majority of heavy bombers were fitted with this new sight, whilst the Wellingtons were fitted with the T.I. bombsight, which was the American version of it.

Despatch by A.O.C. in C.

The S.A.B.S. did not have a long life in Bomber Command, as the Mark XIV was found to be superior to it in ease of manipulation. The S.A.B.S. was fitted to two squadrons, Nos. 97 and 207, of No. 5 Group in February 1943. In May, Air Ministry agreed to its withdrawal from the Command, and the fitting of all Lancasters with the Mark XIV. In addition to requiring highly-skilled operation the S.A.B.S. compressor was inaccurate above 15,000 feet, and it was necessary to fly straight and level for the final approach to the target. In September 1943, it was decided to equip No. 617 Squadron with the S.A.B.S. Mark IIA, as it was extremely accurate against pinpoint targets in the hands of a skilled crew.

TABLE VIII

BOMBS IN USE. 1943.

HIGH EXPLOSIVE

TYPE	DESCRIPTION	PURPOSE	INTRODUCED	REMARKS
GENERAL PURPOSE (G.P.). 40 LBS.	Thick-cased, Stream-lined.	Anti-personal	Pre 1939 War.	Normally carried (6) in 250 lb. SBC (Small Bomb Container).
20 LB F.	"	"	"	Normally carried (12) in S.B.C.
A. 250 LB. B. 500 " C. 1000 " D. 1900 " E. 4000 " General Purpose (G.P.)	"	Attacks against targets not strongly protected where penetration and fragmentation were more important than blast.	A. Pre 1939 War B. " " " C. " " " D. 1940 E. 1942	Obsolescent in 1943, and were being expended pending adequate supplies of M.C. Bombs.
A. 500 LB. B. 1000 LB. C. 2000 LB. D. 4000 LB. MEDIUM CAPACITY (M.C.)	Medium-cased, parallel-sided bomb.	Attacks against targets as above, with increased blast performance as the main asset	A. Mid 1942. B. February, 1943 C. Not known D. February, 1943	The successors to the G.P. series. Improved design and H.E. filling ratio gave much better performance. Very few 2000 lb. bombs made or used.
A. 2000 LB. B. 4000 " C. 8000 " D. 12,000 LB. HIGH CAPACITY (H.C.)	Thin cased Blunt nosed	General bombardment against targets where penetration was unimportant but maximum blast effect was necessary.	A. March, 1941 B. " " C. April, 1942 D. October, 1943	(c) & (d) formed of sections of (b), 4000 lb. bombs being the largest that could be handled by Filling factories at the time.
600 LB. (ANTISUBMARINE (A.S.)	Thin case, with high charge/weight ratio Operated by Hydrostatic fuse.	Submarine attack.	June, 1943	

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TABLE VIII (Contd.)

BOMBS IN USE. 1943.

HIGH EXPLOSIVE.

TYPE	DESCRIPTION	PURPOSE	INTRODUCED	REMARKS
2000 LB. (ARMOUR-PIERCING (A.P.)	Thick cased, parallel - sided bomb, with heavy reinforced sharp nose.	Attacks against heavily armoured targets, e.g. when explosion must take place after penetration.	Pre 1939.	
9,100 LBS. SPINNING BOMB ("UPKEEP")	Thin-cased, spherical bomb, high C/W ratio	Attack against Dams	March, 1943	Special Bomb, designed for the attack on MOHNE, EDER and SORPE Dams by Mr. Wallis (Vickers Aviation Ltd.) and successfully used by 617 Squadron on the night of 16th May, 1943. Used only on this occasion.

TABLE VIII (Contd.) BOMBS IN USE. 1943.

INCENDIARY.

TYPE	DESCRIPTION	PURPOSE	INTRODUCED	REMARKS.
4 LB. inc.	Hexagonal Bomb, Magnesium alloy case. Filling and case highly inflammable.	General incendiarism.	September, 1937.	Carried in a) 250 lb. S.B.C's. b) Cluster Projectiles a) for scatter - bombing b) to give a reasonable aiming trajectory.
4 lb. HE/INC.	As above, but fitted with small delayed H.E. charge in nose.	" with H.E. as a deterrent to fire fighters.	March, 1942.	
30 lb. inc.	Light case, Liquid filled, adapted from 30 lb. (L.C.). (chemical weapon) bomb.	General incendiarism with moderate penetration	February, 1941.	Carried in 250 lb. S.B.C's
250 lb. inc.	as above adapted from 250 lb. L.C. bomb	"	1941.	Carried on bomb-racks.
4000 lb. inc.	Liquid filled. 4000 lb. H.C. case.	General incendiarism	August, 1942.	Used in small quantities only on special operations.

ANNEX SECRET

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A P P E N D I C E S

CASABLANCA DIRECTIVE

The Bomber Offensive From The United Kingdom

Directive to the appropriate British and United States Air Force Commanders, to Govern the operation of the British and United States Bomber Commands in the United Kingdom.

(Approved by the Combined Chiefs of Staff at their 65 Meeting on January 21, 1943).

YOUR primary object will be the progressive destruction and dislocation of the German military, industrial and economic system, and the undermining of the morale of the German people to a point where their capacity for armed resistance is fatally weakened.

2. Within that general concept, your primary objectives, subject to the exigencies of weather and of tactical feasibility, will for the present be in the following order of priority:-

(a) German submarine construction yards

(b) The German aircraft industry

(c) Transportation

(d) Oil plants

(e) Other targets in enemy war industry

The above order of priority may be varied from time to time according to developments in the strategical situation. Moreover, other objectives of great importance either from the political or military point of view must be attacked. Examples of these are -

(i) Submarine operating bases on the Biscay coast. If these can be put out of action, a great step forward will have been taken in the U-boat war which the C.C.S. have agreed to be a first charge on our resources. Day and night attacks on these bases have been inaugurated and should be continued so that an assessment of their effects can be made as soon as possible. If it is found that successful results can be achieved, these attacks should continue whenever conditions are favourable for as long and as often as is necessary. These objectives have not been included in the order of priority, which covers long-term operations, particularly as the bases are not situated in Germany.

(ii) Berlin, which should be attacked when conditions are suitable for the attainment of specially valuable results unfavourable to the morale of the enemy or favourable to that of Russia.

3. You may also be required, at the appropriate time, to attack objectives in Northern Italy in connection with amphibious operations in the Mediterranean theatre.

4. There may be certain other objectives of great but fleeting importance for the attack of which all necessary plans and preparations should be made. Of these, an example would be the important units of the German Fleet in harbour or at sea.

5. You should take every opportunity to attack Germany by day, to destroy objectives that are unsuitable for night attack, to sustain continuous pressure on German morale, to impose heavy losses on the German day fighter force and to contain German fighter strength away from the Russian and Mediterranean theatres of war.

/6. When

6. When the Allied Armies re-enter the Continent, you will afford them all possible support in the manner most effective.

7. In attacking objectives in occupied territories, you will conform to such instructions as may be issued from time to time for political reasons by His Majesty's Government through the British Chiefs of Staff.

APPENDIX 2

SECRET

TARGETS RECOMMENDED BY THE MINISTRY OF ECONOMIC WARFARE - 4TH FEBRUARY, 1943

Priorities For Air Attack Among Economic Targets in 1943

Summary and Conclusions

1. The main aim should be the maximum interference with the supply of weapons and equipment to the German Armed Forces in the field.

2. The comparative importance to the enemy of the different categories of weapon production is a matter for military rather than economic appreciation, but it is the tactical and economic considerations which determine how far and in what ways any class of production can be affected by air attack and hence the extent to which desirable strategic objects can be achieved in practice, and at what cost in effort. This paper is concerned only with the economic factors which enter into this equation.

3. The prospects of inflicting effective damage on any class of objective and the extent and duration of the interruption of output which must be imposed in order to achieve decisive results are determined by:-

(a) the vulnerability of plants and processes and their recuperation potential;

(b) the distribution of consumption between direct-war and other uses and hence the possibilities of economies in non-essential consumption in an emergency;

(c) the relation of production (or productive capacity) to requirements and the extent of stocks, work in progress, and excess manufacturing capacity, which may jointly or severally serve to cushion the effects of reduced production;

(d) the degree of concentration of production.

4. Of the four classes of industry and services examined -

Factories manufacturing finished weapons generally show unfavourable characteristics under (a) and (d) which are sufficiently offset by favourable characteristics under (b) and (c) only in the case of factories manufacturing particular types of aircraft or aero-engines.

Factories manufacturing intermediate products (components) produce several examples where the omens are in varying degrees favourable under each of the above headings and in general provide the most fruitful targets.

Factories manufacturing raw materials mostly show unfavourable characteristics under (b) and (c) and it is only in the cases of synthetic rubber and alumina that these are offset to any extent by other factors.

Service industries suffer as targets from the marked disadvantage under (b) that even the most successful attack would usually leave the enemy with the ability to divert the effects of reduced facilities on to the least important sections of his economy. Hence only oil qualifies for consideration in this category since in this case the supply position may now be so stringent that substantially no non-essential consumers remain to take the first impact.

/5. In arriving

5. In arriving at a final priority, first choice falls upon:-

(i) Ball Bearing Factories

(ii) Factories producing Injection Pumps and Electrical Ignition Equipment;

(iii) Tyre Factories

(iv) Propeller Factories

This choice is designed to have the largest and quickest effect on the widest possible range of military naval and air weapons, including weapons and equipment already in service as well as new production.

6. The following are placed in a somewhat lower class of priority since damage falling upon such an early stage in the production process would take some months to affect the output of finished products. Should resources permit, however, the attack of these objectives would provide a useful insurance against attempts by the enemy to render the production of finished weapons less vulnerable by increased dispersal -

(v) Synthetic rubber plants

(vi) Alumina plants.

7. Aircraft and aero-engine factories need to be considered separately since the attack of these is regarded not so much as an end in itself as a means to facilitate more effective attacks against other targets by strengthening the tactical superiority of the Allied Air Forces.

8. No firm priority can be allotted to oil targets until sufficient new photographic intelligence is available to show more clearly the manner in which synthetic production is likely to develop during 1943 and so to establish the size of the target which would have to be effectively attacked in order to produce decisive results.

9. The above programme does not provide any targets closely related to the U-boat programme. There are in this category no targets where the prospects of inflicting a decisive degree of interruption of output approach those existing in the case of the targets already named. The least unpromising targets in this category are provided by factories manufacturing accumulators.

Priorities For Air Attack Among Economic Targets In 1943

I. Introduction

1. The main aim in the bombing of industrial targets should be the maximum interference with the supply of weapons and equipment for the German Armed Forces on the field.

2. The comparative importance to the enemy in 1943 of the different branches of his weapon production - that is the production respectively of aircraft, tanks, guns and ammunition, submarines, motor transport etc. - is a matter for military rather than economic appreciation. But while military considerations may play the chief part in indicating the class of weapon production with which it would be most desirable to interfere, it is the tactical and economic factors which determine how far and in what ways any class of production can be affected by air attack and therefore the extent to which desirable strategic aims can be achieved in practice and at what cost in effort.

3. This paper is concerned only with the economic factors which enter into this equation and endeavours, by analysis of the set-up of German weapon production and of the industries which are engaged in supplying to it raw materials, components and services, to determine the most effective points of attack.

4. In arriving at conclusions on this point, it is necessary to take account of a number of considerations which are often conflicting and the interactions of which are nearly always complex. These are set out briefly below.

II. General Considerations

5. The principal considerations which have to be taken into account in assessing the target potentialities of particular industries or industrial plants are:-

(a) Vulnerability of plants and processes to air attack

The extent to which output is capable of being interrupted by air attack and the possibilities of recovery by repair or dispersal are all material to consideration of the weight of attack needed to encompass the immobilization of particular objectives.

(b) Distribution of consumption

This must be investigated in order to establish the proportion of current output which does not go into direct war uses and hence the possibilities which exist in an emergency of maintaining supplies to direct war uses at the expense of other consumers.

(c) Current relation of production (or productive capacity) to requirements and level of stocks

Information on this subject, when added to (b) completes the data which is required in order to establish the reduction in output, both in size and in time, which must be achieved in order to produce decisive results, when account has been taken of all the cushioning effects of economies in non-essential consumption, idle capacity, possibilities of substitution, stocks and all the various expedients which could be adopted in an emergency.

(d) Degree of concentration or dispersal of production

This establishes the number of targets which would have to be destroyed in order to achieve the aim.

/III Analysis

III Analysis Of Overall Vulnerability Of War Industries

6. The various industries which have to be considered in the light of the above considerations fall into four main categories:-

(i) Factories manufacturing finished weapons

7. The vulnerability of factories in this class (e.g. aircraft assembly and aero-engine plants, tank factories, submarine yards, M.T. factories, etc.) must usually be rated low since the production and assembly processes are usually performed in parallel and the plant and equipment employed is often of heavy construction and standard type, thus being difficult to destroy and easy to replace.

8. In most of these factories there can be no question that the destination of all the output is military and in many cases it will be found that, at this stage of the war, requirements equal or exceed production and that in the event of interruptions to output only a thin cushion would exist in the shape of alternative productive capacity or stored reserves.

9. Although production as a whole is usually well spread among a considerable number of separate factories, when broken down into its constituent parts the production of particular types (e.g. fighter aircraft or B.M.W. aero-engines) is often more highly concentrated.

10. On the balance of the above considerations, this class does not provide targets which afford the prospect of a large return from a given weight of effort. The most favourable opportunities arise from the possibilities of affecting particular classes of aircraft production by the attack of selected aircraft.

11. Inasmuch as the effectiveness of all operations may depend upon it, consideration must obviously be given, as a matter of major tactics, to the attack of industrial targets the destruction of which would seriously weaken the enemy's fighter defences, viz:-

(a) S.E. Fighter assembly factories
(b) Aero-engines factories supplying them

These are listed in the Annex to this Appendix .

(ii) Factories manufacturing intermediate products (components, etc.)

12. Although most plants in this category usually perform their manufacturing processes in parallel, which makes complete stoppage difficult to achieve, vulnerability of production to air attack is in many cases rated high owing to dependence upon specialized equipment and special types of skilled labour which are easy to damage and difficult to replace.

13. Although output is sometimes distributed between military and civil uses, the former usually accounts for by far the greater proportion of the output. Although, also, in some cases spare productive capacity exists, in others requirements are thought to be well up to the limits of present productive capacity. In such cases it is unlikely that large stocks exist though, since this class of production is one stage removed from the finished weapons, some cushion will always be available to offset the immediate effects of reduced production in the shape of work in progress in the "pipe-line."

14. Since the manufacturing techniques employed are often highly specialized, a high degree of concentration of output exists in many classes of special component manufacture. Any large degree of dispersal seems to have been prevented hitherto, as in this country, by the impossibility of decentralizing production without incurring an intolerable loss of output during the period of removal and reorganization.

/15. On balance

15. On balance, this class of industry is by far the most productive of industrial targets the attack of which would produce maximum returns from a minimum expenditure of effort.

The most promising of these targets are:-

(a) Ball Bearings
(b) Internal Combustion Engine Components
(c) Aircraft Propellors
(d) Rubber Tyres
(e) Accumulators

The principal targets in each class are set out in the Annex to this Appendix.

16. Attacks directed at these industrial groups would have some effect on practically every branch of weapon production, though naval construction would be less severely affected than the manufacture of aircraft, tanks, and motor transport. (a) and (b) would affect the whole range of military equipment in which internal combustion engines are used. (c) provides an alternative to the more direct attack of aircraft production in the assembly and engine factories. (d) has the advantage of affecting tanks, motor transport and aircraft simultaneously. Moreover since a large proportion of total tyre requirements are for maintenance, the attack of tyre factories is likely to go much further in affecting the efficiency of equipment already in use than is the case with (a), (b) and (c). The same is true in some degree of accumulators which are, however, selected principally as being the least unpromising target in the field of major components for submarines.

(iii) Factories producing Raw Materials

17. Some of the plants in this group, such as chemical plants operating continuous processes, involving a number of manufacturing stages in series, might be more susceptible to complete stoppage than any factory in groups (i) and (ii), though, in many cases the heavy construction of the plants and their well-spaced layout distract from their vulnerability.

18. In most of these industries a large proportion of the output is still devoted to non-military uses. Although many of these are essential to the enemy's war effort in the long term, they provide openings for the curtailment of consumption in the short term in order to shield the military uses from the effects of a temporary loss of production. In addition, since such industries are situated at the bottom of the production ladder, this cushion is further swollen by the considerable stock of material in course of manufacture which may at any time amount to 3-9 months output of finished products.

19. The high concentration of output which is to be found in one or two raw material producing industries does something to offset the adverse factors outlined above but these remain in most cases the dominant factors.

20. In consequence, the only industries in this class which qualify for consideration as primary targets are those in which a high degree of concentration of production is accompanied by a stringent supply position, a high degree of concentration of consumption in direct-war uses, and the absence of large idle productive capacity. On this basis, the only industries which merit further consideration for adoption as primary targets are:-

(a) Synthetic Rubber
(b) Alumina

These industries are further considered in the Annex to this Appendix.

/(iv) Service

(iv) Service Industries

21. In this class are included all installations in the fuel, power, public utility and transportation groups, which are engaged in supplying the sources of heat, light, stationary and motive power, and the means of distribution for the whole range of economic activities.

22. Some of the targets in this class would show a high degree of vulnerability to air attack, but this factor is offset in most cases by the considerable number of targets involved, the formidable possibilities of substitution and improvisation and above all by the cushions provided by the wide distribution of consumption among a variety of users. Even a serious reduction by bomb damage in the volume of essential services available, will always leave the enemy with the power to choose where to take the punch and provided that he retains sufficient freedom of manoeuvre he will usually succeed in taking it on the part of his economy where it hurts his war effort least, or at any rate least quickly.

23. For this reason it is doubtful whether, in spite of their great importance to the enemy's economy, the attack of power and transportation systems would provide a sound primary basis of target policy for any forseeable bomber force. This does not however exclude the possibility of achieving substantial effects on the war production of particular areas of restricted size by concentrated attack on their means of transport or power supplies. Moreover it does not detract from the value of targets in the power and transportation classes as secondary objectives - e.g. for attack by aircraft which cannot profitably be employed in the attack of primary objectives - in view of their easy accessibility (in the case of transport) or vulnerability to a comparatively light scale of attack (in the case of power).

24. The only industry in this class which merits consideration as a primary target is Oil. This is justified by the exceptionally stringent supply position at the present time which has resulted in a ruthless cutting down of all consumption which is not absolutely essential and the reduction of stocks at least to the minimum required to ensure effective distribution. As long as this situation obtains, the loss of productive resources is capable of having a comparatively rapid effect in the military sector.

The position is further examined in the Annex to this Appendix.

IV. Summary Of Principal Economic Targets

25. The primary targets from the ten categories of activities described above and analysed more fully in the appendices, fall into three main classes:-

(a) Isolated targets in Germany and Italy
(b) Industrial targets situated in German and Italian towns
(c) Related targets in Occupied Territories.

26. Effective action against (a) will usually depend upon the possibilities of precise attack.

In the case of (b) there may be possibilities of supplementing or even replacing precise attacks by area attacks. The possibilities will depend in particular cases not only upon the various tactical factors involved but also upon the part played by the factory or industry concerned in the economic life of particular towns. In some cases the particular activity will occupy such a small part in the economic life of the town that the chances of affecting it seriously by area attack will be remote. In other cases, where the economic life of a town is dominated by a particular industry, area attack may be an essential factor in the interruption of activity in this industry. The degree of specialization of the principal towns in Germany can be found by reference to the "Bombers Baedeker," Parts II & III.

/27. The related

27. The related targets in Occupied Territories are specified separately since political considerations will probably require that they should be the subject of precise attacks and tactical considerations may permit them to be attacked by weapons which cannot be used against (a) and (b).

28. In the following table, the principal targets in each category of primary economic objectives are accordingly analysed in the light of the above classifications. The towns specified in Column 2 are those of sufficient size to be suitable for area attack and of sufficient specialization in the industry concerned to give reasonable prospects of interrupting its activity by general dislocation.

/Analysis

ANALYSIS OF PRIMARY ECONOMIC OBJECTIVES

Class of Target.	Primary Objectives for Precise Attack in Germany and Italy.		Related Towns in Germany and Italy.	Population	Related Objectives for Precise Attack in Occupied Territories.	
(i) S.E. Fighter Assembly Factories.	Focke-Wulf	BREMEN	BREMEN	383,000		
	Ago	OSCHERSLEBEN				
	Fieseler	KASSEL	KASSEL	216,000		
	Arado	WARNEMUNDE			Nil	
	Erla	LEIPZIG				
	Messerschmitt	REGENSBURG	REGENSBURG	87,000		
	W.N.Flugzeugwerke	WIENER-NEUSTADT	WIENER-NEUSTADT	55,000		
(ii) Aero-Engine Factories.	B.M.W.	MUNICH-ALLACH				
	B.M.W.	BASDORF				
	B.M.W.	EISENACH	EISENACH	50,000	Nil	
	Daimler-Benz	GENSHAGEN				
	Henschel	KASSEL	KASSEL	216,000		
	Daimler-Benz	MARIENFELDE				
(iii) Ball-Bearing Factories.	Fischer	SCHWEINFURT	SCHWEINFURT	60,000	C.A.M.	PARIS-IVRY
	V.K.F. I & II	SCHWEINFURT	STUTTGART	450,000	C.A.M.	PARIS-COLOMBES
	Norma	STUTTGART-BAD CANSTATT				
	D.K.F.	LEIPZIG				
	D.K.F.	BOHLITZ-EHRENBURG				
	V.K.F.	ERKNER				
	R.I.V.	TURIN				
(iv) Fuel Injection Pumps & Electrical Ignition Equipment	Bosch	STUTTGART TOWN	STUTTGART	450,000	Lavalette	PARIS - ST.OUEN
	Bosch	STUTTGART-FEUERBACH	DESSAU	200,000	S.E.V.	PARIS - ISSY LES MOULINEAUX
(v) Equipment	Bosch	KLEINMACHNOW	MILAN	1,250,000		
	Bosch	KLOSTER ZINNA				
	Junkers	DESSAU				
	Deckel	MUNICH				
	Marelli	MILAN				

/(vi)

Class of Target.	Primary Objectives for Precise Attack in Germany and Italy.		Related Towns in Germany and Italy.	Population	Related Objectives for Precise Attack in Occupied Territories.	
(vi) Aircraft Propellors.	V.D.M.	FRANKFURT-HEDDERNHEIM	DESSAU	200,000	Ratier	FIGEAC
	V.D.M.	ALTONA-BAHRENFELD			Ratier	PARIS-MONTROUGE
	Junkers	DESSAU			Ratier	PARIS-CHATILLON
					S.G.E.A.	LYONS-VILLEURBANNE
					S.G.E.A.	PARIS-VITRY
					Bloch	PARIS-ST.CLOUD
					Gnome & Rhone	PARIS-BD.KELLERMANN
(vii) Rubber Tyres.	Continental	HANOVER-TOWN	HANOVER	450,000	Michelin	CLERMONT-FERRAND
	Continental	HANOVER-NORDHAFEN	HANAU	41,000	Dunlop	MONTLUCON
	Dunlop	HANAU	MILAN	1,250,000		
	Pirelli	MILAN				
(viii) Accumulators.	A.F.A.	HAGEN	HAGEN	150,000	Tudor	LILLE
	Gottfried Hagen	COLOGNE-KALK	SOEST	23,000	Tudor	FLORIVAL
	Wilhelm Hagen	SOEST	MILAN	1,250,000	Akkumulator Fabriken	LYNGBY
	H.A.F.	HOPPECKE	MONZA	64,000	Norsk Accumulator	OSLO
	Marelli	MILAN			Marinens Minevesen	HORTEN
	Hensemberger	MONZA				
(ix) Synthetic Rubber.	Chemische Werke Hüls	HÜLS-BEI-MARL	NIL		Nil	
	Bunawerke Schkopau	SCHKOPAU				
(x) Alumina.	V.A.W. (Lautawerk)	LAUTA	LUNEN	46,000	Pechiney	GAARDANNES
	V.A.W. (Lippewerk)	LUNEN	PORTO MARGHERA/ MESTRE	45,000	Pechiney	ST. AUBAN
	V.A.W. (Nabwerk)	SCHWANDORF			Pechiney	SALINDRES
	A.I.A.G. (Martinswerk)	COLOGNE-GREVEN BROICH			Ugine	LA BARASSE
	Giulini	MANNHEIM-MUNDENHEIM			A.I.A.G.	ST.LOUIS-LES-AYGALADES
	S.A.V.A.	PORTO MARGHERA				
	Montecatini II	PORTO MARGHERA				

SECRET

Class of Target.	Primary Objectives for Precise Attack in Germany and Italy.		Related Towns in Germany and Italy.	Population	Related Objectives for Precise Attack in Occupied Territories.
(xi) Oil.	I. G. Farben	LEUNA MARGHERA	NIL		NIL
	Hydrierwerke Pölitz	STETTIN-PÖLITZ			
	Brabag	TROGLITZ-ZEITZ			
	Wintershall	LUTZKENDORF			
	Brabag	SCHWARZHEIDE			
	Gelsenberg	GELSENKIRCHEN-NORDSTERN			
	Hibernia	GELSENKIRCHEN-BUER			
	Brabag	BRUX			
	Brabag	BLECHHAMMER			
	Brabag	BOHLEN			
	Brabag	MAGDEBURG			
	Union Rheinische	WESSELING			

V. Priorities Among Economic Targets

29. The ten categories of primary economic targets outlined above are to some extent competitive with one another in so far as a completely successful attack against one group would in theory render attacks on certain others redundant. For instance the successful attack on factories making aircraft propellors would not result in much further reduction in the output of aircraft if the principal aircraft or aero-engine factories had already been destroyed. Similarly a completely effective attack on any one of the categories involved in the manufacture of components would in theory render factories making other components in a greater and smaller degree useless to the enemy's war effort. The principal factor which needs to be taken into account in making the final choice of priorities is the time factor. First priority should be accorded to those categories in which the most immediate effect is likely to be produced on the enemy's war effort, especially if this is combined with the prospect of a long delay in restoring production.

30. Aircraft and aero-engine factories need to be considered separately from the other categories, since the attack of these is regarded not so much as an end in itself as a means to facilitate more effective attacks against other targets at a later date. For the purpose of affecting German fighter strength, attacks on assembly factories would seem to promise more immediate results than attacks on engine factories.

31. In the case of oil, it is impossible to allot a firm priority until photographic intelligence is available which will show more clearly the manner in which synthetic production is likely to develop during 1943 and so to establish the size of the target which would have to be attacked in order to produce decisive results, and the time factor affecting it.

32. The attack of accumulator production is worthy of consideration only as the least unpromising method of affecting submarine construction in the component field. Both on supply grounds and on grounds of vulnerability, it compares unfavourably with the other targets considered.

33. Subject to the above qualifications in the case of aircraft and oil targets, first preference is given to:-

(i) Ball Bearings
(ii) Factories producing injection pumps and electrical ignition equipment
(iii) Tyre factories
(iv) Propellor factories

The choice of (i) would affect the sidest possible range of vital military and industrial production. The attack of (ii) is designed more specifically to affect the manufacture of internal combustion engines for military purposes. The high priority accorded to (iii) is given on account of the vulnerability of this class of target and of the extent to which successful attack would affect the operational efficiency of motor transport and aircraft already in service. The choice of (iv) is due to a desire to include a class of target which will specifically affect aircraft production by the attack of a smaller number of targets than would be involved by the attack of aircraft assembly or engine factories.

34. A lower priority is given to:-

(v) Synthetic rubber plants
(vi) Alumina plants

because damage falling upon such an early stage in the production process would take some months to affect the output of finished products. Should resources permit, however, the attack of these objectives would be a useful insurance against any attempt by the enemy to render the production of finished products less vulnerable to further bombing by the dispersal of manufacture.

COMBINED BOMBER OFFENSIVE PLAN

General Plan Of Operations And Forces Required

It would be highly desirable to initiate precision bombing attacks against German fighter assembly and engine factories immediately. However our present force of day bombers is too small to make the deeper penetrations necessary to reach the majority of those factories. Considering the number of German fighters which can be concentrated laterally to meet our bombers on penetration, and again on withdrawal, it is felt that 300 heavy bombers is the minimum operating force necessary to make deep penetrations.

Experience in the Theatre to date indicates that at least 800 aeroplanes must be in the Theatre to dispatch 300 bombers on operations. (See Table G). Hence until the level of U.S. bomber strength in this Theatre reaches approximately 800, it will not be feasible to sustain a precision bombing offensive against the German fighter factories. To accomplish the task set forth in Phase I, 944 bombers are required by the end of the period. It is estimated that we will be able to accommodate and train a force of this capacity by July of this year. In the interim every effort should be made to reduce the German fighter force by attack of those fighter factories which can be reached, and by combat under favourable conditions. The repair depots and aerodromes are included for the purpose of giving commanders the necessary tactical latitude. Concurrently operations can be conducted against submarine installations within reach and against other targets contributing directly to the principal objectives which are within covering range of our own fighters, or which do not require deep penetration. Some operations will have to be conducted to provide the necessary training for the incoming forces; such operations must be conducted against objectives within the listed categories.

During the next phase, from July to October, in which it is estimated that we will be able to penetrate to a limit of 400 miles, a determined effort must be made to break down the German fighter strength by every means at our disposal, concentrating primarily upon fighter aircraft factories. During this time interim an additional increment of 248 bombers is required so that the strength in the Theatre by October should be approximately 1,192. This would provide a striking force of 450 bombers at the end of this period. The average striking force during this period would be 400.

During the third phase the German fighter force must be kept depleted, and the other sources of German strength must also be undermined. During this phase our bombing offensive forces must be adequate to perform all their major tasks.

From October to January an additional increment of 554 bombers are required, bringing the total to 1,746. This should provide an operational striking force of 655 bombers at the end of that time. The average striking force during this period will be 550 bombers.

During the last phase - early 1944 - the entire force should be used to sustain the effect already produced and to pave the way for the Combined Operation on the Continent. This will require a force of 2,702 heavy bombers.

Estimated effect of precision bombing effort

Each of the targets to be destroyed has been analysed and translated into terms of the precision bombing effect achieved to date. On this basis the force required and effect expected during each phase is tabulated below.

No computation of size force required has been made in the case of the R.A.F. bomber effort. It is intended that the entire weight of the R.A.F. bomber Command be employed if necessary to undermine the industrial areas surrounding the selected precision targets.

/TARGET

TARGET SELECTION

1. Target selection has been made after thorough study of:-

(a) The operational capabilities as established by experience in this Theatre.

(b) The effect of the destruction of these targets on the German Military Machine.

2. The German military machine consists of three major elements: its submarine fleet, its air force and its ground forces. It has been considered vital in target selection, in view of the probable size of our striking force, to inflict the maximum damage to each of these elements by the destruction of the fewest targets which will accomplish our purpose.

3. Based on the above, the selected systems, for inclusion in the operational plan, are as follows:-

(a) Intermediate objectives -

German Fighter Strength

(b) Primary Objectives of equal priority -

Submarine Yards and Bases
The remainder of German Aircraft Industry
Ball Bearings
Oil (contingent upon operation against Ploesti)

(c) Secondary objectives in order of priority -

Synthetic Rubber and Tyres
Military Motor Transport Vehicles

4. There is complete agreement on all sides with the following conclusion of the Operations Analysts:-

"It is better to cause a high degree of destruction in a few really essential industries than to cause a small degree of destruction in many industries. Results are cumulative and the plan once adopted should be adhered to with relentless determination."

In the application of this principle, the following considerations obtain:-

(a) The situation is not static. The destruction of the Roumanian oil refineries would immediately make a maximum effort against the synthetic oil plants in Germany mandatory. Similarly the importance of synthetic rubber and tyres fluctuates with the success of the blockade.

(b) A geographical spread of targets is necessary both on account of weather, and also to allow of diversionary and training operations. These considerations led to the inclusion of Motor Transport, especially in view of its benefits to future ground operations.

5. Thus while six systems of targets are discussed and portrayed, only the first three are mandatory - the last three depending on the future course of events and tactical expediency.

6. The most immediate effect on the German fighter strength can be obtained by the destruction of airframe factories. Hence concentration upon those is in order. Later, however, it is reasonable to suppose that

/the rebuilding

the rebuilding of the facilities as has been done by the British will be accomplished in such a way as to make them unprofitable bombing objectives. In such a case, if continued destruction of the fighter industry is called for, it may be found that fighter engine factories provide the most profitable objectives. Fighter repair and storage depots have been included to give tactical latitude while contributing to the reduction of the German fighter strength.

7. Intensive search must be continued to isolate other concentrated critical systems of objectives which cut across nearly all war production as does the Ball Bearing System. If and when such a system is found, priority of objectives should be modified accordingly. The grinding wheel and abrasive industries show promise of being such a system although in the light of present knowledge, there is insufficient justification for its selection as a priority objective.

/Application

Application and Effect of Daylight Striking Force by Phase

First Phase (Present to July 1st, 1943)

(Average Aeroplanes required in the Theatre in this Phase - 622)

I. Submarines

(a) (Operating Bases)

Brest
Lorient
St. Nazaire
La Pallice

(b) (Building Yards)

Bremen
Vegesack
Wilhelmshaven
Bremerhaven
Emden

II. German Air Force

(a) Fighters

Bremen (F.W.)

III. Ball Bearings

Schweinfurt
Paris

IV. Petroleum

Gelsenkirhen
Wessoling
Bottrop
Scholven
Wanne Eickel

V. German Air Force

Repair and Storage

Paris
Antwerp
Brussels
Albert/Meaulte
Courcelles/G
Amstordam
Valkenburg
Le Mans

Secondary Effort to be carried out when weather or the tactical situation makes such operations desirable.

Second Phase (July 1st, 1943 to October 1st, 1943)

(Average aeroplanes required in the Theatre in this Phase 1068)

I. Submarines

(a) Operating Bases

Brest
Lorient
St. Nazaire
La Pallice

(b) Building Yards

Bremen
Vegesack
Hamburg
Kiel
Wilhelmshaven
Bremerhaven
Flensburg
Emden
Lubeck

/II. German

II. German Air Force

(a) Fighters

Bremen
Kassel

(b) Fighter Engines

Brunswick
Cassel
Hamburg
Eisenach

(c) Bombers

Bremen
Leeuwarden

(e) Repair and Storage

Paris
Antwerp
Brussels
Albert/Meaulte
Courcelles/G
Amsterdam
Valkenburg
Le Mans
Romilly
Rheims/Chartreuse
Nantes
Bourges

III. Ball Bearings

Schweinfurt
Paris

IV. Petroleum Production

Gelsenkirchen
Wesseling
Bottrop
Scholven
Wanne Eickel

V. Rubber

(a) Synthetic Rubber Plant

Huls

(b) Rubber Tyre Plants

Aachen/Englebert
Wuppertal/Vorwerk
Hannau/Dunlop
Hanover/Continental
Hanover/Continental
Harburg/Phoenix

Third Phase (October 1st, 1943 to January 1st, 1944)

(Average Aeroplanes required in the Theatre in this Phase - 1,469)

I. Submarines

(a) Operating Bases

Lorient
St. Nazaire
La Pallice

(b) Building Yards

Bremen
Vegesack
Hamburg
Kiel
Wilhelmshaven
Bremerhaven
Flensburg
Emden
Lubeck
Rostock

/II. German

II. German Air Force

(a) Fighters, S.E.

Bremen, Focke-Wulf
Cassel
Oschersleben
Warnemunde
Dessau
Brunswick

(b) Fighter Engines

Brunswick
Cassel
Stuttgart
Hamburg
Eisenach

(c) Bombers

Bremen
Leeuwarden
Dessau
Bernberg
Wismar
Halle
Schkeuditz
Rostock

(e) Repair and Storage

Paris
Antwerp
Brussels
Albert/Meaulte
Courcelles/G
Amsterdam
Valkenburg
Le Mans
Romilly
Rheims/Chartreuse
Nantes
Bourges
Strasbourg
Limoges

III. Ball Bearings

Schweinfurt
Paris
Stuttgart

IV. Petroleum Production

Gelsenkirchen
Wesseling
Bottrop
Scholven
Wanne Eickel
Magdeburg
Leuna
Boehlen

V. Rubber

(a) Synthetic Rubber

Huls
Schopau

(b) Rubber Tyre Plants

Aachen/Englebert
Wuppertal/Vorwerk
Hanau/Dunlop
Hanover/Continental
Harburg/Phoenix
Montlucon/Dunlop
Clermont/Ferrand

VI. Military Transport Plants

Paris/Renault
Paris/Citroen
Cologne/Ford
Bourges/Matford
Stuttgart/Daimler-Benz

/Fourth Phase

Fourth Phase (January 1st 1944, to April 1st, 1944).

(Average Aeroplanes required in the Theatre in this Phase - 2,224

I. Submarines.

(a) Operating Bases

Brest
Lorient
St. Nazaire
La Pallice
Bordeaux
Heligoland

(b) Building Yards

Bremen
Vegesack
Hamburg
Kiel
Wilhelmshaven
Bremerhaven
Flensburg
Emden
Lubeck
Rostock

II. German Air Force

(a) Fighters

Bremen
Cassel
Oschersleben
Warnemunde
Zeipzig
Dessau
Brunswick
Augsburg

(b) Fighter Engines

Brunswick
Cassel
Stuttgart
Hamburg
Eisenach
Suhlsdorf
Genshagen
Berlin

(c) Bombers

Bremen
Leeuwarden
Dessau
Oldenburg
Wismar
Halle
Leipzig
Schkeuditz
Rostock
Schonefeld
Bernberg

(d) Bomber Engines

Dessau
Magdeburg
Schonebeck
Leipzig

(e) Repair and Storage

Paris
Antwerp
Brussels
Albert/Meaulte
Courcelles/g
Amsterdam
Valkenburg
Le Mans
Romilly
Rheims/Chartreuse
Nantes
Bourges
Strasbourg
Limoges
Bordeaux

III. Ball Bearings

Schweinfurt
Paris
Stuttgart
Leipzig
Berlin/Erkner
Annecy

/IV. Petroleum

IV. Petroleum

Gelsenkirchen
Wesseling
Bottrop
Scholven
Wanne Eickel
Magdeburg
Leuna
Bochlen
Zeitz
Brux.

V. Rubber

(a) Synthetic Rubber Plants

Huls
Schopau

(b) Rubber Tyre Plants

Aachen/Englebert
Wuppertal/Vorwerk
Hanau/Dunlop
Hanover/Continental
Hanover/Continental
Harburg/Phoenix
Montlucon/Dunlop
Clermont-Ferrand

VI. Military Transport Plants

Paris/Renault
Paris/Citroen
Cologne/Ford
Bourges/Matford
Stuttgart/D Benz
Brandenburg

TOWNS SUITABLE FOR AREA ATTACK RELATED TO U.S. PRECISION TARGETS

Name of Place	Population	Distance From Mildenhall	Notes	See Notes Below
1. Submarine Shipbuilding Yards				
Bremen	424,000	350		(1)
Hamburg	1,711,000	400		(2)
Kiel	274,000	420		
Wilhelmshaven	114,000	330		
Bremerhaven	113,000	350		
Flensburg	71,000	400		
Emden	35,000	290		
2. German Air Force				
(a) Fighter Assembly Plants				
Bremen	424,000	350		(1)
Kassel	216,000	390		(3)
Leipzig	707,000	510		(4)
Dessau	119,000	500		(5)
Augsburg	185,000	530		
Regensburg	96,000	550		
(b) Fighter Engine Plants				
Brunswick	196,000	420		
Kassel	216,000	390		(3)
Stuttgart	458,000	450		(6)
Hamburg	1,711,000	400		(2)
Eisenach	53,000	430		
Berlin	4,339,000	540	For two targets, one at Genshagen	(8)
(c) Bomber Assembly Plants				
Bremen	424,000	350		(1)
Dessau	119,000	500		(5)
Bernburg	42,000	470		
Halle	220,000	480		
Leipzig	707,000	510		(4)
Berlin	4,339,000	540	For plant at Schönefelde	(8)
(d) Bomber Engine Plants				
Dessau	119,000	500		(5)
Magdeburg	337,000	420		(7)
Leipzig	707,000	510		(4)

/3. Ball

Name Of Place	Population	Distance from Mildenhall	Notes	See Notes Below
3. Ball Bearings				
Schweinfurt	49,000	440		
Stuttgart	458,000	450		(6)
Berlin	4,339,000	540		(8)
Leipzig	707,000	510		(4)
4. Petroleum Products (Synthetic Oil)				
Gelsenkirchen	317,000	300	Covers two targets	
Bottrop	83,385	280		
Wanne Eickel	87,000	290		
Magdeburg	337,000	420		(7)
Merseberg	38,000	490		(9)
5. Synthetic Rubber and Tyres				
Recklinghausen	86,000	290	For Huls	
Merseberg	38,000	490	For Schkopau	(9)
Aachen	162,000	270		
Wuppertal	402,000	300		
Hanau	42,000	390		
Hanover	471,000	380		
Hamburg	1,711,000	400		(2)
Munich	829,000	560		
6. Motor Transport				
Cologne	772,000	290		
Stuttgart	458,000	450		(6)
Brandenburg	84,000	500		

Notes In Connection With Towns Which Appear More Than Once (See last column of Schedule)

(1) Bremen appears in the list three times
(2) Hamburg appears in the list three times
(3) Kassel appears in the list twice
(4) Leipzig appears in the list four times
(5) Dessau appears in the list three times
(6) Stuttgart appears in the list three times
(7) Magdeburg appears in the list twice
(8) Berlin appears in the list three times. One corresponds to four targets
(9) Merseberg appears in the list twice.

APPENDIX 5
SECRET

TARGETS IN OCCUPIED COUNTRIES FOR THE U.S. EIGHTH AIR FORCE

10th May, 1943

Naval Targets

France

(i)	Rennes Naval Stores Depot		Z429B

German Air Force

France

(i)	Villacoublay Aircraft Assembly Plants and Repair Works		Z204
(ii)	Meaulte	Aircraft Repair and Overhaul Works	Z189
(iii)	Rheims/Champagne		Z349
(iv)	St. Omer/Fort Rouge		Z256
(v)	St. Andre De L'eure		Z341
(vi)	Nantes (Chateau-Baugon)		Z206
(vii)	Le Mans		Z444

Belgium

(i)	Courcelles-Motte	Aircraft Repair and Overhaul Works	ZB903
(ii)	Courcelles-Motte		ZB903x
(iii)	Brussels-Evere (Sabea) and (Sabena)		ZB863

Holland

(i)	Valkenburg, Wassenaer Gouda	Aircraft Repair and Overhaul Works	ZH62

Transportation

France

(i)	Le Mans (Arnage)	Marshalling Yard	Z444A
(ii)	Le Mans (Arnage)	Renault Arms and Traction Works	Z444D
(iii)	Aulnoye	Marshalling Yard	Z599
(iv)	Blanc Misseron	Locomotive and Rolling Stock Works	Z610
(v)	Poissy	Motor Transport Works	Z166

Belgium

(i)	Antwerp	Motor Transport Works	ZB851
(ii)	Haine St. Pierre	Locomotive and Wagon Works	ZB876

G.225497/DEW/11/49.

APPENDIX 6
SECRET

POINTBLANK DIRECTIVE

10th June, 1943

S.46368/A.C.A.S.(Ops.)

Sir,

I am directed to refer to Directive C.C.S.166/1/D dated 21st January, 1943, issued by the Combined Chiefs of Staff and forwarded to the Commanding General, Eighth Air Force and the Air Officer Commanding-in-Chief, Bomber Command under cover of Air Ministry letter S.46368/A.C.A.S.(Ops.) dated 4th February, 1943. This directive contained instructions for the conduct of the British and American bomber offensive from this country.

2. In paragraph 2 of the directive, the primary objectives were set out in order of priority, subject to the exigencies of weather and tactical feasibility. Since the issue of this directive there have been rapid developments in the strategical situation which have demanded a revision of the priorities originally laid down.

3. The increasing scale of destruction which is being inflicted by our night bomber forces and the development of the day bombing offensive by the Eighth Air Force have forced the enemy to deploy day and night fighters in increasing numbers on the Western Front. Unless this increase in fighter strength is checked we may find our bomber forces unable to fulfil the tasks allotted to them by the Combined Chiefs of Staff.

4. In these circumstances it has become essential to check the growth and to reduce the strength of the day and night fighter forces which the enemy can concentrate against us in this theatre. To this end the Combined Chiefs of Staff have decided that first priority in the operation of British and American bombers based in the United Kingdom shall be accorded to the attack of German fighter forces and the industry upon which they depend.

5. The primary object of the bomber forces remains as set out in the original directive issued by the Combined Chiefs of Staff (C.C.S.166/1/D dated 21st January, 1943) i.e.:-

> "the progressive destruction and dislocation of the German military, industrial and economic system, and the undermining of the morale of the German people to a point where their capacity for armed resistance is fatally weakened."

6. In view, however, of the factors referred to in para. 4 of the following priority objectives have been assigned to the Eighth Air Force:-

Intermediate objective :

German Fighter strength

Primary objectives :

German submarine yards and bases
The remainder of the German aircraft industry
Ball bearings
Oil (contingent upon attacks against Ploesti from the Mediterranean)

Secondary objectives :

Synthetic rubber and tyres
Military motor transport vehicles.

While the forces of the British Bomber Command will be employed in accordance with their main aim in the general disorganisation of German industry their action will be designed as far as practicable to be complementary to the operations of the Eighth Air Force.

/7. In pursuance

7. In pursuance of the particular requirements of para. 6 above, I am to request you to direct your forces to the following tasks:-

(i) the destruction of German airframe, engine and component factories and the ball-bearing industry on which the strength of the German fighter force depend.

(ii) the general disorganisation of those industrial areas associated with the above industries.

(iii) the destruction of those aircraft repair depots and storage parks within range, and on which the enemy fighter force is largely dependent.

(iv) the destruction of enemy fighters in the air and on the ground.

The list of targets appropriate to these special tasks is in Appendix 'A' forwarded under cover of Air Ministry letter S.46368/3/D.B.Ops. dated 4th June, 1943. Further copies of this list, which will be amended from time to time as necessary, will be forwarded in due course.

8. Consistent with the needs of the air defence of the United Kingdom the forces of the British Fighter Command will be employed to further this general offensive by:-

(i) the attack of enemy aircraft in the air and on the ground.

(ii) the provision of support necessary to pass bomber forces through the enemy defensive system with the minimum cost.

9. American fighter forces will be employed in accordance with the instructions of the Commanding General, Eighth Air Force in furtherance of the bomber offensive and in co-operation with the forces of Fighter Command.

10. The allocation of targets and the effective co-ordination of the forces involved is to be ensured by frequent consultation between the Commanders concerned. To assist this co-ordination a combined operational planning committee has been set up. The suggested terms of reference under which this Committee is to operate is outlined in Air Ministry letter CS.19364/A.C.A.S.(Ops) dated 10th June, 1943.

11. It is emphasised that the reduction of the German fighter force is of primary importance; any delay in its prosecution will make the task progressively more difficult. At the same time it is necessary to direct the maximum effort against the submarine construction yards and operating bases when tactical and weather conditions preclude attacks upon objectives associated with the German Fighter Force. The list of these targets is in Appendix 'B' forwarded with the Appendix 'A' referred to in paragraph 7 above.

I am, Sir,
Your obedient Servant,

(Sgd) N. H. Bottomley

Air Vice Marshal, A.C.A.S. (Ops).

ATTACK ON G. A. F.

MAIN TOWNS

(POINTBLANK DIRECTIVE - APPENDIX A)

Town	Population	Distance From Base Miles	G. A. F. TARGETS IN AREAS			
			Firm	District	Type	Target No.
Augsburg	185,000	540	Messerschmitt		Fighter Aircraft Assembly Plant	GY.4752A
Berlin Area	4,338,000	550	Daimler Benz Daimler Benz B.M.W. V.K.F.	Marienfelde Genshagen Basdorf Erkner	Aero Engine Works (7 m. S.) Aero Engine Works (15 m. S.S.W.) Aero Engine Works (16 m. N.) Ball Bearing Works (16 m. E.S.E.)	GY.4683A GY.4671 GY.4655 GZ.2714
Bernburg	42,000	480	Junkers		Fighter Aircraft Assembly Plant	GY.4835
Bremen	420,000	350	Focke Wulf Focke Wulf Focke Wulf Focke Wulf	Neuenland Hasstedt Hemlingen Kirchweg	Fighter Aircraft Assembly Plant Aircraft Components Works Aircraft Components Works Aircraft Components Works	GY.4772A GY.4773 GY.4805 -
Brunswick	196,000	430	M.I.A.G. Neidersachsische M.I.A.G. M.I.A.G.	Waggum Querum Wilhelmitor Neupetritor	Fighter Aircraft Assembly Plant Aero Engine Factory Airframe Components Works Airframe Components Works	GY.4776A GY.4676 GY.4775 GY.4842
Dessau	119,000	500	Junkers Junkers		Aero Engine Works (including propellers) Fighter Aircraft Assembly Plant	GY.4670A GY.4670B
Eisenach	53,000	430	B.M.W. ? B.M.W.	Stockhausen	Aero Engine Works ? Aero Engine Works	GY.4680 GY.4679
Frankfurt	553,000	380	V.D.M. Adam Opel (15 miles S.W. of Frankfurt)	Heddernheim Russelheim	Propeller Factory Cockpit Covers, Under-carriage Parts Works etc.	GZ.2805 GN.3786
Friedrichshafen	25,000	520	Dornier Dornier Dornier	Lowenthal Manzell Allmansweiler	Fighter Aircraft Assembly Plant Aircraft Assembly Plant Aircraft Assembly Plant	GY.4758A GY.4755 GY.4758B
Gotha	55,000	440	Gothaer		Fighter Aircraft Assembly Plant	GY.4765
Hamburg	1,712,000	400	Klockner V.D.M.	Moorfleth Bahrenfeld	Aero Engine Works Propeller Works	GY.4678 GZ.2844
Hanover	471,000	380	Continental Continental	Vahrenwalderstrasse Nordhafen	Aero Tyre Works Aero Tyre Works	GS.152 GS.159
Kassel	216,000	390	Fieseler Fieseler Fieseler Henschel	Waldau Waldau Bettenhausen Altenbauna	Main Fighter Aircraft Assembly Plant Branch Fighter Aircraft Factory Aircraft Components Works Aero Engine Works	GY.4809A GY.4809B GY.4766A GY.4681

/LEIPZIG

Town	Population	Distance From Base Miles	G. A. F. TARGETS IN AREAS			
			Firm	District	Type	Target No.
Leipzig	707,000	520	Erla Erla Erla Erla D.K.F.	Mockau Heiterblick Altnaundorf	Fighter Aircraft Assembly Plant Aircraft Components Works Aircraft Components Works Werke 5 Aircraft Components Works Ball Bearing Works	GY.4825A GY.4796 GY.4847 GY.4846 GZ.2703
Munich	829,000	570	B.M.W. B.M.W. Dornier	Allach Oberpfaffenhofen (15 miles W.S.W. of Munich)	Aero Engine Works Aero Engine Works Fighter Aircraft Assembly Plant	GY.4653 GY.4662A GY.4759
Oschersleben	18,000	450	A.G.O.		Fighter Aircraft Assembly Plant	GY.4801A
Paris		250	C.A.M. C.A.M.	Bois Colombes Ivry	Ball Bearing Works Ball Bearing Works	Z.179B Z.305B
Regensburg	96,000	560	Messerschmitt		Fighter Aircraft Assembly Plant	GY.4828A
Schweinfurt	49,000	440	Kugelfischer V.K.F. Deutsche Stat V.K.F.		Ball Bearing Works Ball Bearing Works (Werke II) Ball Bearing Works Ball Bearing Works (Werk I)	GZ.2707A GZ.2707C GZ.2707D GZ.2707E
Stuttgart	458,000	450	Daimler Benz Bosch Bosch V.K.F. (Norma)	Unterturkheim Feuerbach Bad Canstatt	Aero Engine Works Injection Pump and Ignition Equipment Works Injection Pump and Ignition Equipment Works Ball Bearing Works	GY.4654 GB.3282 GB.3280 GZ.2704
Warnemunde	10,000	500	Heinkel (Arado)	Grossklein	Fighter Aircraft Assembly Plant	GY.4793
Wiener-Neustadt	39,000	760	Wiener-Neustadter		Fighter Aircraft Assembly Plant	GY.4808A

The following towns are not included in the above schedule:

Town	Population	Works in Area
Anklam	20,000	Aircraft Components
Aschersleben	32,000	Aircraft Components
Furth	6,000	Airframes
Halberstadt	51,000	Aircraft Components
Hanau	42,000	Aero Tyres
Stassfurt	16,000	Aircraft Components
Turin	716,000	Ball Bearing Works

APPENDIX 7
SECRET

BODYLINE DIRECTIVE

C.M.S. 82/A.C.A.S.(Ops.) 18th September, 1943.

Sir,

Bodyline

I am directed to inform you that at a recent meeting of the Defence Committee it was decided that factories suspected of being engaged in the manufacture of rocket components should be attacked whenever possible in the course of our night bombing operations.

2. In Air Ministry letter of the above references dated 28th August, 1943, you were informed that Intelligence Reports had confirmed that important components of the long range rocket were being manufactured in the Zeppelin works at Friedrichshafen. These works are believed to be a key point in rocket production and reports indicate that the damage already inflicted by your Command has caused great delay, though production has now been restarted.

3. I am to request that special consideration should be given to the destruction of both the Zeppelin and Maybach works at Friedrichshafen and that an attack against these objectives should be launched as soon as weather conditions permit.

4. With regard to other plants which are suspected of producing rocket apparatus, I am to request that every effort be made to destroy these in the course of your normal operations. A provisional list is attached at Appendix 'A', but, as a result of the ruling of the Defence Committee referred to above, the list is under review and an amended list will be forwarded to you in due course. It is to be noted that in the course of previous raids, Askania and Gesellschaft fur Electrische Apparate factories in Berlin have already suffered heavy damage and the Brown Boveri Mannheim, and the Rhein Metal Borsig, Berlin, have suffered slight damage.

I am, Sir,
Your obedient Servant,

(Sgd) W.A. Coryton

Air Vice Marshal,
Assistant Chief of the Air Staff (Operations)

The Air Officer Commanding-in-Chief,
Headquarters, Bomber Command,
Royal Air Force,
High Wycombe,
Bucks.

Factories suspected of manufacturing Long Range Rocket Components

Appendix A

Argus Works	Berlin	GY.4684
Rheinmetal-Borsig	Berlin/Tegel	GH.526 GF.2258 GR.3687 GN.3780
Brown Boveri	Mannheim	GB.3213
Hanomag	Hanover/Brink	GZ.2845, GH.522
Krupps Works	Magdeburg	GF.2260
Hermann Goering Works	Gleiwitz	Not yet targeted
Raxwerke	Wiener Neustadt	D.T.M.107
Askania Works	Berlin	GL.2613 - not yet issued
Gesellschaft fur Electrische Apparate.	Berlin	

G.225497/DEW/11/49.

/Order

Order of Priority of Targets concerned with Bodyline Production

Appendix 'A' - First Revision - 5th October, 1943

Factory	Location	Activity
(a) First Priority		
Luftschiffsbau Zeppelin	Friedrichshafen G.R.3682	Radio control equipment; also important manufacturing centre for all RADAR equipment
Fichtel & Sachs Kugelfischer VKF	Schweinfurt G.Z.2707	Control equipment and possibly other special components. It is thought that Fichtel & Sachs are the firm most likely to be concerned. The others are responsible for at least 50% of the German ball-bearing output and are all situated in close proximity to one another.
(b) Second Priority		
* Hanomag	Hanover-Linden G.Z.2845 G.H.522 and (?) Hanover-Brink	Heavy engineering and armaments concern. In addition to the old factory in the Linden area, a large new engineering plant in the Brink area is under strong suspicion as being associated with Hanomag a and may be engaged on this work.

* If the Brink factory, now under re-examination, proves to be associated with Bodyline, it would warrant classification under the first priority.

Friedrich Krupp	Essen G.F.2224 Magdeburg G.F.2260 Breslau	Heavy engineering and armaments concerns engaged on a wide range of armaments production. The most likely producers of forgings etc. required in Bodyline weapons.
Bochumer Verein	Bochum G.F.2266	
Rheinmetall Borsig	Berlin-Tegel G.F.2258 Dusseldorf-Derendorf G.Z.2779 Dusseldorf-Rath G.F.2223	
Mannesmannröhrenwerke	Dusseldorf-Rath G.Z.2850 G.N.3812 G.F.2242 G.R.3701	

APPENDIX 7
SECRET

Order Of Priority Of Targets Concerned With Bodyline Production

Appendix 'A' - Second Revision - 16th November, 1943

Factory	Location	Remarks
First Priority		
Luftschiffsbau Zeppelin	Friedrichshafen G.R.3682	Radio control equipment, also an important manufacturing centre for all radar equipment
Maybach Zahbradfabrik	Friedrichshafen G.R.3682	Submarine diesel engine works.
Klein Schanzlin & Becker, and associated works.	Frankenthal G.R.3716	Pump and compressor manufacturers.
Julius Pintsch	Berlin-Furstenwalde G.N.5049	Engineering and armaments manufacturers
Henschel	Wiener Neustadt G.Y.4808.C	Manufacturers of locomotives
Second Priority		
Rhein-metall Borsig	Berlin-Tegel G.F.2258 G.R.3687	Heavy engineering and armament works, engaged on a wide range of armaments production. The most likely producers of forgings, etc., required in Bodyline weapons.
Krupp Grosonwerke	Magdeburg G.F.2260	
Hanomag Old Works	Hanover-Linden G.Z.2845	
Bochumer Verein	Bochum G.F.2266	
Hanomag	Hanover-Brink	
Mannesmannrohrenwerke	Dussoldorf-Rath G.Z.2850 G.N.3812 G.R.3701 G.F.2242	
Rhein-metall Borsig	Dusseldorf-Rath G.F.2223	
Rhein-metall Borsig	Dusseldorf-Derendorf G.Z.2779	
Krupps	Essen G.F.2224	

OBOE TARGETS (FOR 8 GROUP)

Second Revision - 2nd December, 1943

1st Priority - Target of Special Importance

1.	Leverkusen	I.G. Farben Chemical Factory	GS.116	

2nd Priority - Targets of Special Importance Producing High Grade Steels

1.	Dusseldorf-Derendorf	Rheinmetall-Borsig	GZ.2779	Slightly damaged.
2.	Bochum	Bochumer-Verein	GF.2266	Damaged but operating.
3.	Dusseldorf-Rath	Rheinmetall-Borsig	GF.2223	Slightly damaged.
4.	" "	Mannesmann	GZ.2850	" "
5.	Essen	Krupps	GF.2224	Largely destroyed, almost entirely inactive.

3rd Priority - Other Works Producing High Grade Steels

1.	Weisweiler	G. Für Elektrometallurgie	GO.1130	
2.	Krefeld	Edelstahlwerke	GF.2213	
3.	Remscheid	"	GF.2253	Very severely damaged.
4.	Duisburg-Hamborn	August Thyssen	GF.2229	Slightly damaged.

4th Priority - Target of Special Importance

1.	Wuppertal	J. Jaeger Ball-bearings	GZ.2701

5th Priority - Electrical Power Targets

1.	Brauweiler	Switching and Transformer Stn.	GO.1428
2.	Knapsack	Power Station	GO.1237
3.	Fortuna	" "	GO.1236
4.	Herdecke	Power and Switching Stn.	GO.1123
5.	Stockum	" " " "	GO.1128
6.	Hattingen	" " " "	GO.1095
7.	Essen-Karnap	Power Station	GO.1103

6th Priority - Other targets of importance, arranged in an approximate order of priority within their industrial category

A. - Synthetic rubber

1.	Huls	Synthetic Rubber Works	GS.162

B. - Steel Works

1.	Duisburg-Rheinhausen	Alfred Hutte	GF.2254
2.	Oberhausen	Guthoffnungshutte	GF.2252
3.	Dortmund	Union	GF.2269
4.	Dortmund	Hoesch	GF.2267
5.	Duisburg-Ruhrort	Ver. Stahl.	GF.2220
6.	Dortmund	Horde	GF.2268
7.	Witten	Ruhrstahl.	GZ.2791
8.	Gelsenkirchen	Ver. Stahl.	GH.555B

/C. Alumina Works

C. - Alumina Works

1.	Lunen	Ver. Aluminiumwerke	GF.2355
2.	Ichendorf	Alumina Martinswerke	GF.2354

D. - Synthetic Oil Plants

1.	Gelsenkirchen-Nordstern	Synthetic Oil	GQ.1509
2.	Gelsenkirchen-Buer	" "	GQ.1537
3.	Koln-Wesseling	" "	GQ.1510
4.	Castrop-Rauxel	" "	GQ.1534
5.	Sterkrade-Holton	" "	GQ.1517
6.	Bottrop-Welheim	" "	GQ.1536

E. - General Engineering

1.	Bochum	Eisenhuttenwerke	GZ.2849
2.	Dusseldorf-Buderich	Gebr. Bohler	GZ.2818
3.	Koln-Mulheim	Felten and Guillaume	GR.3685
4.	Krefeld-Uerdingen	Waggon Works	GL.2642
5.	Duren	Durener Metallwerke	GH.477B
6.	Solingen	R. Rautenbach	GL.2629
7.	Solingen (Ohligs)	Kronprinz	GL.2567
8.	Solingen	J.A. Henckels	GZ.2908

MINISTRY OF ECONOMIC WARFARE NOTE

ON SCHWEINFURT

The three ball-bearing factories in this town -

Kugelfischer
V.K.F. I.
V.K.F. II.

are the three most important producers of ball-bearings in Axis Europe. It is believed that they are responsible for at least 50% by number of the total Axis supplies of ball-bearings. It is known that they concentrate particularly upon the special types and qualities required for use in the armaments industry, for which reason they may account for as much as 66% of the ball-bearing requirements of the German armed forces. Examination of the markings on a substantial sample of bearings taken from crashed G.A.F. aircraft showed that 75% were manufactured by Kugelfischer or V.K.F. Allowing for the existence of a sizeable V.K.F. plant near Berlin, this is thought to indicate that at least 66% of B.A.F. ball-bearing requirements are manufactured in Schweinfurt.

2. Less is known regarding the breakdown of total supplies by major use categories, but it is believed that up to 40% of the total output is required for aircraft and aero-engine construction, a slightly larger proportion for guns, predictors, M.T. and other equipment for the ground forces and the small remaining percentage for a variety of essential uses in industry.

3. It is believed that all ball-bearing capacity in Germany is fully occupied. There is a limited amount of spare capacity in France and possibly Italy but it is relatively inefficient in the sense that it is capable of turning out only a limited range of standard types and sizes. There is, therefore, little possibility of offsetting loss of production at Schweinfurt by immediate development of production elsewhere. Moreover there is now no possibility of obtaining increased supplies by importing. Germany already has import orders outstanding in Sweden and Switzerland but these cannot now be increased. In Sweden British and Russian pre-emptive orders will occupy the bulk of the useful capacity up till at least the middle of 1944. As from the beginning of 1944, the Swedish exports will also come under restriction by the Swedish Government. It has also been possible, by diplomatic pressure, to impose a ceiling on Swiss exports to Germany.

4. The vulnerability of ball-bearing plants to air attack is rated high. In the U.S. 8th Air Force attack on Schweinfurt of August 17th in which one works received 20 hits, another 5 hits and the third 1 hit, and in which generally speaking no major buildings were seriously affected, it is estimated that a total loss of production was inflicted which was equivalent to one week's supply of the total Axis ball-bearing output. The immediate German reaction was to despatch emissaries to Sweden to place orders at greatly enhanced prices for special bearings from the Swedish S.K.F. company. In view of the pre-emption mentioned above, this mission failed totally in its purpose.

5. Of the other ball-bearing plants available to the enemy the most important are:-

Norma at Stuttgart-Bad Canstatt
This was badly damaged in a night raid in the spring.
D.K.F. at Leipzig
Not yet attacked.
V.K.F. at Berlin-Erkner
Not yet attacked.
C.A.M. at Paris-Bois Colombes
Badly damaged in a recent attack by U.S. 8th Air Force.
C.A.M. at Paris-Ivry.
Not yet attacked.
R.I.V. at Turin
Not yet attacked.
R.I.V. at Villar Perosas
Not yet attacked.

/There

There are some smaller works in France which should make good targets for 2 Group Mosquitoes.

M.E.W./E.1.2.

14.10.43

DIARY OF OPERATIONS, BOMBER COMMAND

FEBRUARY 1943 TO FEBRUARY 1944

The figures for bomb tonnage used here are those given in the A.M.W.R. summary of operations. These include the loads of all aircraft claiming attack, and of those which were missing. The latter were more often shot down after bombing than before, so this figure is considered the closest approximation available. The final night raid reports of the Operational Research Section at Bomber Command, whose figures are otherwise very accurate, omit the bomb loads of those aircraft which were missing, and therefore unable to claim attack.

Detailed figures for Special Duty Operations are not available until January 1944. After this date, they are divided into Special Operations Executive and Radio Counter Measures Operations. The former were under the control of Air Ministry until September, and the latter until December, 1943.

S.O.E. Operations include S.I.S. (Secret Intelligence Service) Sorties.

Abbreviations Used

D/C	Depth Charge
S.O.E.	Operations in aid of resistance movements (Special Operations Executive)
R.C.M.	Radio Counter-Measures

/DIARY OF OPERATIONS

APPENDIX 10
SECRET

DIARY OF OPERATIONS

February 1943 to February 1944

1943
February

Date		Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
1		Anti-submarine Patrols	8	3	-	-	91	Whitley
2	St. Omer	Marshalling yards	12	-	-	-	2	Ventura
	Bruges	Engine sheds	12	12	-	12.6	2	Ventura
	Abbeville	Marshalling yards	12	12	-	13.1	2	Ventura
		Anti-submarine Patrols	13	13	-	-	6,91	(Halifax (Whitley
2/3	Cologne		161	142	5	470.9	1,4,5,6	(Mosquito (Stirling (Halifax (Lancaster
		Sea mining	13	5	-	(9 mines)	6	Halifax
		Leaflets, Paris	1	1	-	-	91	Wellington
3	Courtrai/ Wevelghem	Aerodrome	12	-	1	-	2	Ventura
	St. Omer/ Fort Rouge	Aerodrome	24	-	1	-	2	Ventura
	Ijmuiden	Steel works	12	-	-	-	2	Ventura
	Abbeville	Marshalling yards	12	11	-	12.3	2	Ventura
		Anti-submarine Patrols	8	8	-	-	6,91	Halifax Whitley
3/4	Hamburg		263	142	16	392.8	All Groups	Stirling Halifax Lancaster Wellington
		Sea-mining	8	6	2	(12 mines)	1,3	Wellington
		Leaflets, France	4	4	-	-	92	Wellington
4		Anti-submarine Patrols	8	8	-	(6 x 250 DC) (1 aircraft) (attacked)	6,91	Halifax Whitley
4/5	Turin		188	159	3	341.6	1,3,4,5,6	Halifax Lancaster Stirling
	Spezia		4	3	-	5.4	8	Lancaster
	Lorient		128	121	-	212.7	1,4,5,6	Lancaster Wellington Halifax
	Bochum		1	1	-	0.7	8	Mosquito
	Ruhrort		1	1	-	0.7	8	Mosquito
		Sea-mining	1	1	2	(2 mines)	8	Wellington
5		Anti-submarine Patrols	9	9	-	-	6,91	Halifax Whitley

Date		Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
5/6		Sea-mining	19	11	3	(56 mines)	3	Stirling
6		Anti-submarine Patrols	5	5	-	-	91	Whitley
6/7	Dusseldorf		2	1	-	0.7	8	Mosquito
		Sea-mining	72	50	-	(107 mines)	1,3,4,6	Wellington Halifax
		Leaflets, Paris	3	3	-	-	93	Whitley
		Anti-submarine Patrols	11	11	-	-	6,91	Halifax Whitley
7/8	Lorient		323	302	7	796.9	1,3,4, 5,6,8	Stirling, Wellington Halifax Lancaster
	Essen		1	1	-	0.7	8	Mosquito
	Hamborn		1	1	-	0.7	8	Mosquito
8		Anti-submarine Patrols	12	12	-	-	6,91	Halifax Whitley
8/9		Sea-mining	6	6	-	(18 mines)	5	Lancaster
9		Anti-submarine Patrols	13	13	-	-	6,91	Halifax Whitley
9/10	Essen		1	1	-	0.7	8	Mosquito
	Ruhrort		1	1	-	0.7	8	Mosquito
		Sea-mining	21	15	-	(30 mines)	1,3,6	Wellington
10	Caen	Marshalling yard	12	11	-	12.3	2	Ventura
		Anti-submarine Patrols	4	4	-	-	6	Halifax
11	Serqueux	Railway Centre	2	2	-	1.8	2	Boston
	Caen	" "	2	-	-	-	2	Boston
	Boulogne	Shipping	11	-	-	-	2	Boston
	Alkmaar	Railway Centre	2	-	-	-	2	Boston
	Roosendaal	" "	2	2	1	1.8	2	Boston
		Anti-submarine Patrols	11	11	-	-	6,91	Halifax Whitley
11/12	Wilhelmshaven		177	140	3	431.7	1,4,5,8	Stirling Halifax Lancaster
	Hamborn		1	-	-	-	8	Mosquito
	Bochum		1	1	-	0.7	8	Mosquito
		Sea-mining	34	22	-	(50 mines)	3,6	Wellington Stirling
		Leaflets, Vichy	5	3	-	-	91	Wellington
12	Tergnier	Railway Centre	2	1	-	0.9	2	Mosquito
	Rheine	" "	4	3	-	2.7	8	Mosquito
	Lingen	" "	4	4	-	3.6	8	Mosquito

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
12	Ougree	Armament Works	6	4	-	3.6	2	Mosquito
12/13	Rheinhausen		1	1	-	0.7	8	Mosquito
	Dusseldorf		1	1	-	0.7	8	Mosquito
		Sea-mining	38	35	-	(77 mines)	1,3,4,6	Wellington Stirling
		Leaflets, Orleans	2	2	-	-	91	Wellington
13	Boulogne	Shipping	(12 (10	11 -	- -	9.8 -	2 2	Boston
	St. Malo	Docks	10	10	-	8.9	8	Boston
	Ijmuiden	Steel Works	24	20	-	21.3	2	Ventura
		Anti-submarine Patrols	9	9	-	-	91	Whitley
13/14	Lorient		466	437	7	1169.1	1,3,6,8	Stirling Halifax Lancaster Wellington
	Duisburg/ Ruhrort		1	1	-	0.7	8	Mosquito
	Essen		1	-	-	-	8	Mosquito
		Leaflets, Paris, Rouen, Limoges	17	17	-	-	91,92,93	Wellington
14	Tours	Marshalling Yards	10	6	-	5.4	2	Mosquito
		Anti-submarine Patrols	9	9	-	-	6,91	Halifax Whitley
14/15	Milan		142	124	2	278.6	1,5,8	Lancaster
	Spezia		4	4	-	7.1	8	Lancaster
	Cologne		243	217	9	528.3	1,3,4, 6,8	Stirling Halifax Wellington
15	Dunkirk	Armed Raider	23	11	-	9.8	2	Boston
		Anti-submarine Patrols	12	10	-	-	6,91	Halifax Whitley
	Tours	Marshalling Yard	12	12	-	10.7	2	Mosquito
15/16	St. Trond		4	4	-	2.2	8	Mosquito
	Essen		1	1	-	0.7	8	Mosquito
	Rheinhausen		1	1	-	0.7	8	Mosquito
		Sea-mining	4	4	-	(12 mines)	3	Stirling
		Leaflets, Paris	2	2	-	-	93	Wellington
16		Anti-submarine Patrols	11	11	-	-	6,91	(Halifax (Whitley
16/17	Lorient		377	363	2	1003.0	1,3,4, 5,6,8	Stirling Halifax, Lancaster, Wellington
		Sea-mining	32	27	-	(68 mines)	1,3,4,	(Wellington (Stirling
		Leaflets, Paris	4	3	-	-	93	Wellington

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
17	Dunkirk	Armed Raider	12	-	-	-	2	Ventura
	Emden	Cloud-Cover	6	3	-	4.0	4	Wellington
		Anti-submarine Patrols	4	4	-	-	91	Whitley
		Other Sorties (Photo. Recce)	1	1	-	-	2	Mosquito
17/18	Bochum		1	1	-	0.7	8	Mosquito
	Hamborn		1	1	-	0.7	8	Mosquito
		Sea-mining	12	9	-	(32 mines)	3	Stirling
18	Dunkirk	Armed Raider	12	-	-	-	2	Ventura
	Tours	Marshalling Yard	20	18	1	16.1	2	Mosquito
	Liege	Marshalling Yard	6	-	-	-	2	Mosquito
		Anti-submarine Patrols	13	13	-	-	6,91	Halifax Whitley
18/19	Wilhelmshaven		195	185	4	596.1	1,4,5, 6,8	Stirling Halifax Lancaster
		Sea-mining	89	74	2	(187 mines)	1,3,4,6	Wellington Stirling Halifax
		Leaflets, Paris, Orleans	9	9	1	-	91,92	Whitley Wellington
19	Den Helder	Docks	12	10	-	11.2	2	Ventura
		Anti-submarine Patrols	10	10	-	-	6,91	Halifax Whitley
19/20	Wilhelmshaven		338	311	11	781.1	1,3,4, 5,6,8	Stirling Halifax Lancaster Wellington
	Essen		1	1	-	-	8	Mosquito
	Dortmund		1	1	-	0.7	8	Mosquito
20		Anti-submarine Patrols	9	9	-	-	6,91	Halifax Whitley
20/21		Sea-mining	20	18	1	(35 mines)	6	Wellington
21		Anti-submarine Patrols	10	6	1	-	6,91	Halifax Whitley
21/22	Bremen		143	129	-	424.4	1,5,8	Stirling Halifax Lancaster
22		Anti-submarine Patrols	12	12	-	(6 x 250 DC) (1 Aircraft) (attacked)	6,91	Halifax Whitley
23		Anti-submarine Patrols	10	10	-	-	6,91	Halifax Whitley
24		Anti-submarine Patrols	9	9	-	-	6,91	Halifax
24/25	Wilhelmshaven		115	105	-	192.6	6,8	Wellington Lancaster Halifax Stirling

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
24/25	Brauweiler		2	1	-	0.7	8	Mosquito
	Dusseldorf		2	2	-	1.3	8	Mosquito
25		Anti-submarine Patrols	9	9	-	-	6,91	Halifax Whitley
25/26	Nuremburg		337	291	9	758.3	1,3,4, 5,8	Lancaster Halifax Stirling
	Aachen		2	2	-	1.3	8	Mosquito
	Essen		1	1	-	0.7	8	Mosquito
	Cologne		1	1	-	0.7	8	Mosquito
	Dusseldorf		1	1	-	0.7	8	Mosquito
	Dortmund		1	-	-	-	8	Mosquito
		Sea-mining	54	33	-	(67 mines)	1,3,4,6	Wellington Halifax
		Leaflets, Nantes, Clermont, Paris	20	19	-	-	91,92,93	Wellington
26	Dunkirk	(Armed Raider)	60 (5 Ops. (12 a/c (each	33 of)))	-	36.6	2	Ventura
	Rennes	(Naval Storage Dep.)	20	17	3	15.2	2	Mosquito
		Anti-submarine Patrols	9	9	-	-	6,91	Halifax Whitley
26/27	Cologne		427	382	10	1062.1	1,3,4, 5,6,8	Halifax Lancaster Stirling Mosquito Wellington
	Aachen		2	2	-	1.3	8	Mosquito
		Sea-mining	21	18	-	(88 mines)	1,3,4,5	Wellington Stirling Halifax Lancaster
		Leaflets, Rouen	4	4	-	-	93	Whitley
27	Dunkirk	Armed Raider	24	23	-	25.6	2	Ventura
		Anti-submarine Patrols	9	9	-	-	6,91	Halifax Whitley
27/28	Munchen Gladbach		1	1	-	0.7	8	Mosquito
	Krefeld		1	-	-	-	8	Mosquito
	Dortmund		1	1	-	0.7	8	Mosquito
	Essen		1	-	-	-	8	Mosquito
	Bochum		1	-	-	-	8	Mosquito
	Hamborn		1	1	-	0.7	8	Mosquito

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
27/28		Sea-mining	91	81	-	(272 mines)	1,3,4, 5,6	Wellington Stirling Halifax Lancaster
		Leaflets, Clermont	2	1	-	-	92	Wellington
28	Hengelo	Engineering Works	4	4	-	3.6	2	Mosquito
		Anti-submarine Patrols	5	5	-	-	91	Whitley
	Ougree	Armament Works	6	6	-	4.9	2	Mosquito
28/ 1 Mar.	St. Nazaire		437	413	5	1129.1	All Groups	Halifax Lancaster Stirling Mosquito Wellington
	Essen		1	1	-	0.7	8	Mosquito
	Krefeld		1	-	-	-	8	Mosquito
	Munchen Gladbach		1	-	-	-	8	Mosquito
		Sea-mining	5	4	-	(8 mines)	1	Wellington
		Leaflets, Vichy	2	1	1	-	92	Wellington
March								
1		Anti-submarine Patrols	8	8	-	-	91	Whitley
1/2	Berlin		302	257	17	664.9	All Groups	Stirling Halifax Lancaster
	Cologne		1	1	-	0.7	8	Mosquito
	Ruhrort		1	1	-	0.7	8	Mosquito
	Dortmund		1	1	-	0.7	8	Mosquito
	Bochum		1	1	-	0.7	8	Mosquito
	Essen		1	-	-	-	8	Mosquito
1/2	Duisburg		1	1	-	0.7	8	Mosquito
		Sea-mining	49	35	2	(70 mines)	1,3,4,6	Wellington Halifax
		Leaflets, Lille	4	4	-	-	92	Wellington
2		Anti-submarine Patrols	7	7	-	-	91	Whitley
2/3	Rheinhausen		1	1	-	0.7	8	Mosquito
	Hamborn		1	-	-	-	8	Mosquito
	Cologne		1	1	-	0.7	8	Mosquito
	Essen		1	1	-	0.7	8	Mosquito
	Dusseldorf		1	1	-	0.7	8	Mosquito
	Bochum		1	-	-	-	8	Mosquito
		Sea-mining	60	40	2	(94 mines)	1,4,5,6	Halifax Wellington Lancaster
3	Knaben	Molybdenum Mines	10	9	1	8.0	2	Mosquito

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March

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
3		Anti-submarine Patrols	5	5	-	-	91	Whitley
3/4	Hamburg		417	354	10	922.0	All Groups	Halifax Lancaster Stirling Mosquito Wellington
	Essen		1	1	-	0.7	8	Mosquito
	Dusseldorf		1	1	-	0.7	8	Mosquito
	Dortmund		1	1	-	0.7	8	Mosquito
	Cologne		1	1	-	0.7	8	Mosquito
	Bochum		1	1	-	0.7	8	Mosquito
		Sea-mining	14	11	1	(30 mines)	3,4	Halifax Wellington Stirling
		Leaflets, Limoges	5	2	-	-	91	Wellington
4	Arnage	Railway Centre	6	6	-	5.1	2	Mosquito
	Aulnoye	Railway Centre	6	3	-	2.7	2	Mosquito
		Anti-submarine Patrols	5	5	-	(6 x 250 DC) (1 aircraft) (attacked)	91	Whitley
4/5	Dortmund		1	-	-	-	8	Mosquito
	Cologne		1	1	-	0.7	8	Mosquito
	Dusseldorf		1	-	-	-	8	Mosquito
	Hamborn		1	1	-	0.7	8	Mosquito
	Mulheim		1	-	-	-	8	Mosquito
	Bochum		1	1	-	0.7	8	Mosquito
		Sea-mining	27	23	1	(80 mines)	1,3,5	Lancaster Stirling Wellington
		Leaflets, Lille	16	15	1	-	93	Wellington
5		Anti-submarine Patrols	5	5	-	-	91	Whitley
5/6	Essen (Krupps)		442	366	14	1014.3	All Groups	Halifax Lancaster Stirling Mosquito Wellington
		Sea-mining	7	5	-	(14 mines)	4	Halifax Wellington
6		Anti-submarine Patrols	5	5	-	-	91	Whitley
7		Anti-submarine Patrols	5	5	-	-	91	Whitley
7/8		Sea-mining	20	13	2	(30 mines)	4	Halifax Wellington
		Leaflets, Limoges	2	2	-	-	91	Wellington

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Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
8	Lingen	Railway Workshops	3	2	1	1.8	2	Mosquito
	Tergnier	Railway Centre	3	3	-	2.7	2	Mosquito
	Aulnoye	Railway Centre	10	10	-	8.9	2	Mosquito
		Anti-submarine Patrols	9	9	-	-	91	Whitley
8/9	Nuremburg		335	301	7	798.4	All Groups	Halifax Lancaster Stirling Mosquito Wellington
	Hagen		1	1	-	0.7	8	Mosquito
	Dusseldorf		1	-	-	-	8	Mosquito
	Cologne		1	1	-	0.7	8	Mosquito
	Essen		1	1	-	0.7	8	Mosquito
		Sea-mining	16	11	-	(22 mines)	6	Wellington
9	Arnage	Remault Works	15	15	1	13.4	2	Mosquito
		Anti-submarine Patrols	8	8	-	-	91	Whitley
9/10	Munich		264	226	8	578.8	All Groups	Halifax Lancaster Stirling Mosquito Wellington
	Essen		2	1	-	0.7	8	Mosquito
	Rheinhausen		1	1	-	0.7	8	Mosquito
	Ruhrort		1	1	-	0.7	8	Mosquito
	Bochum		1	1	-	0.7	8	Mosquito
	Hamborn		1	1	-	0.7	8	Mosquito
	Mulheim		1	1	-	0.9	8	Mosquito
	Duisburg		1	1	-	0.9	8	Mosquito
		Sea-mining	62	47	3	(115 mines)	1,3,4,5,6	Wellington Stirling Lancaster
		Leaflets, Nantes	4	4	-	-	92	Wellington
10		Anti-submarine Patrols	6	5	1	-	91	Whitley
		Air/Sea Rescue	1	1	-	-	91	Whitley
10/11	Mulheim		1	1	-	0.7	8	Mosquito
	Essen		1	1	-	0.7	8	Mosquito
		Sea-mining	35	30	2	(115 mines)	3,5	Stirling Lancaster
		Leaflets, Clermont Ferrand area	5	5	-	-	91	Wellington
11		Anti-submarine Patrols	4	4	-	-	91	Whitley

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March

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
11/12	Stuttgart		314	279	11	820.9	All Groups	Halifax Lancaster Stirling Mosquito Wellington
		Sea-mining	14	13	-	(73 mines)	3,5	Stirling Lancaster
12	Ougree	Steelworks	12	11	1	9.8	2	Mosquito
		Anti-submarine Patrols	7	7	-	(6 x 250 DC) (1 aircraft) (attacked)	91	Whitley
12/13	Essen (Krupps)		457	384	23	1026.9	All Groups	Halifax Lancaster Stirling Mosquito Wellington
		Sea-mining	9	9	-	(50 mines)	3	Stirling
		Leaflets, Rouen	7	7	-	-	93	Wellington Whitley
13		Anti-submarine Patrols	5	5	-	-	91	Whitley
13/14		Sea-mining	68	49	3	(137 mines)	1,4,5,6	Wellington Lancaster
14		Anti-submarine Patrols	5	5	-	(12 x 250 DC) (2 aircraft) (attacked)	91	Whitley
14/15		Sea-mining	13	13	-	(26 mines)	4	Wellington
15	St. Brieuc	(La Plaine Aerodrome)	11	11	1	11.1	2	Ventura
		Anti-submarine Patrols	10	8	-	-	91	Whitley
16	Paderborn	(Railway Workshops)	16	12	1	10.7		Mosquito
16/17		Sea-mining	12	12	-	(24 mines)	1	Wellington
17		Anti-submarine Patrols	10	8	-	-	91	Whitley
18	Maasluis	Oil Refinery	12	12	-	11.9	2	Ventura
	Boulogne	Marshalling Yard	12	-		abandoned	2	Ventura
		Anti-submarine Patrols	7	7	-	-	91	Whitley
19		Anti-submarine Patrols	5	5	-	-	91	Whitley
20	Leer		1	1	-	4.9	1	Lancaster
	Louvain	Marshalling Yard	6	6	-	5.4	2	Mosquito
	Malines	Marshalling Yard	6	-	-	-	2	Mosquito
		Anti-submarine Patrols	5	5	-	-	91	Whitley
20/21		Sea-mining	16	4	-	(24 mines)	1,3,	Wellington Lancaster
21		Anti-submarine Patrols	5	5	-	-	91	Whitley
22	Maasluis	Oil Refinery	12	12	-	12.3	2	Ventura
	Caen	Railway Centre	12	-	-	-	2	Ventura

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
22		Anti-submarine Patrols	8	8	-	(21 X 250 DC) (4 aircraft) (attacked)	91	Whitley
22/23	St. Nazaire		357	284	1	914.9	All Groups	Halifax Lancaster Stirling Wellington Mosquito
		Sea-mining	6	6	-	(12 mines)	4	Wellington
23	Nantes	Locomotive Works	15	12	-	10.7	8	Mosquito
		Anti-submarine Patrols	9	9	-	(5 x 250 DC) (1 aircraft) (attacked)	91	Whitley
23/24		Sea-mining	45	42	1	(122 mines)	3,4,6	Lancaster Stirling Wellington
		Leaflets, Orleans, Lille	21	17	1	-	92,93	Wellington Whitley
24	Hamm	Railways	1	1	-	0.9	2	Mosquito
	Osnabruck	Railways	1	1	-	0.9	2	Mosquito
	Paderborn	Railways	1	-	-	-	2	Mosquito
25		Anti-submarine Patrols	1	1	-	-	91	Whitley
26		Anti-submarine Patrols	7	7	-	-	91	Whitley
26/27	Duisburg		455	392	6	943.8	All Groups	Halifax Lancaster Stirling Wellington Mosquito
		Leaflets, Orleans	5	4	-	-	91	Whitley
27	Hengelo	Engineering Works	6	5	-	4.5	2	Mosquito
	Ougree	Steel Works	6	-	-	-	2	Mosquito
		Anti-submarine Patrols	5	5	-	-	91	Whitley
27/28	Berlin		396	338	9	883.4	All Groups	Halifax Lancaster Stirling Wellington Mosquito
		Sea-mining	24	24	-	(81 mines)	1,3	Wellington Lancaster Stirling
		Leaflets, Rouen, Orleans	4	4	-	-	91,92	Wellington Whitley
28	Rotterdam	Shipping	24	23	-	25.7	2	Ventura
	Kinkempois	Marshalling Yard	6	-	2	-	2	Mosquito
		Anti-submarine Patrols	5	5	-	-	91	Whitley

Date		Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
28/29	St. Nazaire		323	297	2	680.2	All Groups	Halifax Lancaster Stirling Wellington Mosquito
		Sea-mining	7	6	-	(12 mines)	1	Wellington
		Leaflets, Paris area	5	5	-	-	91	Wellington
29	Abbeville	Railway Centre	12	6	-	6.7	2	Ventura
	Rotterdam	Shipping	49	34	-	37.9	2	Ventura
		Anti-submarine Patrols	9	9	-	-	91	Whitley
29/20	Berlin		329	234	21	606.1	All Groups	Halifax Lancaster Stirling Wellington Mosquito
	Bochum		157	110	13	149.1	1,4,6,8	Wellington Mosquito
	Dortmund		1	1	-	0.7	8	Mosquito
		Sea-mining	7	5	-	(30 mines)	3	Stirling
30	Eindhoven	Phillips' Works	10	9	-	7.8	2	Mosquito
		Anti-submarine Patrols	7	6	1	-	91	Whitley
31		Anti-submarine Patrols	5	5	1	-	91	Whitley
April								
1	Emmerich	Cloud-cover	1	-	1	-	1	Wellington
	Trier	Electric Power Station	6	6	-	5.1	2	Mosquito
	Ehrang	Marshalling Yard	6	4	-	3.6	2	Mosquito
		Anti-submarine Patrols	5	5	-	-	91	Whitley
2		Anti-submarine Patrols	5	5	-	-	91	Whitley
		Met. Flights	1	1	-	-	8	Mosquito
2/3	St. Nazaire		55	50	1	171.6	All Groups	Halifax Lancaster Stirling Wellington Mosquito
	Lorient		47	40	-	118.1	All Groups	Halifax Lancaster Stirling Wellington Mosquito
		Sea-mining	33	29	1	(141 mines)	1,3,5	Wellington Lancaster Stirling
3	Brest	Shipping	12	8	-	8.9	2	Ventura
	Malines	Railway Works	2	2	-	1.8	2	Mosquito
	Namur	Railway Centre	2	2	-	1.8	2	Mosquito

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Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
3	Tergnier	Railway Centre	2	1	-	0.9	2	Mosquito
	Aulnoye	Railway Centre	2	1	1	0.9	2	Mosquito
		Anti-submarine Patrols	5	4	-	-	91	Whitley
		Met. Flights	1	1	-	-	8	Mosquito
		Other Sorties (P.R.)	1	1	-	-	8	Mosquito
3/4	Essen		348	317	21	983.2	All Groups	Halifax Lancaster Stirling Wellington Mosquito
		Sea-mining	20	16	1	(32 mines)	1,4	Wellington
		Leaflets, Rheims, Nantes	9	9	-	-	91,92	Wellington Whitley
4	Caen-Carpiquet Aerodrome		25	24	-	24.1	2	Ventura
	St. Brieuc	Railway Works	11	9	-	9.4	2	Ventura
	Rotterdam	Shipyards	24	23	2	25.3	2	Ventura
		Anti-submarine Patrols	5	5	-	-	91	Whitley
		Met. Flight	1	1	-	-	8	Mosquito
4/5	Kiel		577	519	13	1380.7	All Groups	Halifax Lancaster Stirling Wellington Mosquito
5	Brest	Docks	12	12	4	13.3	2	Ventura
		Anti-submarine Patrols	9	9	-	-	91	Whitley
6	Namur	Marshalling Yard	8	6	-	5.4	2	Mosquito
		Anti-submarine Patrols	7	7	-	-	91	Whitley
6/7		Sea-mining	47	38	2	(103 mines)	All Groups	Wellington Stirling Lancaster Halifax
7		Anti-submarine Patrols	5	5	-	-	91	Whitley
8		Anti-submarine Patrols	5	5	-	-	91	Whitley
		Met. Flights	2	2	-	-	8	Mosquito
8/9	Duisburg		392	304	19	846.3	All Groups	Halifax Lancaster Stirling Wellington Mosquito
		Sea-mining	27	21	-	(63 mines)	1,3,5	Wellington Stirling Lancaster
9	Orleans	Railway Centre	4	-	-	-	2	Mosquito
	Julich	Railway Works	4	-	-	-	2	Mosquito

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April

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
9		Anti-submarine Patrols	5	5	-	-	91	Whitley
		Met. Flights	3	3	-	-	8	Mosquito
9/10	Duisburg		109	99	8	321.1	1,5,8	Lancaster Mosquito
		Leaflets, Orleans	5	5	-	-	91	Wellington
10		Anti-submarine Patrols	7	7	-	-	91	Whitley
		Met. Flights	3	3	-	-	8	Mosquito
10/11	Frankfurt		502	456	20	1059.8	All Groups	Halifax Lancaster Stirling Wellington
		Sea-mining	7	7	-	(42 mines)	3	Stirling
		Leaflets, Lyons	4	4	-	-	92	Wellington
11	Hengelo	Diesel engine Works	4	2	1	1.8	2	Mosquito
	Malines	Railway Works	4	4	1	3.6	2	Mosquito
		Anti-submarine Patrols	5	5	-	-	91	Whitley
11/12		Sea-mining	46	41	2	(130 mines)	1,3,4, 5.6	Wellington Stirling Lancaster
12		Met. Flights	2	2	-	-	8	Mosquito
13	Abbeville	Railway Centre	12	12	-	10.5	2	Ventura
	Caen	Railway Centre	12	11	-	10.5	2	Ventura
		Anti-submarine Patrols	9	9	-	-	91	Whitley
		Met. Flights	1	1	-	-	8	Mosquito
13/14	Spezia		211	193	4	505.2	1,5,8	Halifax Lancaster
	Hamburg		2	2	-	1.8	2	Mosquito
	Wilhelmshaven		2	2	-	1.8	2	Mosquito
	Bremen		2	2	-	1.8	2	Mosquito
		Sea-mining	10	8	-	(32 mines)	5	Lancaster
		Leaflets, Rouen, Lille	18	15	-	-	92,93	Wellington
14		Anti-submarine Patrols	6	6	-	(6 x 250 DC) (1 aircraft) (attacked)	91	Whitley
		Met. Flights	2	2	-	-	8	Mosquito
14/15	Stuttgart		462	393	23	800.8	All Groups	Halifax Lancaster Stirling Wellington
15	Cherbourg	Shipping	13	12	-	13.4	2	Ventura
		Anti-submarine Patrols	6	6	-	-	91	Whitley
15/16		Sea-mining	23	23	-	(59 mines)	1,3,6	Wellington Lancaster Stirling

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April

Date		Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
15/16		Leaflets, Orleans	5	4	-	-	91	Wellington
16	Ostend	Chemical Works	13	9	-	10.0	2	Ventura
	Haarlem	Railway Works	12	12	-	12.3	2	Ventura
		Anti-submarine Patrols	5	5	-	-	91	Whitley
		Met. Flights	2	1	1	-	8	Mosquito
16/17	Pilsen		327	285	37	617.0	All Groups	Wellington Halifax Lancaster Stirling
	Mannheim		271	225	18	362.0	1,3,4, 6,8	Halifax Stirling Wellington
		Leaflets, Rouen	11	10	-	-	93	Whitley Wellington
17	Abbeville	Railway Centre	12	12	-	11.3	2	Ventura
	Caen	" "	12	12	-	11	2	Ventura
	Zeebrugge	Coke Ovens	13	10	-	10.5	2	Ventura
		Anti-submarine Patrols	5	4	1	(6 x 250 DC) (1 aircraft) (attacked)	91	Whitley
17/18		Sea-mining	24	21	-	(56 mines)	1,3,4,5	Wellington Stirling Lancaster
		Leaflets, Orleans	1	1	-	-	91	Wellington
18	Dieppe	Shipping	12	11	-	12.2	2	Ventura
		Anti-submarine Patrols	5	5	-	-	91	Whitley
		Met. Flights	1	1	-	-	8	Mosquito
18/19	Spezia		178	164	1	433.4	1,3,5,8	Lancaster Halifax
		Sea-mining	18	17	-	(68 mines)	3,5	Stirling Lancaster
		Leaflets, Lille	3	2	-	-	92	Wellington
19	Namur	Marshalling Yard	6	-	-	-	2	Mosquito
		Anti-submarine Patrols	8	8	-	-	91	Whitley
		Met. Flights	1	1	-	-	8	Mosquito
20	Zeebrugge	Coke Ovens	12	11	-	11.1	2	Ventura
	Boulogne	Marshalling Yard	12	11	-	11.0	2	Ventura
	Cherbourg	Shipping	12	12	-	13.4	2	Ventura
		Anti-submarine Patrols	8	8	-	(2 x 250 DC) (1 aircraft) (attacked)	91	Whitley
20/21	Stettin		339	326	22	847.1	All Groups	Lancaster Stirling Halifax

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
20/21	Rostock		86	77	8	133.1	3,8	Stirling
	Berlin		11	10	1	8.9	2	Mosquito
		Sea-mining	18	15	-	(30 mines)	1,6	Wellington
		Leaflets, Lille	3	3	-	-	92	Wellington
21	Abbeville	Railway Centre	11	10	3	10.1	2	Ventura
		Anti-submarine Patrols	6	6	-	-	91	Whitley
		Met. Flights	3	3	-	-	8	Mosquito
22		Anti-submarine Patrols	5	5	-	(6 x 250 DC) (1 aircraft) (attacked)	91	Whitley
22/23		Sea-mining	32	27	2	(80 mines)	1,3,4,5	Wellington Stirling Lancaster
		Leaflets, Limoges, Lemans	5	5	-	-	91	Wellington
23		Anti-submarine Patrols	3	-	Re-called	-	91	Whitley
24	Paderborn	Railway Works	2	1	-	0.9	2	Mosquito
	Trier	Railway Works	1	-	-	-	2	Mosquito
	Tours	Railway Centre	2	-	-	-	2	Mosquito
		Anti-submarine Patrols	5	5	-	-	91	Whitley
25		Anti-submarine Patrols	5	5	-	-	91	Whitley
26	Tours	Railway Centre	2	2	-	1.8	2	Mosquito
	Lingen	Railway Works	2	1	-	0.9	2	Mosquito
	Julich	Railway Works	2	2	-	1.8	2	Mosquito
		Anti-submarine Patrols	7	7	-	-	91	Whitley
		Met. Flights	1	1	-	-	8	Mosquito
26/27	Duisburg		561	523	17	1492.2	All Groups	Halifax Stirling Lancaster Wellington Mosquito
		Leaflets, Paris, Rouen	8	8	-	-	93	Wellington Whitley
27	St. Brieuc	Railway Works	12	-	-	-	2	Ventura
		Anti-submarine Patrols	8	8	-	-	91	Whitley
		Met. Flights	1	1	-	-	8	Mosquito
27/28		Sea-mining	160	123	1	(458 mines)	1,3,4, 5,6	Lancaster Stirling Wellington Halifax
		Leaflets, Limoges	4	2	-	-	92	Wellington
28		Anti-submarine Patrols	5	5	-	-	91	Whitley

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April

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
28		Met. Flights	1	1	-	-	8	Mosquito
28/29	Wilhelmshaven		6	6	-	4.0	2	Mosquito
		Sea-mining	226	176	23	(593 mines)	1,3,4, 5,6	Lancaster Stirling Halifax Wellington
30		Anti-submarine Patrols	5	5	-	-	91	Whitley
		Met. Flights	3	3	-	-	8	Mosquito
30/ 1st May	Essen		305	251	12	839.3	All Groups	Mosquito Halifax Lancaster
	Bocholt		12	7	1	18.7	8	Stirling Halifax
May								
1	Caen	Railway Centre	12	-	-	-	2	Boston
		Anti-submarine Patrols	5	5	-	-	91	Whitley
		Met. Flights	3	3	-	-	2,8	Mosquito
	Eindhoven	Chemical Works	6	-	-	-	2	Mosquito
1/2		Sea-mining	30	28	-	(66 mines)	1,3,4	Wellington Stirling
2	Ijmuiden	Steel Works	24	24	-	23.9	2	Boston Ventura
		Anti-submarine Patrols	5	5	-	-	91	Whitley
		Met. Flights	3	3	-	-	8	Mosquito
	Thionville	Railway Works	7	6	-	5.4	2	Mosquito
3	Ijmuiden	Power Station	6	6	1	5.1	2	Boston
	Amsterdam	Power Station	12	-	10	-	2	Ventura
		Anti-submarine Patrols	8	8	1	(5 x 250 DC) (1 aircraft) (attacked)	91	Whitley
		Met. Flights	2	2	-	-	8	Mosquito
3/4		Leaflets, Paris	4	4	-	-	91	Whitley
4	Haarlem	Power Station	3	-	-	-	2	Mosquito
	The Hague	Power Station	3	3	-	2.7	2	Mosquito
	Abbeville	Marshalling Yard	12	11	-	11.2	2	Ventura
		Anti-submarine Patrols	8	8	-	-	91	Whitley
		Met. Flights	2	2	-	-	8	Mosquito
4/5	Dortmund		596	534	31	1570.4	All Groups	Halifax Stirling Lancaster Mosquito Wellington

1943
May

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
4/5	Rheine		8	6	-	19.7	5,8	Stirling Halifax Lancaster
		Leaflets, Rouen, Nantes	24	21	-	-	91,92,93	Wellington Whitley
5	Tubize	Railway Works	5	1	-	0.9	2	Mosquito
		Anti-submarine Patrols	5	5	-	(4 x 250 DC) (1 aircraft) (attacked)	91	Whitley
		Met. Flights	2	2	-	-	8	Mosquito
5/6		Sea-mining	21	17	1	(96 mines)	3	Stirling
6		Anti-submarine Patrols	5	5	-	6	91	Whitley
		Met. Flights	2	2	-	-	8	Mosquito
7	Boulogne	Outreau Railway Centre	6	-	-	-	2	Mitchell
		Anti-submarine Patrols	5	5	-	(6 x 250 DC) (2 aircraft) (attacked)	91	Whitley
9		Anti-submarine Patrols	5	5	-	(5 x 250 DC) (1 aircraft) (attacked)	91	Whitley
		Met. Flights	2	1	1	-	8	Mosquito
9/10		Sea-mining	21	20	-	(64 mines)	3	Stirling
11	Boulogne	Outreau Railway Centre	6	-	-	-	2	Mitchell
		Anti-submarine Patrols	7	7	-	-	91	Whitley
		Met. Flights	2	2	-	-	8	Mosquito
12		Met. Flights	2	2	-	-	8	Mosquito
12/13	Duisburg		572	517	34	1553.8	All Groups	Halifax Stirling Lancaster Mosquito Wellington
13	Boulogne	Outreau Railway Centre	6	5	1	8.9	2	Mitchell
	Cherbourg	Shipping	12	11	-	9.8	2	Boston
		Met. Flights	1	1	-	-	8	Mosquito
13/14	Bochum		442	378	24	1056.2	All Groups	Halifax Stirling Lancaster Mosquito Wellington
		Sea-mining	8	8	-	(43 mines)	3	Stirling Lancaster
		Leaflets, Rouen	12	12	-	-	91,93	Whitley Wellington
	Berlin		12	10	1	7.9	2	Mosquito

1943
May

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
13/14	Pilsen	Skoda Works	168	150	9	526.8	5,8	Lancaster Halifax
14	Ijmuiden	Steel Works	6	-	-	-	2	Mitchell
		Anti-submarine Patrols	11	9	-	(15 x 250 DC) (3 aircraft) (attacked)	91	Whitley
14/15		Leaflets, Rouen	5	5	-	-	91	Wellington
15	Poix	Aerodrome	24	12	-	10.7	2	Boston
	Caen	Carpiquet Aerodrome	6	6	-	10.5	2	Mitchell
	Caen	Carpiquet Assembly Shops	6	-	-	-	2	Mitchell
		Anti-submarine Patrols	8	8	-	-	91	Whitley
		Met. Flights	1	1	-	-	8	Mosquito
15/16	Berlin		3	2	-	1.8	2	Mosquito
		Leaflets, Paris and West Coast of France	17	17	-	-	93	Wellington Whitley
16	Caen	Carpiquet Aerodrome	6	5	-	8.9	2	Mitchell
	Tricqueville	Aerodrome	6	-	-	-	2	Mitchell
	Morlaix	Ploujean Aerodrome	12	12	-	13.4	2	Ventura
		Anti-submarine Patrols	5	5	-	-	91	Whitley
16/17	Ruhr	Dams on rivers Mohne, Sorpe, Eder, Schwelm	19	11	8	60.8 (Special) (Mines)	5	Lancaster
	Berlin		3	2	-	1.8	2	Mosquito
	Cologne		2	2	-	1.8	2	Mosquito
	Dusseldorf		2	2	-	1.8	2	Mosquito
	Munster		2	2	-	1.8	2	Mosquito
		Sea-mining	54	50	1	(154 mines)	3,4,6	Stirling Wellington
		Leaflets, Orleans	4	4	-	-	92	Wellington
17	Caen	Carpiquet Aerodrome	13	11	-	10.4	2	Ventura
		Anti-submarine Patrols	8	6	2	(6 x 250 DC) (1 aircraft) (attacked)	91	Whitley
		Met. Flights	2	2	-	-	8	Mosquito
17/18	Munich		3	2	-	1.8	2	Mosquito
		Sea-mining	6	5	1	(22 mines)	3	Stirling Lancaster
18	Abbeville	Drucat Aerodrome	13	12	-	10.7	2	Boston

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May

Date		Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
18		Anti-submarine Patrols	8	8	-	-	91	Whitley
		Met. Flights	1	1	-	-	8	Mosquito
18/19		Sea-mining	17	14	-	(67 mines)	1,6	Lancaster Wellington
19	Morlaix	Ploujean Aerodrome	12	-	-	-	2	Ventura
		Anti-submarine Patrols	5	5	-	-	91	Whitley
		Met. Flights	1	1	-	-	8	Mosquito
19/20	Berlin		6	2	-	1.8	2	Mosquito
		Leaflets, Orleans	5	5	-	-	91	Wellington
20	Tergnier	Railway Centre	2	2	-	1.8	2	Mosquito
		Anti-submarine Patrols	5	5	-	-	91	Whitley
20/21	Berlin		3	2	-	1.8	2	Mosquito
		Sea-mining	23	17	-	(80 mines)	1,3	Lancaster Stirling
21	Abbeville	Drucat Aerodrome	12	-	-	-	2	Mitchell
	Orleans	Les Aubrais Railway Centre	4	3	1	2.7	2	Mosquito
		Anti-submarine Patrols	5	5	-	(11 x 250 DC) (2 aircraft) (attacked)	91	Whitley
		Met. Flights	1	1	-	-	8	Mosquito
21/22	Berlin		4	3	-	2.7	2	Mosquito
		Sea-mining	104	87	4	226	1,3,4, 6	Wellington Stirling Lancaster
22	Nantes	Railway Works	7	-	-	-	2	Mosquito
		Anti-submarine Patrols	5	5	-	(12 x 250 DC) (3 aircraft) (attacked)	91	Whitley
23	Zeebrugge	Coke Ovens	12	11	-	12.3	2	Ventura
		Anti-submarine Patrols	6	6	-	-	91	Whitley
23/24	Dortmund		826	764	38	2248.0	All Groups	Halifax Stirling Lancaster Wellington Mosquito
		Leaflets, Paris, Rouen	15	9	1	-	93	Wellington Whitley
24		Anti-submarine Patrols	10	10	-	(6 x 250 DC) (1 aircraft) (attacked)	91	Whitley
25	Abbeville	Drucat Aerodrome	12	5	2	8.0	2	Mitchell
	Cherbourg	Port Area	12	-	-	Task Aban-doned	2	Boston
		Anti-submarine Patrols	9	9	-	-	91	Whitley

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May

Date		Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
25		Met. Flights	1	1	-	-	8	Mosquito
25/26	Dusseldorf		759	686	27	2037.7	All Groups	Halifax Stirling Lancaster Mosquito Wellington
26		Met. Flights	2	2	-	-	8	Mosquito
27	Jena	Naval Armament Works, Dusk attack	8	3	3	2.7	2	Mosquito
	Jena	Optical Glass Factory	6	3	-	2.7	2	Mosquito
		Anti-submarine Patrols	6	5	1	-	91	Whitley
		Met. Flights	3	3	-	-	8	Mosquito
27/28	Essen		518	493	23	1442.7	All Groups	Halifax Stirling Lancaster Mosquito Wellington
		Sea-mining	23	18	1	(89 mines)	1,3,	Wellington Stirling
		Leaflets, Orleans, Paris, Lille	19	17	-	-	91,92,93	Wellington Whitley
28	Zeebrugge	Coke Ovens	12	12	1	13.4	2	Ventura
		Anti-submarine Patrols	6	6	1	-	91	Whitley
28/29		Sea-mining	34	32	-	(108 mines)	3,4,6	Lancaster Stirling Wellington
		Leaflets, Orleans, Nantes	5	5	-	-	91,92	Wellington
29	Caen	Carpiquet Aerodrome	12	11	-	10.4	2	Ventura
		Anti-submarine Patrols	8	5	1	-	91	Whitley
		Met. Flights	3	3	-	-	8	Mosquito
29/30	Wuppertal		719	644	33	1895.3	All Groups	Halifax Stirling Lancaster Mosquito Wellington
		Leaflets	3	-	-	Recalled	93	Wellington
30		Anti-submarine Patrols	5	4	1	(6 x 250 DC) (1 aircraft) (attacked)	91	Whitley
30/31		Sea-mining	27	24	-	(80 mines)	1,3,5	Wellington Stirling Lancaster
		Leaflets, Lille, Paris	14	14	-	-	92,93	Wellington Whitley
31	Caen	Carpiquet Aerodrome	12	11	-	10.6		Ventura
	Grand Quevilly	Power Station	12	-	-	Recalled		Boston

1943
May

Date		Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
31	Cherbourg	Port area	6	6	-	6.7		Ventura
	Flushing	Oil Refinery and Storage	12	12	-	21.4		Mitchell
	Zeebrugge	Coke Ovens	12	11	-	12.3		Ventura
		Anti-submarine Patrols	8	8	-	-	91	Whitley
June								
1		Anti-submarine Patrols	8	8	-	-	91	Whitley
1/2		Sea-mining	33	30	-	(95 mines)	3,4,6	Stirling Wellington
2		Anti-submarine Patrols	5	5	-	-	91	Whitley
		Met. Flight	1	1	-	-	8	Mosquito
2/3		Sea-mining	35	32	-	(80 mines)	1,3,4	Wellington Stirling
3		Anti-submarine Patrols	5	4	1	-	91	Whitley
		Met. Flights	1	1	-	-	8	Mosquito
3/4		Sea-mining	39	30	-	(77 mines)	1,3,4,6	Wellington Stirling
		Leaflets, St. Nazaire, Lorient	16	15	1	-	92.93	Wellington
4		Anti-submarine Patrol	1	-	-	Recalled	91	Whitley
5		Anti-submarine Patrols	5	5	-	-	91	Whitley
		Met. Flight	1	1	-	-	8	Mosquito
5/6		Sea-mining	12	12	-	(66 mines)	3	Lancaster Stirling
		Leaflets, Vichy, Orleans	5	4	-	-	91	Wellington
6		Anti-submarine Patrols	5	5	-	-	91	Whitley
		Met. Flights	1	1	-	-	8	Mosquito
7		Met. Flights	1	1	-	-	8	Mosquito
8		Met. Flights	2	2	-	-	8	Mosquito
9		Met. Flights	2	1	-	-	8	Mosquito
9/10		Leaflets, Brest, Tours, St. Nazaire, Lille, Lorient	8	6	-	-	91	Wellington
10		Anti-submarine Patrols	8	-	-	Recalled	91	Whitley
10/11		Leaflets, Lorient, Nantes	6	3	1	-	91	Whitley Wellington
11		Anti-submarine Patrols	8	8	-	-	91	Whitley
		Met. Flights	1	1	-	-	8	Mosquito
11/12	Dusseldorf		783	693	38	2101.4	All Groups	Halifax Stirling Wellington Mosquito Lancaster

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June

Date		Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
11/12	Munster		72	65	5	187.7	8	Stirling Lancaster Halifax
	Duisburg		3	2	-	1.3	8	Mosquito
	Cologne		2	2	-	1.1	8	Mosquito
		Leaflets, Orleans, Caen, Le Mans, Nantes	23	21	1	-	91,92.93	Whitley Wellington
12		Anti-submarine Patrols	7	6	-	-	91	Whitley
		Met. Flights	2	2	-	-	8	Mosquito
12/13	Bochum		503	454	24	1595.9	All Groups	Halifax Stirling Wellington Mosquito Lancaster
		Sea-mining	34	30	-	(59 mines)	1,4,6	Wellington
13		Anti-submarine Patrols	6	6	-	-	91	Whitley
		Met. Flights	1	1	-	-	8	Mosquito
13/14	Berlin		6	5	-	3.9	8	Mosquito
	Cologne		3	3	-	2.3	8	Mosquito
	Dusseldorf		4	3	-	2.3	8	Mosquito
		Sea-mining	30	24	1	(65 mines)	1,3,6	Wellington Stirling
		Leaflets, Paris, Lille	8	6	-	-	93	Wellington Whitley
14		Anti-submarine Patrols	9	8	1	(6 x 250 DC) (2 aircraft) (attacked)	91	Whitley
		Met. Flights	2	1	1	-	8	Mosquito
14/15	Oberhausen		203	165	17	645.0	1,5	Lancaster
	Cologne		2	2	-	1.3	8	Mosquito
		Sea-mining	29	25	1	(59 mines)	3,4,6	Stirling Wellington
15		Anti-submarine Patrols	9	9	-	-	91	Whitley
		Met. Flights	2	1	-	-	8	Mosquito
15/16	Berlin		6	5		3.7	8	Mosquito
16		Anti-Submarine Patrols	5	5		-	91	Whitley
		Met. Flights	1	1		-	8	Mosquito
16/17	Cologne		212	179	14	717.9	1,5,8	Halifax/ Lancaster
	Berlin		3	3		2.3	8	Mosquito
		Leaflets Paris area	4	3	-	-	92	Wellington
17		Anti-Submarine Patrols	5	5		-	91	Whitley
17/18	Berlin		4	2		1.6	8	Mosquito

Date	Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
17/18	Duisburg	1	1		0.8	8	Mosquito
	Dusseldorf	1	-		-	8	Mosquito
	Cologne	1	1		0.8	8	Mosquito
18	Met. Flights	1	1		-	8	Mosquito
19	Anti-submarine Patrols	5	5		-	91	Whitley
19/20	Le Creusot (Schneider Works	287	273	2	751.3	3,4,6,8	Halifax Stirling Lancaster Mosquito
	Montchanin (Transformer Station)	29	29		106.4	8	Stirling Lancaster
	Dusseldorf	2	2		1.6	8	Mosquito
	Duisburg	2	2		1.6	8	Mosquito
	Cologne	2	1		008	8	Mosquito
	Sea-mining	12	11	1	(55 mines)	3	Lancaster
20	Anti-submarine Patrols	5	5	1	(12 x 250DC) (2a/c attacked)	91	Whitley
	Met. Flights	2	2		-	8	Mosquito
20/21	Friederichshaven	60	59		174.9	5,8	Lancaster
	Berlin	4	4		3.1	8	Mosquito
	Dusseldorf	1	1		0.8	8	Mosquito
	Sea-mining	15	13		(69 mines)	1,3	Lancaster Stirling
	Leaflets, Rouen, Rennes, Rheims, Amiens	3	3		-	93	Wellington
21	Anti-submarine Patrols	9	9		-	91	Whitley
	Met. flights	2	2		-	8	Mosquito
21/22	Krefeld	705	661	44	2067.8	All Groups	Halifax Stirling Lancaster Wellington Mosquito
	Hamborn	1	1		0.8	8	Mosquito
	Leaflets, Paris Orleans, Tours, etc,	15	15		-	91,92	Wellington
22	Anti-submarine Patrols	5	5		-	91	Whitley
	Met. flights	1	1		-	8	Mosquito
22/23	Mulheim	557	499	35	1642.8	All Groups	Halifax Stirling Lancaster Wellington Mosquito
	Cologne	4	4		3.1	8	Mosquito

Date	Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
22/23	Berlin	4	4		3.1	8	Mosquito
	Sea-mining	52	47		(173 mines)	1,3,4,6	Wellington Stirling Lancaster Halifax
	Leaflets, Lille, Amiens, Rheims, etc.	26	23	1	-	93	Wellington Whitley
23	Anti-submarine Patrols	5	5		-	91	Whitley
23/24	Spezia	52	49		119.9	5,8	Lancaster
	Cologne	3	3		2.3	8	Mosquito
	Duisburg	3	3		2.3	8	Mosquito
	Sea-mining	30	29		(79 mines)	1,3,6	Wellington Stirling Lancaster
24	Anti-submarine Patrols	5	5		(6 x 250 DC) (1 aircraft) (attacked)	91	Whitley
24/25	Wuppertal	630	554	34	1745.9	All Groups	Halifax Stirling Lancaster Wellington Mosquito
	Duisburg	4	2		1.6	8	Mosquito
	Sea-mining	4	2		(6 mines)	3	Stirling
	Leaflets, Paris Rennes	7	7		-	91	Whitley
25	Anti-submarine Patrols	5	5		-	91	Whitley
25/26	Gelsenkirchen	473	424	30	1393.6	All Groups	Halifax Stirling Lancaster Mosquito Wellington
	Sea-mining	33	30	1	(72 mines)	1,3,4,	Wellington Stirling Lancaster
26	Anti-submarine Patrols	5	5		-	91	Whitley
26/27	Hamburg	4	4		3.1	8	Mosquito
	Duisburg	3	3		2.3	8	Mosquito
	Sea-mining	16	12	1	(23 mines)	4,6	Wellington
	Leaflets, Le Mans Tours, Rennes, Caen	14	14		-	93	Wellington Whitley
27	Anti-submarine Patrols	6	6		-	91	Whitley
27/28	Sea-mining	30	25	1	(150 mines)	1,3	Lancaster Stirling
	Leaflets, Paris	4	4		-	92	Wellington

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
28		Anti-submarine Patrols	8	8		-	91	Whitley
		Met. Flight	1	1		-	8	Mosquito
28/29	Cologne		608	540	25	1727.4	All Groups	Halifax Stirling Lancaster Mosquito Wellington
	Hamburg		4	4		3.1	8	Mosquito
		Sea-mining	6	6		(19 mines)	3	Stirling
29		Anti-submarine Patrols	9	9		(6 x 250 DC) (1 aircraft) (attacked)	91	Whitley
		Met. Flights	1	1		-	8	Mosquito
29/30		Sea-mining	16	15	1	(30 mines)	1,4	Wellington
30		Anti-submarine Patrols	5	5		-	91	Whitley
July								
1		Anti-submarine Patrols	5	5		-	91	Whitley
		Met. Flight	1	1		-	8	Mosquito
1/2		Sea-mining	12	12		(72 mines)	5	Lancaster
		Leaflets, Tours, Paris Laval, etc.	25	23		-	91,92,93	Whitley Wellington
2		Anti-submarine Patrols	5	5		-	91	Whitley
		Met. Flight	1	1		-	8	Mosquito
2/3	Duisburg		2	2		1.6	8	Mosquito
	Cologne		3	3		2.3	8	Mosquito
		Sea-mining	32	27		(70 mines)	1,4,6	Wellington Halifax
3		Anti-submarine Patrols	5	5		-	91	Whitley
3/4	Cologne		653	589	30	1878.2	All Groups	Halifax Stirling Lancaster Mosquito Wellington
	Hamburg		4	4		3.1	8	Mosquito
	Duisburg		4	3		2.3	8	Mosquito
		Sea-mining	14	12	2	(62 mines)	3	Stirling
4		Anti-submarine Patrols	5	5		-	91	Whitley
		Met. Flight	1	1		-	8	Mosquito
4/5	Duisburg		3	2		1.6	8	Mosquito
		Sea-mining	13	13		(40 mines)	3	Stirling
		Leaflets, Bourges	4	4		-	92	Wellington
5		Anti-submarine Patrols	8	7	1	-	91	Whitley
		Met. Flights	2	2		-	8	Mosquito

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Date	Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
5/6	Hamburg	4	3	-	2.3	8	Mosquito
	Cologne	4	4		3.1	8	Mosquito
	Sea-mining	34	30	2	(90 mines)	3,4	Stirling Wellington
	Leaflets, Lille, Lens, Orleans, Paris	18	15		-	93	
		18	15		-	93	Whitley Wellington
6	Anti-submarine Patrols	8	8		-	91	Whitley
	Met. Flights	1	1		-	8	Mosquito
6/7	Cologne	4	2		1.6	8	Mosquito
	Dusseldorf	3	2		1.6	8	Mosquito
	Sea-mining	46	30	1	(103 mines)	1,3,4,6	Lancaster Stirling Wellington
7	Anti-submarine Patrols	5	5		-	91	Whitley
7/8	Duisburg	4	3		2.3	8	Mosquito
	Cologne	4	4		3.1	8	Mosquito
8	Anti-submarine Patrols	5	5		-	91	Whitley
	Met. Flights	1	1		-	8	Mosquito
8/9	Cologne	288	255	7	1096.6	1,5,8	Lancaster Mosquito
	Duisburg	3	3		2.3	8	Mosquito
	Sea-mining	46	41	1	(106 mines)	1,3,4,6	Wellington Stirling
	Leaflets, Dreux, Laval, Argenton, etc.	27	21		-	91,93	Wellington Whitley
9	Met. Flights	1	1		-	8	Mosquito
9/10	Gelsenkirchen	422	386	12	1343.1	1,3,4, 5,6	Mosquito Halifax Lancaster
	Sea-mining	18	18		(80 mines)	3,6	Stirling Wellington
10	Met. Flights	2	2		-	8	Mosquito
11	Met. Flights	1	1		-	8	Mosquito
12	Anti-submarine Patrols	5	4	1	-	91	Whitley
	Met. Flight	1	1		-	8	Mosquito
12/13	Turin	295	277	13	789.9	1,5,8	Lancaster
	Sea-mining	22	19		(36 mines)	4,6	Wellington
	Leaflets, Laval, Beauvais, Cambrai, etc.	19	17		-	93	Wellington Whitley
13	Anti-submarine Patrols	10	10		-	91	Whitley

Date	Target or Purpose				Tonnage	Groups	Aircraft
13/14	Aachen	374	352	20	874.6	1,3,4,6,8	Halifax Stirling Lancaster Wellington Mosquito
	Cologne	2	-		-	8	Mosquito
	Leaflets, Rennes, Etampes, Versailles, etc.	8	7	1	-	92	Wellington
14	Anti-submarine Patrols	6	1		Recalled	91	Whitley
	Met. Recce.	1	1		-	8	Mosquito
14/15	Berlin	8	7	1	5.5.	8	Mosquito
15	Anti-submarine Patrols	3	3		-	91	Whitley
	Met. flight	1	1		-	8	Mosquito
15/16	Montbelliard (Peugeot Works)	165	157	5	390.7	4,8	Halifax.
	Munich	6	2		1.6	8	Mosquito
	Transformer & Switching Stns. in N. Italy	24	23	2	70.7	5	Lancaster
16	Anti-submarine Patrols	7	6	1	-	91	Whitley
16/17	Munich	6	6		4.7	8	Mosquito
	Transformer & Switching Stns. in N. Italy	18	17	1	51.9	5	Lancaster
	Leaflets, Granville, Le Mans, etc.	7	7		-	91	Wellington
17	Anti-submarine Patrols	6	6		-	91	Whitley
	Met. flights	2	2		-	8	Mosquito
17/18	Leaflets, Argentan, Laval, Alencon, Le Mans	4	4		-	92	Wellington
18	Met. flight	1	-	1	-	8	Mosquito
	Anti-submarine Patrols	1	-	1	-	91	Whitley
18/19	Seamining	16	16		(32 mines)	1	Wellington
19	Anti-submarine Patrols	9	8	1	-	91	Whitley
	Met. flight	1	1		-	8	Mosquito
20	Met. flight	1	1		-	8	Mosquito
22	Met. flight	3	2		-	8	Mosquito
23	Met. flight	2	2		-	8	Mosquito
23/24	Leaflets, Paris	7	7		-	91	Whitley
24	Met. flight	1	1		-	8	Mosquito

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July

Date	Target or Purpose					Tonnage	Groups	Aircraft
24/25	Hamburg		791	740	12	2396.5	All Groups	Lancaster Halifax Stirling Wellington
	Leghorn		33	33		83.3	5	Lancaster
	Duisburg		4	3		2.3	8	Mosquito
	Kiel		3	2		1.5	8	Mosquito
	Lubeck		3	3		2.3	8	Mosquito
	Bremen		3	3		2.3	8	Mosquito
		Sea-mining	6	6		(12 mines)	1	Wellington
		Leaflets, Tours, Fontainebleu, etc.	7	6		-	92	Wellington
25		Met. Flights	3	3		-	8	Mosquito
25/26	Essen		705	627	26	2032.4	All Groups	Halifax Stirling Mosquito Wellington Lancaster
		Sea-mining	17	17		(78 mines)	3,4	Stirling, Lancaster Wellington
		Leaflets, Alencon Le Mans, Argentan	7	6		-	93	Wellington
	Cologne		3	3		2.3	8	Mosquito
	Hamburg		6	6		4.6	8	Mosquito
	Gelsenkirchen		3	1		0.7	8	Mosquito
26		Met. Flights	2	2		-	8	Mosquito
26/27	Hamburg		6	5		3.9	8	Mosquito
		Leaflets, Chateaudun, Blois	3	2		-	92	Wellington
27		Met. Flight	1	1		-	8	Mosquito
27/28	Hamburg		787	739	17	2417.1	All Groups	Halifax Stirling Lancaster Wellington
	Duisburg		3	3	1	2.4	8	Mosquito
		Sea-mining	6	5		(9 mines)	6	Wellington
		Leaflets, Dreux, Orleans, Paris	11	9		-	93	Wellington Whitley
28/29	Hamburg		4	4		3.1	8	Mosquito
	Dusseldorf		3	3		2.3	8	Mosquito
		Sea-mining	17	16		(94 mines)	3	Stirling Lancaster
		Leaflets, Cherbourg, Granville, St. Malo.	4	3		-	92	Wellington

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July

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
29		Met. Flight	1	1		-	8	Mosquito
29/30	Hamburg		777	726	28	2382.5	All Groups	Halifax Stirling Wellington Lancaster Mosquito
	Dusseldorf		4	4		3.1	8	Mosquito
		Sea-mining	6	4		(8 mines)	4,5	Mosquito Wellington Lancaster
		Leaflets; towns in France & Italy	12	12		-	4,5,92	Wellington Lancaster
30		Met. Flight	1	1		-	8	Mosquito
30/31	Remscheid		273	243	15	778.4	All Groups	Halifax Stirling Mosquito Wellington Lancaster
		Sea-mining	8	8		(35 mines)	3	Stirling Lancaster
31		Met. Flight	1	1		-	8	Mosquito
August								
1/2		Sea-mining	29	26		(69 mines)	3,4	Stirling Wellington
2		Met. Flights	3	2	-	-	8	Mosquito
2/3	Hamburg		740	425	30	1425.9	All Groups	Lancaster Halifax Stirling Mosquito Wellington
	Duisburg		5	3		2.3	8	Mosquito
		Sea-mining	6	3	1	(6 mines)	1	Wellington
		Leaflets, Lille, Arras, Rennes, etc.	12	11		-	92,93	Wellington
3/4		Sea-mining	12	10		(19 mines)	6	Wellington
4		Met. Flight	1	1	-	-	8	Mosquito
4/5	Duisburg		3	3		2.3	8	Mosquito
	Cologne		2	2		1.6	8	Mosquito
5		Met. Flight	1	1		-	8	Mosquito
5/6	Dusseldorf		4	1		0.8	8	Mosquito
	Duisburg		4	4		3.1	8	Mosquito
6		Met. Flight	1	1		-	8	Mosquito
6/7	Cologne		3	3		2.3	8	Mosquito
	Duisburg		4	4		3.1	8	Mosquito

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August

Date	Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
6/7	Sea-mining	34	25	2	(68 mines)	3,4,6	Stirling Wellington
	Leaflets, Paris, Chateaudun, Tours, etc.	14	13		-	92,93	Wellington Whitley
7	Met. Flights	2	2		-	8.	Mosquito
7/8	(Turin	74	74		192.0	1,8	Lancaster
	(Milan	73	72	2	197.4	5,8.	Lancaster
	(Genoa	73	72		166.3	1,5,8	Lancaster
7/8	Dusseldorf	1	1		0.8	8	Mosquito
	Cologne	4	4		3.1	8	Mosquito
8	Met. Flight	1	1		-	8	Mosquito
9	Met. Flight	1	1		-	8	Mosquito
9/10	Mannheim	457	432	9	1723.1	1,4,5, 6,8	Lancaster Halifax
	Sea-mining	10	10	-	(55 mines)	3	Stirling
	Leaflets, Orleans, Le Mans, Angers, etc	14	13		-	91	Wellington Whitley
	Duisburg	6	6		4.7	8	Mosquito
10	Met. Flights	2	2		-	8	Mosquito
10/11	Nuremburg	653	611	16	1671.3	All Groups	Halifax Stirling Lancaster
	Mannheim	3	2		1.1	8	Mosquito
	Cologne	3	3		2.3	8	Mosquito
	Dusseldorf	3	3		2.3	8	Mosquito
	Sea-mining	18	18		(36 mines)	1	Wellington
11/12	Cologne	4	4		3.1	8	Mosquito
	Duisburg	4	4		3.1	8.	Mosquito
	Sea-mining	23	20	1	(40 mines)	4,6	Wellington
	Leaflets; towns in France	19	14	1	-	92,93	Wellington
12	Met. Flights	2	2		-	8	Mosquito
12/13	Milan	504	481	4	1232.3	All Groups	Halifax Lancaster
	Turin	152	144	2	239.9	3,8	Halifax Lancaster Stirling
	Berlin	7	6	1	4.7	8.	Mosquito
	Sea-mining	24	20	2	(40 mines)	1,6	Wellington

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August

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
12/13		Leaflets, Brest, La Rochelle, Rouen, etc.	9	9		-	93	Wellington
14		Met. Flight	1	1		-	8	Mosquito
14/15	(Milan		109	106	1	318.8)	1,5,8	Lancaster
	(Milan	Land Armament Works	31	28		89.6)		
	Berlin		7	4		3.1	8	Mosquito
15		Met. Flight	1	1		-	8	Mosquito
15/16	Milan		199	193	7	591.2	1,5,8	Lancaster
	Berlin		8	5		3.8	8	Mosquito
		Sea-mining	63	57	3	(139 mines)	1,3,4,6	Wellington Stirling
		Leaflets, Blois, Tours, Versailles, etc.	16	16		-	91,92	Wellington
16		Met. Flight	1	1		-	8	Mosquito
16/17	(Turin		130)					Lancaster
	(Turin	Aero-Engine & Motor Car Works	) 24)	137	4	244.3	3,8	Halifax Stirling
17		Met. Flight	1	1		-	8	Mosquito
17/18	Peenemunde		597	571	40	1937.3	All Groups	Halifax Stirling Lancaster
	Berlin		8	8	1	6.3	8	Mosquito
18/19		Leaflets; towns in France	20	18		-	93	Wellington
19		Met. Flights	2	2		-	8	Mosquito
19/20	Berlin		8	7	1	5.2	8	Mosquito
20		Met. Flight	1	1		-	8	Mosquito
21		" "	1	1		-	8	Mosquito
22		" "	2	2		-	8	Mosquito
22/23	Leverkusen		462	427	5	1728.8	1,4,5, 6,8	Mosquito Lancaster Halifax
	Brauweiler (Cologne)		12	3		2.3	8	Mosquito
	Hamburg		6	3		2.2	8	Mosquito
		Sea-mining	47	22		(87 mines)	3,4	Stirling Wellington
		Leaflets; towns in France	7	7		-	91	Wellington
23		Met. Flight	1	1		-	8	Mosquito
23/24	(Berlin		719	625	57	1772.1	(All	Mosquito
	(Berlin	Route markers	8	-		-	(Groups	Halifax Stirling Lancaster

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August

Date	Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
23/24	Sea-mining	40	32		(64 mines)	1,4,6	Wellington
	Leaflets, Tours, Montargis, Etampes, etc.	22	17		-	92,93	Wellington
24	Mot. Flights	2	2		-	8	Mosquito
	Air/Sea rescue	1	-		-	3	Stirling
24/25	Berlin	8	7		5.2	8	Mosquito
	Sea-mining	66	63		(165 mines)	1,3,4,6	Wellington Stirling Lancaster
25/26	Berlin	6	5		3.6	8	Mosquito
	Sea-mining	42	36		(99 mines)	1,3,6	Wellington Stirling
	Leaflets, Fontainebleau Beauvais etc.	7	5	1	-	91	Wellington
26	Mot. flights	2	2		-	8	Mosquito
26/27	[illegible] Sea-mining	32	27		(72 mines)	3,4,6	Stirling Lancaster Mosquito Whitley
	Leaflets, St. Malo	1	-		-	91	Wellington
27	Mot. flights	2	2		-	8	Mosquito
27/28	Nuremburg	674	621	33	1773.0	All Groups	Halifax Lancaster Stirling
	Duisburg	4	3		2.0	8	Mosquito
	Sea-mining	47	41	1	(94 mines)	1,3,4,6	Wellington Stirling
	Leaflets, Cherbourg, St. Malo, etc.	10	9		-	91,93	Wellington Whitley
29/30	Cologne	4	4		3.1	8	Mosquito
	Duisburg	4	3	1	2.4	8	Mosquito
30	Mot. flights	2	2		-	8	Mosquito
30/31	Munchen-Gladbach	660	616	25	2353.4	All Groups	Halifax Stirling Lancaster Wellington Mosquito
	Sea-mining	9	9		(51 mines)	3	Stirling
	Duisburg	12	10	1	7.0	8	Mosquito
	Forot d'Eperlogues (Starkey targets)	45	34	2	66.0	8,91, 92,93	Mosquito Halifax Wellington
31	Mot. flights	2	2		-	8	Mosquito

Date	Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
31/1 Sept.	Berlin	612	512	47	1447.9	All Groups	Stirling Halifax Mosquito Lancaster
	Brauweiler	5	3		2.3	8	Mosquito
	Foret de Hosdin (Starkey targets)	41	35		68.6	4,8,91, 92,93.	Mosquito Halifax Wellington
September							
2	Met. Flights	3	3		-	8	Mosquito
2/3	Cologne	4	3		2.3	8	Mosquito
	Duisburg	4	2		1.6	8	Mosquito
	Foret de Mormal (Starkey targets)	41	36		75.2	1,8,91, 92, 93	Mosquito Wellington
	Sea-mining	89	73		(303 mines)	1,3,5,6	Lancaster Wellington Mosquito Stirling
3	Met. Flight	1	1		-	8	Mosquito
3/4	Berlin	316	295	22	999.4	1,3,5, 6,8	Mosquito Lancaster
	Dusseldorf	4	3		2.7	8	Mosquito
3/4	Foret de Raismes (Starkey targets)	44	39		77.4	6,8,91, 92,93	Wellington Mosquito Halifax
	Sea-mining	56	45	1	(165 mines)	3,4	Stirling Halifax
	Leaflets, Northern France	7	6	1	-	91	Whitley
4	Met. Flight	1	1		-	8	Mosquito
4/5	Cologne	4	2		1.6	8	Mosquito
	Duisburg	4	3		2.3	8	Mosquito
	Sea-mining	38	34		(103 mines)	1,3,6	Wellington Stirling
5	Met Flights	2	2		-	8	Mosquito
5/6	Mannheim	605	546	34	1535.6	All Groups	Stirling Lancaster Halifax
	Dusseldorf	4	4		3.1	8	Mosquito
	Sea-mining	25	18		(35 mines)	1,6	Wellington
6	Met. flights	2	2		-	8	Mosquito
6/7	Munich	404	365	17	1045.0	All Groups	Lancaster Halifax
7	Met. flights	2	2		-	8	Mosquito

Date	Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
8	Met. flights	3	3		-	8	Mosquito
8/9	Boulogne area Gun positions (Starkey targets)	257	234		669.9	1,3,6, 91,92,93	Halifax Mosquito Wellington Stirling
9	Met. flights	3	3		-	8	Mosquito
10	Met. flights	1	1		-	8	Mosquito
13	Met. flights	1	1		-	8	Mosquito
13/14	Duisburg	5	3		2.3	8	Mosquito
	Cologne	5	2		1.6	8	Mosquito
14	Met. flights	3	3		-	8	Mosquito
14/15	Berlin	8	4	1	3.1	8	Mosquito
	Dortmund-Ems Canal (Greven)	8	-	1	-	5	Lancaster
15	Met. flights	4	4		-	8	Mosquito
15/16	Montlucon	369	351	3	1015.9	3,4,6,8	Halifax Stirling Lancaster
	Dortmund-Ems Canal (Greven)	8	6	5	32.9	5	Lancaster
	Leaflets, Northern France	13	12		-	91,92	Wellington
16	Met. flights	2	2		-	8	Mosquito
16/17	Modane (marshalling yard)	340	295	3	625.5	3,4,5, 6,8	Lancaster Halifax Stirling
	Antheor (Viaduct)	12	10	1	21.2	5	Lancaster
	Berlin	5	4		2.8	8	Mosquito
	Leaflets, Northern France	3	2		-	91	Wellington
17	Met. flights	1	1		-	8	Mosquito
17/18	Berlin	6	6		4.5	6,8	Mosquito Wellington
	Sea-mining	8	8		(16 mines)	6	Wellington
18	Met. flight	1	1		-	8	Mosquito
18/19	Cologne	5	5		3.9	8	Mosquito
	Sea-mining	49	45		(118 mines)	1,3,6	Wellington Stirling Lancaster
20/21	Berlin	8	8		5.8	8	Mosquito
	Sea-mining	20	17		(34 mines)	1,6	Wellington
	Leaflets, Northern France	21	17		-	92,93	Wellington
21	Met. flights	3	3		-	8	Mosquito

Date	Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
21/22	Sea-mining	26	25		(116 mines)	1,3	Lancaster Wellington Stirling
	Leaflets, Laon Compiegne	3	2		-	92	Wellington
22	Met. flights	2	2		-	8	Mosquito
22/23	Hannover	711	658	26	2502.7	All Groups	Halifax Stirling Lancaster Wellington
	Oldenburg (Spoof)	29	29		71.8	8	Mosquito Lancaster
	Emden (Oboe Range Test)	12	11		16.7	8	Mosquito
	Sea-mining	4	2		(10 mines)	3	Stirling
	Leaflets, Northern France	7	7		-	91	Whitley
23	Met. flights	3	3		-	8	Mosquito
23/24	Mannheim	630	571	32	1974.1	All Groups	Halifax Stirling Lancaster Wellington Mosquito
	Darmstadt (Spoof	29	29		85.4	8	Mosquito Lancaster
	Aachen	6	6		4.7	8	Mosquito
	Leaflets, Northern France	28	24	1	-	91,92,93	Wellington Whitley
24	Met. flight	1	1		-	8	Mosquito
24/25	Duisburg	4	4		3.1	8	Mosquito
	Sea-mining	39	37		(127 mines)	1,3,6	Lancaster Wellington Stirling
	Leaflets, Cambrai, St. Quentin	2	2		-	91	Whitley
25	Met. flights	3	3		-	8	Mosquito
25/26	Cologne	4	4		3.1	8	Mosquito
	Dusseldorf	4	4		3.1	8	Mosquito
	Sea-mining	10	7		(38 mines)	3	Stirling
	Leaflets, Northern France	11	10		-	93	Wellington
26	Met. flights	3	3		-	8	Mosquito
26/27	Duisburg	4	4		3.1	8	Mosquito
	Aachen	5	3		2.3	8	Mosquito
	Cologne	4	3		2.3	8	Mosquito
	Leaflets Northern France	4	4		-	92	Wellington

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September

Date	Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
26/27	Met. flights	3	3		-	8	Mosquito
27	Met. flights	2	2		-	8	Mosquito
27/28	Hannover	678	612	38	2357.7	All Groups	Halifax Stirling Lancaster Wellington
	Brunswick (Spoof)	27	27	1	89.4	8	Lancaster Mosquito
	Emden	9	9		3.5	8	Mosquito
	Aachen	5	3		2.3	8	Mosquito
	Sea-mining	19	18		(62 mines)	3	Stirling
	Leaflets, Northern France	4	4		-	92	Wellington
28	Met. Flight	1	1		-	8	Mosquito
28/29	Cologne	4	4		3.1	8	Mosquito
	Gelsenkirchen	4	3		2.7	8	Mosquito
29	Met. Flight	1	1		-	8	Mosquito
29/30	Bochum	352	316	7	1343.5	1,4,5, 6,8	Mosquito Halifax Lancaster
	Gelsenkirchen	11	9		7.0	8	Mosquito
	Sea-mining	14	13	1	(61 mines)	5	Lancaster
30	Met. Flight	1	1		-	8	Mosquito
October							
1	Met. Flights	2	2		-	8	Mosquito
1/2	Hagen	251	240	1	1149.6	1,5,8	Mosquito Lancaster
	Witten Steel Works	12	8		6.2	8	Mosquito
2	Met. Flights	3	3		-	8	Mosquito
2/3	Munich	294	273	8	1014.7	1,5,8	Lancaster
	Gelsenkirchen	4	4		3.1	8	Mosquito
	Cologne	4	4		3.1	8	Mosquito
	Sea-mining	117	100	1	(292 mines)	1,3,4,6	Wellington Stirling Halifax
	Leaflets, Northern France	21	17		-	91,93	Wellington Whitley
3	Met. Flights	2	2		-	8	Mosquito
3/4	Kassel	547	501	24	1616.4	All Groups	Lancaster Mosquito Halifax Stirling

1943
October

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
3/4	Hannover		10	9		6.0	8	Mosquito
	Aachen					3.1	8	Mosquito
	Cologne	Knapsack Power Station	12	9		7.0	8	Mosquito
		Sea-mining	7	7		(42 mines)	3	Stirling
		Leaflets, Northern France	7	6		-	93	Wellington Whitley
4		Met. Flights	3	3		-	8	Mosquito
4/5	Frankfurt		406	357	10	1104.6	All Groups	Halifax Lancaster Stirling Mosquito
	Ludwigshaven	(Diversion)	66	57		235.2	1,8	Lancaster Mosquito
	Aachen	(first G-H trial)	1	1		0.7	8	Mosquito
	Cologne	(Knapsack Power Station)	12	5		4.1	8	Mosquito
		Sea-mining	5	4		(14 mines)	3	Stirling
		Leaflets, Northern France	8	6		-	92	Wellington
5		Met. Flights	1	1		-	8	Mosquito
6		Met. Flights	2	2		-	8	Mosquito
7		Met. Flights	2	2		-	8	Mosquito
7/8	Stuttgart		342	314	4	1256.9	1,3,5, 6,8	Lancaster
	Friedrichshaven	(Feint)	16	15		52.4	8	Lancaster
	Aachen		5	5		3.9	8	Mosquito
	Munich		10	8		5.9	8	Mosquito
	Emden	(first Oboe Repeater trial)	7	7		3.9	8	Mosquito Lancaster
		Sea-mining	80	61	3	(194 mines)	1,3,4,6	Wellington Stirling Halifax
		Leaflets, Northern France	14	13		-	91,93	Wellington
8		Met. Flights	1	1		-	8	Mosquito
8/9	Hannover		504	457	27	1702.3	All Groups	Halifax Mosquito Wellington Lancaster
	Bremen	(Diversion)	119	107	3	298.3	3,8	Halifax Stirling Lancaster

1943
October

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
8/9	Berlin		7	6		3.9	8	Mosquito
	Castrop Rauxel	(Synthetic Oil Plant)	10	8		5.8	8	Mosquito
	Duren	(Metal Castings Works)	1	1		0.7	8	Mosquito
		Sea-mining	17	16		(62 mines)	3	Stirling
		Leaflets, Orleans, Rennes	2	2		-	92	Wellington
9		Met. Flight	1	1		-	8	Mosquito
9/10	Berlin		6½	5		3.5	8	Mosquito
13		Met. Flights	2	2		-	8	Mosquito
13/14	Cologne		4	4		3.1	8	Mosquito
	Duisburg		4	4		3.1	8	Mosquito
16/17	Dortmund		9	9		6.6	8	Mosquito
		Leaflets, Northern France	11	8		-	91,92	Wellington Whitley
17		Met. Flights	2	2		-	8	Mosquito
17/18	Berlin		8	6		4.7	8	Mosquito
	Aachen		3	3		2.3	8	Mosquito
	Duisburg		1	-		-	8	Mosquito
		Sea-mining	54	49		(184 mines)	1,3,6	Wellington Stirling
		Leaflets, Northern France	16	10		-	91.93	Wellington Whitley
18		Met. Flights	4	4		-	8	Mosquito
18/19	Hannover		360	349	17	1696.9	1,3,5,	Lancaster
	Berlin		8	7		5.5	8	Mosquito
	Dusseldorf		1	1		.8	8	Mosquito
	Emden		7	7		3.9	8	Mosquito
	Stolberg	(Smelting and Acid Works)	3	3		2.3	8	Mosquito
	Duisburg	(Blast Furnaces)	11	10		7.8	8	Mosquito
		Sea-mining	6	6		(12 mines)	6	Wellington
		Leaflets, Northern France	12	11		-	93	Wellington
19		Met. Flights	2	2		-	8	Mosquito
20		" "	2	2		-	8	Mosquito
20/21	Leipzig		358	285	16	1084.9	1,3,5, 6,8	Lancaster
	Berlin		9	9	2	5.0	8	Mosquito

APPENDIX 10
SECRET

1943
October

Date		Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
20/21	Emden		5	5		2.5	8	Mosquito
	Cologne	(Knapsack Power Station)	9	4		3.1	8	Mosquito
	Brauweiller	(Transformer Station)	5	5		3.9	8	Mosquito
		Sea-mining	12	12		(63 mines)	3	Stirling
		Leaflets, Northern & Central France	26	20		-	91,92,93	Wellington Whitley
21		Met. Flights	2	2		-	8	Mosquito
21/22	Dortmund		1	1		0.7	8	Mosquito
	Emden		6	5		2.0	8	Mosquito
	Dusseldorf	(Buderich Steel Casting Works)	4	3		2.3	8	Mosquito
		Met. Flights	3	3		-	8	Mosquito
22/23	Kassel		569	486	43	1823.7	All Groups	Lancaster Halifax
	Frankfurt	(Diversion)	35	33	1	94.5	8	Mosquito Lancaster
	Dortmund		1	1		0.7	8	Mosquito
	Cologne	(Knapsack Power Station)	12	9	1	7.0	8.	Mosquito
		Sea-mining	17	15		(56 mines)	3,6	Stirling Wellington Lancaster
		Leaflets, Melun, Fontainebleu	10	2		Recalled	91,92,93	Wellington Whitley
23		Met. Flights	2	2		-	8	Mosquito
24		Met. Flights	2	2		-	8	Mosquito
24/25	Emden		6	5		2.0	8	Mosquito
	Cologne		4	4		3.1	8	Mosquito
	Dusseldorf		4	4		3.1	8	Mosquito
	Dortmund		1	1		0.7	8	Mosquito
	Rheinhausen	(Blast furnaces)	3	2		1.6	8	Mosquito
	Dusseldorf	(Buderich Steel Casting Works)	1	1		0.8	8	Mosquito
24/25		Sea-mining	30	25		(92 mines)	1,3	Wellington Stirling
25/26		Sea-mining	23	22		(56 mines)	3	Stirling
27		Met. Flights	1	1		-	8	Mosquito
27/28		Leaflets, Northern France	22	20		-	91,93	Wellington

1943
October

Date	Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
30	Met. flights	3	3		-	8	Mosquito
31	" "	2	2		-	8	Mosquito
31/1	Cologne	4	4	1	2.9	8	Mosquito
	Emden	6	6		2.7	8	Mosquito
	Dusseldorf	3	3		2.3	8	Mosquito
	Oberhausen (Steel Works)	4	4		2.9	8	Mosquito
November							
1	Met. flights	1	1		-	8	Mosquito
2	" "	1	1		-	8	Mosquito
3	" "	3	3		-	8	Mosquito
3/4	Dusseldorf	551	521	16	2193.2	All Groups	Mosquito Lancaster Halifax
	Dusseldorf (Armament Works)	38	37	2	62.2	3,6	Lancaster
	Cologne (Diversion).	62	58		244.0	8	Mosquito Lancaster
	Rheinhausen (Blast furnaces)	13	10		7.5	8	Mosquito
	Dortmund	2	2		1.5	8	Mosquito
	Sea-mining	23	22		(128 mines)	3	Stirling Lancaster
	Leaflets, Northern France	27	26		-	91,92 93	Whitley Wellington
4/5	Leverkusen (Chemical Works)	24	15		14.6	8	Mosquito
	Aachen	4	4		4.5	8	Mosquito
	Sea-mining	36	28	4	(66 mines)	1,3	Wellington Stirling
5	Met. flights	2	2		-	8	Mosquito
5/6	Dortmund (Blast furnaces).	1	1		1.3	8	Mosquito
	Bochum " "	10	10		12.9	8	Mosquito
	Dusseldorf (Armament Works)	4	4		5.4	8	Mosquito
	Hanover.	5	5		3.9	8	Mosquito
	Hamburg	6	3		2.3	8	Mosquito
	Leaflets, Northern France	27	26		-	91,92,93	Wellington
6	Met. flights	2	2		-	8	Mosquito
6/7	Bochum (Blast furnaces)	9	7		7.8	8	Mosquito
	Duisburg " "	6	6		5.6	8	Mosquito
	Dusseldorf	4	2		1.8	8	Mosquito
	Sea-mining	16	16		(32 mines)	1	Wellington

1943
November

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
		Leaflets, Northern France	8	8		-	92	Wellington
7		Met. flights	4	4		-	8	Mosquito
7/8	Essen	(Steel Works)	6	4		5.4	8	Mosquito
		Sea-mining	35	33	1	(72 mines)	1,3	Wellington Stirling
		Leaflets, Northern France	7	7		-	91,92	Lancaster
8		Met. flights	5	5		-	8	Mosquito
8/9	Duisburg	(Blast furnaces)	4	3		4.0	8	Mosquito
	Cologne		3	3		2.7	8	Mosquito
9		Met. flights	2	2		-	8	Mosquito
9/10	Bochum	(Blast furnaces)	15	12		13.8	8	Mosquito
	Duisburg	" "	3	3		4.0	8	Mosquito
10		Met. flights	4	4		-	8	Mosquito
10/11	Modane	(Railway Centre)	313	301		1120.6	1,5,8	Lancaster
	Dortmund		2	2		2.2	8	Mosquito
		Sea-mining	7	7		(19 mines)	3	Stirling
		Leaflets, Northern & Central France	20	20		-	91,93	Wellington
11		Met. flights	2	2		-	8	Mosquito
11/12	Cannes	(Railway Centre)	134	131	5	281.5	4,6,8	Lancaster Halifax
	Antheor Viaduct		10	4		21.4	5	Lancaster
	Bochum	(Blast furnaces)	3	3		4.0	8	Mosquito
11/12	Dusseldorf	(Armament Works)	12	10		10.7	8	Mosquito
	Berlin		8	8		7.1	8	Mosquito
	Hannover		6	6		5.4	8	Mosquito
		Sea-mining	45	39	2	(111 mines)	1,3,4	Wellington Stirling Lancaster Halifax
		Leaflets, Northern France	6	6		-	91	Wellington
12		Met. flights	2	2		-	8	Mosquito
12/13	Essen	(Armament Works)	2	2		2.7	8	Mosquito
	Dusseldorf	" "	2	2		2.5	8	Mosquito
	Krefeld	(Rolling Mills)	3	2		2.7	8	Mosquito
13		Met. flights	3	3		-	8	Mosquito
13/14	Berlin		9	5		4.5	8	Mosquito

1943
November

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
	Bochum	(Blast furnaces)	8	7		8.9	8	Mosquito
14		Mot. flights	2	1	1	-	8	Mosquito
15		" "	1	1		-	8	Mosquito
15/16	Bonn		2	-	1	-	8	Mosquito
	Dusseldorf	(Armament Works)	10	5	1	6.2	8	Mosquito
16		Mot. flight	1	1		-	8	Mosquito
16/17	Gelsenkirchen		6	6		5.4	8	Mosquito
	Cologne		6	5		4.5	8	Mosquito
	Krefeld	(Rolling Mills)	9	4		3.6	8	Mosquito
		Leaflets, Northern France	8	8		-	92	Wellington
17		Mot. flight	1	1		-	8	Mosquito
17/18	Mannheim/ Ludwigshaven		83	75	1	307.6	8	Lancaster Halifax
	Bonn		4	4		1.3	8	Mosquito
	Berlin		7	4		3.6	8	Mosquito
	Bochum	(Blast furnaces)	2	1		0.9	8	Mosquito
	Duisburg	" "	8	8		7.1	8	Mosquito
		Leaflets, Northern France	4	3		-	92	Wellington
18		Mot. flights	2	2		-	8	Mosquito
18/19	Berlin		444	402	9	1593.6	1,3,5, 6,8	Mosquito Lancaster
	Mannheim/ Ludwigshaven		395	325	23	852.4	3,4,6,8	Lancaster Halifax Stirling
	Aachen		6	6		2.7	8	Mosquito
	Frankfurt		6	6		13.6	8	Mosquito
	Essen	Armament Works	10	8		7.1	8	Mosquito
		Sea-mining	16	16		(16 mines)	1	Wellington
		Leaflets, Northern France	7	7		-	91	Wellington
19		Mot. flights	2	2		-	8	Mosquito
19/20	Leverkusen		266	223	5	656.4	3,4,6,8	Mosquito Halifax Stirling
	Duisburg		6	6		6.8	8	Mosquito
	Rheinhausen	Blast Furnace	2	-		-	8	Mosquito
		Sea-mining	25	25		(92 mines)	1,3	Wellington Stirling Lancaster

Date		Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
		Leaflets, Northern France	11	11		-	91	Wellington Whitley
22		Mot. flights	2	2		-	8	Mosquito
22/23	Berlin		764	670	26	2464.5	All Groups	Halifax Stirling Mosquito Lancaster Wellington
	Leverkusen		12	4		3.6	8	Mosquito
		Sea-mining	14	14		(27 mines)	1	Wellington
		Leaflets, Cherbourg Argentan, St. Malo, Rennes, etc.	12	11		-	93	Wellington Whitley
23		Mot. flight	1	1		-	8	Mosquito
23/24	Berlin		302	322	20	1334.5	1,3,5, 6,8	Mosquito Halifax Lancaster
	Cologne	Knapsack Power Stn.	6	1		0.9	8	Mosquito
24		Mot. flights	2	2		-	8	Mosquito
24/25	Berlin		6	4	1	3.6	8	Mosquito
		Leaflets, Northern France	9	3		-	92	Wellington
25		Mot. flights	2	2		-	8	Mosquito
25/26	Frankfurt		262	237	12	645.5	4,6,8	Halifax Lancaster
	Berlin		3	3		2.7	8	Mosquito
		Sea-mining	48	37	1	(122 mines)	1,3	Wellington Stirling Lancaster
		Leaflets, Paris and Northern France	28	28		-	91,92, 93	Wellington Whitley
26		Mot. flights	4	4		-	8	Mosquito
26/27	Berlin		450	407	28	1575.6	1,3,5, 6,8	Lancaster Halifax
	Stuttgart		178	162	6	446.3	1,4,6,8	Lancaster
		Sea-mining	33	31		(125 mines)	1,3	Wellington Stirling
		Leaflets, Paris, and Northern France	5	5		-	91	Wellington
28		Mot. flights	3	3		-	8	Mosquito
28/29	Essen	Blast furnaces	10	9		8.1	8	Mosquito
	Duisberg	Steel works	1	1		0.9	8	Mosquito
		Sea-mining	10	9		(38 mines)	1,3	Wellington Stirling

Date		Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
28/29		Leflets, Roubaix, Lille, Abbeville, Tourcoing	7	4		-	93	Wellington
29		Met. flights	1	1		-	8	Mosquito
29/30	Cologne		5	4		3.6	8	Mosquito
	Dusseldorf		6	6		6.7	8	Mosquito
	Dusseldorf	Armament works	3	1		0.9	8	Mosquito
	Bochum	Steel works	7	5		4.5	8	Mosquito
		Leaflets, Fontainebleu, Paris, Montargis	9	9		-	93	Wellington Whitley
30		Met. flights	3	3		-	8	Mosquito
30/1 Dec.	Essen	Armament works	4	2		1.8	8	Mosquito
		Sea-mining	44	42		(115 mines)	1,3	Wellington Stirling
		Leaflets, Rouen, Argentan, Paris	7	7		-	91,92	Wellington
December 1		Met. flights	2	2		-	8	Mosquito
1/2		Sea-mining	31	23	2	(80 mines)	3,4	Stirling Halifax
2		Met. flights	2	2		-	8	Mosquito
2/3	Berlin		458	401	40	1685.6	1,3,5, 6,8	Lancaster Halifax Mosquito
	Bochum	Blast furnaces	6	2		1.8	8	Mosquito
	Witten	Steel works	1	-		-	8	Mosquito
		Leaflets, Northern France	25	25		-	91,93	Wellington Whitley
3		Met. flights	2	2		-	8	Mosquito
3/4	Leipzig		527	451	24	1450.9	All Groups	Halifax Lancaster
	Berlin		9	9		7.0	8	Mosquito
		Sea-mining	12	10		(40 mines)	4	Halifax
4		Met. flight	1	1		-	8	Mosquito
4/5	Duisburg	(Steel Works)	9	5		4.5	8	Mosquito
		Sea-mining	48	31	1	(124 mines)	1,3,4	Wellington Stirling Halifax
		Leaflets, Paris, Versailles, Orleans	10	9		-	91,92	Whitley Wellington
5		Met. flights	2	2		-	8	Mosquito

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
10/11	Leverkusen	(Chemical Works)	25	14		12.5	8	Mosquito
	Krefeld	(Blast furnaces)	2	-		-	8	Mosquito
		Leaflets, Northern France	4	4		-	92	Wellington
11		Met. flights	1	1		-	8	Mosquito
11/12	Duisburg	(Steel Works)	18	12		10.0	8	Mosquito
		Met. flights	2	2		-	8	Mosquito
12		" "	1	1		-	8	Mosquito
12/13	Essen	(Armament Works)	20	14	1	12.5	8	Mosquito
	Osnabruck	(Copper Works)	1	1		0.9	8	Mosquito
	Dusseldorf		9	9		8.0	8	Mosquito
		Leaflets, St. Malo, Granville, Rennes	4	3		-	92	Wellington
		Met. flight	1	1		-	8	Mosquito
13/14	Dusseldorf	(Armament Works)	16	8		6.7	8	Mosquito
	Bonn	(Tube Works)	1	1		0.9	8	Mosquito
		Leaflets, Cherbourg, St. Malo, Le Mans	25	25		-	91,92 93	Wellington Whitley
		Met. flights	2	2		-	8	Mosquito
15/16	Leverkusen	(Chemical Works)	4	3		2.7	8	Mosquito
	Bochum	(Blast furnaces)	4	3		2.7	8	Mosquito
		Met. flights	1	1		-	8	Mosquito
16		Met. flights	2	2		-	8	Mosquito
16/17	Berlin		497	450	25	1815.0	1,3,5, 6,8	Mosquito Lancaster
	Duisburg	(Steel Works)	6	5		4.5	8	Mosquito
	Abbeville area	(Crossbow Targets)	48	36		156.3	3,5,8	Mosquito Stirling Lancaster
		Seamining	35	32	1	(113 mines)	1,3	Wellington Stirling
		Intruder Patrols	4	2		-	100	Mosquito Beaufighter
18		Met. flights	1	1		-	8	Mosquito
19		Met. flight	1	1		-	8	Mosquito
19/20		Leaflets, Rennes, Orleans, Montargis	6	6		-	91	Wellington
		Met. flight	1	1		-	8	Mosquito
20		Met. Flight	1	1		-	8	Mosquito

1943
December

Date		Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
20/21	Frankfurt		650	576	40	2281.0	All Groups	Mosquito Lancaster Halifax
	Mannheim		54	52	1	223.6	1,4, 6,8	Mosquito Lancaster Halifax
	Liege	(Steel Works)	16	5	1	11.8	5,8	Mosquito Lancaster
	Leverkusen	(Chemical Works)	5	2		1.6	8	Mosquito
		Sea-mining	23	21	1	(122 mines)	3	Stirling
		Leaflets, Paris and Northern France	38	37		-	91,92, 93	Stirling Whitley Wellington
		Intruder Patrols	2	1		-	100	Beaufighter
	Duisburg/ Rheinhausen	(Blast furnaces)	6	2		1.8	8	Mosquito
21		Met. Flight	1	1		-	8	Mosquito
21/22	Dusseldorf	(Armament Works)	9	4		3.6	8	Mosquito
	Cologne	(Knapsack Power Station)	4	1		0.9	8	Mosquito
		Leaflets, Northern France	4	4		-	92	Wellington
		Met. Flight	1	1		-	8	Mosquito
22/23	Frankfurt		9	9		6.0	8	Mosquito
	Bonn	(Instrument Works)	2	1		0.7	8	Mosquito
	Abbeville Area	(Crossbow Targets)	36	30		137.5	5,8	Mosquito Lancaster
	Dieppe Area	(Crossbow Targets)	15	2		0.4	3,8	Mosquito Stirling
		Sea-mining	16	14		(52 mines)	1,3	Wellington Stirling
		Leaflets, Northern and Central France	21	20		-	91,92, 93	Wellington Whitley
23		Met. Flights	2	2		-	8	Mosquito
23/24	Berlin		391	338	15	1287.9	1,3,5,8	Mosquito Halifax Lancaster
	Leipzig		7	7		4.7	8	Mosquito
	Duisburg	(Steel Works)	9	3		2.7	8	Mosquito
		Leaflets, Northern France	7	7		-	93	Wellington Whitley
		Intruder Patrols	4	3	1	-	100	Beaufighter
24		Met. Flights	2	2		-	8	Mosquito
24/25		Sea-mining	35	30		(91 mines)	4,6	Halifax

1943
December

Date		Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
28/29	Duisburg	(Steel Works)	10	8		6.8	8	Mosquito
	Dusseldorf.	(Metal Works)	9	6		5.2	8	Mosquito
	Cologne		1	1		0.9	8	Mosquito
		Leaflets, Northern France	11	11		-	91,92	Wellington
29		Met. Flights	1	1		-	8	Mosquito
29/30	Berlin		712	656	20	2314.5	All groups	Mosquito Lancaster Halifax
	Magdeburg		8	8		5.4	8	Mosquito
	Leipzig		5	5		3.3	8	Mosquito
	Leverkusen	(Chemical Works)	3	1		0.9	8	Mosquito
	Dusseldorf	(Metal Works)	6	2		1.8	8	Mosquito
	La Glaceric	(Crossbow Targets)	4	3		2.7	8	Mosquito
		Sea-mining	28	14		(65 mines)	3	Stirling
		Leaflets, Northern France	4	4		-	92	Wellington
		Met. flight	1	1		-	8	Mosquito
		Intruder Patrols	2	2		-	100	Beaufighter
30/31	N.W. Amiens area	(Crossbow Targets)	14	12		48.5	5,8	Mosquito Lancaster
	La Glaceric	(Crossbow Targets)	2	1		0.9	8	Mosquito
	Bochum	(Steel Works)	3	1		0.9	8	Mosquito
	Duisburg	(Steel Works)	8	2		1.8	8	Mosquito
	Cologne		10	8		7.8	8	Mosquito
		Met. Flight	1	1		-	8	Mosquito
		Sea-mining	26	26		(97 mines)	1,3	Wellington Stirling
		Leaflets, Northern and Central France	28	26		-	91,93	Wellington Whitley
31/1		Sea-mining	2	2		(12 mines)	3	Stirling
1944 January								
1		Met. recce.	1	1		-	8	Mosquito
1/2	Berlin.		421	369	28	1400.4	1,3,5, 6,8	Lancaster
	Hamburg		15	14		9.4	8	Mosquito
	Witten	(Steel Works)	11	8		7.2	8	Mosquito
	Duisburg/ Hamborn		7	5		4.5	8	Mosquito
	Cologne		1	1		0.9	8	Mosquito

1944
January

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
1/2	N. France	(Crossbow Targets)	4	2		1.8	8	Mosquito
		Leaflets, France	14	11	1	-	91,93	Wellington
		R.C.M.	6	6		-	10	Mosquito Wellington
2		Mot. Recce	2	2		-	8	Mosquito
2/3	Berlin		383	284	27	1116.4	1,3,5, 6,8	Lancaster Halifax Mosquito
		Intruder Patrols	2	2			100	Beaufighter
		R.C.M.	7	6			100	Wellington Mosquito
	Northern France (Crossbow targets)		3	3		2.7	8	Mosquito
	Duisburg/Hamborn		8	6		5.4	8	Mosquito
		Minelaying	26	24		(88 mines)	1,3,6	Wellington Stirling Halifax
		Leaflets, Northern and Central France	25	23			91,92,93	Whitley Wellington
3/4	Solingen	(Engineering Works)	6	3		2.7	8	Mosquito
	Essen	(Krupps)	2	2		1.8	8	Mosquito
		Mot. Recce	1	1			8	Mosquito
4		Mot. Recce	1	1			8	Mosquito
4/5	Northern France (Crossbow targets)		80	79		357.8	3,5,8	Mosquito Stirling Lancaster
	Berlin		13	8		6.9	8	Mosquito
	Krefeld/ Uerdingen (Steel Works)		3	2		1.8	8	Mosquito
		R.C.M.	4	4			100	Mosquito
		S.O.E.	25				3	Hudson Stirling Halifax
	Cologne		2	2		1.8	8	Mosquito
		Minelaying	40	38		(86 mines)	1,3,6	Wellington Stirling Halifax
		Leaflets (Northern France)	8	7			91,92	Wellington
		Mot. Recce.	2	1			8	Mosquito
5		Mot. Recce.	1	1			8	Mosquito
5/6	Stettin		358	333	15	1122.8	1,5,6,8	Halifax Lancaster
	Berlin	(Diversion)	13	10		6.6	8	Mosquito
	Essen	(Krupps)	4	-		-	8	Mosquito

1944
January

Date	Target or Purpose		Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
5/6	Solingen	(Engineering Works)	7	3		2.5	8	Mosquito
	Krefeld	(Steel Works)	11	9		8.0	8	Mosquito
	N.W. France	(Crossbow targets)	3	3		2.7	8	Mosquito
		Minelaying	6	5		(25 mines)	5	Lancaster
		Intruder Patrol	1	1		-	100	Mosquito
		R.C.M.	1	1		-	100	Mosquito
		Met. Recce.	1	1		-	8	Mosquito
6		Met. Recce.	1	1		-	8	Mosquito
6/7	Duisburg		16	15		12.3	8	Mosquito
	Dortmund		1	1		0.9	8	Mosquito
	Solingen		1	-		-	8	Mosquito
	N.W.France	(Crossbow targets)	2	2		1.8	8	Mosquito
		Minelaying	67	65		(164 mines)	1,3,4,6	Wellington Stirling Halifax
		Leaflets, Northern France	10	10		-	93	Wellington
		Met. Recce.	1	1		-	8	Mosquito
		S.O.E.	21				3	Hudson Stirling Halifax
7		Met. Recce.	1	1		-	8	Mosquito
7/8	Krefeld/Uerdingen	(Steel Works)	6	6		5.4	8	Mosquito
	Duisburg/Hamborn		5	5		4.5	8	Mosquito
		S.O.E.	20				3	Stirling Halifax
		Leaflets, Northern France	14	14		-	91	Wellington Whitley
		R.C.M.	3	2		-	100	Wellington
8/9	Solingen Area		8	2		1.8	8	Mosquito
	Aachen		3	3		2.7	8	Mosquito
	Frankfurt		10	6	1	5.4	8	Mosquito
	Dortmund		2	2		1.8	8	Mosquito
10		Met. Recce.	1	1		-	8	Mosquito
10/11	Berlin		10	8		7.1	8	Mosquito
	Solingen		7	5		4.5	8	Mosquito
	Koblenz		2	2		1.8	8	Mosquito
	Krefeld		1	1		0.9	8	Mosquito
		R.C.M.	3	3		-	100	Mosquito Wellington
		S.O.E.	10				3	Stirling Halifax

Date	Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
10/11	Met. Recce.	3	2		-	8	Mosquito
13/14	Koblenz	2	2		1.8	8	Mosquito
	Essen	12	10	1	8.2	8	Mosquito
	Aachen	2	2		1.6	8	Mosquito
	Duisburg/Rheinhausen (Krupps)	9	3		2.7	8	Mosquito
	R.C.M.	1	1		-	100	Mosquito
14/15	Brunswick	498	434	38	2225.8	1,3,5, 6,8	Lancaster Halifax
	Berlin (Diversion)	6	5		3.9	8	Mosquito
	Magdeburg (Diversion)	11	10		6.9	8	Mosquito
	Northern France (Crossbow targets)	82	78		361.8	3,8	Stirling Mosquito Halifax
	Minelaying	29	23		(66 mines)	1,3,4	Wellington Stirling Halifax
	Leaflets, Northern and Central France	36	32			91,92,93	Wellington
	R.C.M.	8	8			100	Wellington Halifax Manchester
	Intruder Patrols	2	1			100	Mosquito
19	Met. Recce.	4	4			8	Mosquito
20	Met. Recce.	2	2			8	Mosquito
20/21	Berlin	769	642	35	2400.6	All Groups	Mosquito Lancaster Halifax
	Kiel	4	3		2.0	8	Mosquito
	Hannover	3	3		1.6	8	Mosquito
	Dusseldorf/Rath) Dusseldorf/Derendorf)	12	11		9.8	8	Mosquito
	Minelaying	29	29		(141 mines)	1,3	Wellington Stirling
	Leaflets, Northern and Central France	20	19			91,93	Wellington Whitley
	Intruder Patrols	9	4			100	Mosquito
	R.C.M.	8	1			100	Mosquito Wellington Halifax
21	Met. Recce.	2	2			8	Mosquito
21/22	Magdeburg	653	530	55	2240.1	All Groups	Mosquito Halifax Lancaster
	Berlin (Diversion)	34	29	1	78.4	5,8	Lancaster Mosquito

Date	Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
21/22	Oberhausen	8	3		2.2	8	Mosquito
	Duisburg /Rheinhausen	5	1		0.9	8	Mosquito
	Northern France (Crossbow targets)	111	102		416.8	3,5,8	Stirling Lancaster Mosquito
	Minelaying	8	8		(16 mines)	1	Wellington
	Leaflets, Northern and Central France	16	14			91,92,93	Wellington
	Intruder Patrols	8	5			100	Mosquito
	R.C.M.	8				100	Mosquito Wellington Halifax
23/24	Dusseldorf	21	19		15.6	8	Mosquito
	Dusseldorf/Rath	2	1		0.9	8	Mosquito
	Dusseldorf/Dorendorf	2	2		1.8	8	Mosquito
	Rocklinghausen/Huls	2	-		-	8	Mosquito
	Aachen	4	3		2.7	8	Mosquito
	Duren (Aircraft Factory)	5	1		0.9	8	Mosquito
	Koblenz	1	1		0.9	8	Mosquito
	Minelaying	9	8		(28 mines)	1,3	Wellington Stirling
	Met. Recce.	1	1		-	8	Mosquito
	R.C.M.	3	3		-	100	Mosquito
25	Met. Recce.	1	1		-	8	Mosquito
25/26	Aachen	14	14		12.5	8	Mosquito
	Northern France (Crossbow targets)	76	63		232.0	3,5,8	Stirling Lancaster Mosquito
	Leaflets, Northern France	18	17		-	92,93	Wellington
	Met. Recce.	1	1		-	8	Mosquito
27	Met. Recce.	1	1		-	8	Mosquito
27/28	Berlin	536	454	32	1760.5	1,3,5, 6,8	Mosquito Lancaster
	Heligoland	21	21		60.0	1,8	Halifax Lancaster
	Aachen	12	11		7.4	8	Mosquito
	N.W. France (Crossbow targets)	9	7		6.3	8	Mosquito
	Minelaying	80	73	1	(326 mines)	1,3	Wellington Stirling
	Leaflets, Northern and Central France	10	10		-	91,92	Wellington

Date	Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
27/28	Intruder Patrols	12	5		-	100	Mosquito
	R.C.M.	9				100	Mosquito Wellington Halifax
	S.O.E.	8				3	Halifax
28/29	Berlin	683	555	43	1954.0	All Groups	Mosquito Lancaster Halifax
	Hanover (Diversion)	4	4		3.3	8	Mosquito
	Drolon, Leeuwarden, Gilze and Venlo aerodromes:-	23	21		18.0	8	Mosquito
	Intruder Patrols	6	3	1	-	100	Mosquito
	Minelaying	67	58	2	(163 mines)	3,8	Stirling Halifax
	Met. Recce.	1	1			8	Mosquito
	Leaflets, Northern and Central France	16	14			91,93	Wellington
	R.C.M.	6	6			100	Wellington Halifax
	S.O.E.	5				3	Halifax
29/30	Duisburg/Hamborn	6	5		3.9	8	Mosquito
	Northern France (Crossbow targets)	10	10		8.9	8	Mosquito
	Leaflets, Northern France	6	6		-	91	Whitley
	Met. Recce.	1	1		-	8	Mosquito
	R.C.M.	1	-		-	100	Mosquito
	S.O.E.	5	-		-	3	Halifax
30	Met. Recce.	1	1		-	8	Mosquito
30/31	Berlin	540	456	33	1960.3	All Groups	Mosquito Lancaster Halifax
	Brunswick	5	4		3.3	8	Mosquito
	Elberfeld	22	9		8.0	8	Mosquito
	Intruder Patrols	7	4		-	100	Mosquito
	Minelaying	12	1		(3 mines)	3	Stirling
	Leaflets, Northern France	22	22		-	91,92,93	Wellington
	R.C.M.	8	-		-	100	Mosquito Wellington
31	Met. Recce.	1	1		-	8	Mosquito
February 1/2	Berlin	12	10	1	9.6	8	Mosquito
	Aachen	3	2		1.8	8	Mosquito
	Krefeld	3	2		1.8	8	Mosquito

Date	Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
1/2	Intruder Patrols	3	2		-	100	Mosquito
	R.C.M.	2	2		-	100	Mosquito
2	Met. Recce.	1	1		-	8	Mosquito
2/3	Elberfeld	6	4		3.6	8	Mosquito
	Duisburg/Rheinhausen	7	4		3.6	8	Mosquito
	Minelaying	50	41		(79 mines)	4,6	Halifax
	R.C.M.	2	1		-	100	Wellington
	Intruder Patrols	5	4		-	100	Mosquito
	Met. Recce.	1	1		-	8	Mosquito
3/4	Cologne	3	3		2.7	8	Mosquito
	Dortmund	4	2		1.5	8	Mosquito
	Krefeld	7	4		3.6	8	Mosquito
	Minelaying	35	32		(92 mines)	1,3,4,6	Wellington Stirling Halifax
	Leaflets, Northern France	4	4		-	92	Wellington
	Met. Recce.	1	1		-	8	Mosquito
	R.C.M.	4	4		-	100	Mosquito
	S.O.E.	3				3	Mosquito Wellington Halifax
4/5	Elberfeld	8	1		0.9	8	Mosquito
	Frankfurt	9	6		4.7	8	Mosquito
	Aachen	2	2		1.8	8	Mosquito
	Minelaying	28	28		(67 mines)	1,3,4	Wellington Stirling Halifax
	Met. Recce.	1	1		-	8	Mosquito
	Intruder Patrols	2	2		-	100	Mosquito
	S.O.E.	49				3	Lysander Hudson Stirling Halifax
5/6	Berlin	18	15		13.4	8	Mosquito
	Duisburg/Hamborn	7	2		1.8	8	Mosquito
	Hanover	1	1		0.7	8	Mosquito
	Met. Recce.	1	1		-	8	Mosquito
	Minelaying	19	15		(30 mines)	4,6	Halifax
	Leaflets, France and Low Countries	15	15		-	91,93	Wellington
	Intruder Patrols	4	3		-	100	Mosquito

Date	Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
5/6	S.O.E.	46		1		3	Stirling Halifax
7	Met. Recce.	1	1		-	8	Mosquito
7/8	Frankfurt	19	19		16.7	8	Mosquito
	Mannheim	1	1		0.4	8	Mosquito
	Elberfeld	8	4		3.6	8	Mosquito
	Krefeld	5	3		2.7	8	Mosquito
	Aachen	2	2		1.6	8	Mosquito
	Intruder Patrols	5	3		-	100	Mosquito
	R.C.M.	5				100	Mosquito Wellington Halifax
	S.O.E.	12				3	Stirling Halifax
8	Met. Recce.	1	1		-	8	Mosquito
8/9	Limoges	12	12		56.3	5	Lancaster
	Brunswick	11	11		9.4	8	Mosquito
	Elberfeld	8	3		2.7	8	Mosquito
	Leaflets, Northern France	19	18		-	91,92	Wellington Whitley
	Met. Recce.	2	2		-	8	Mosquito
	Intruder Patrols	4	2		-	100	Mosquito
	S.O.E.	39			-	3	Lysander Hudson Stirling Halifax
9/10	Elberfeld	8	3		2.5	8	Mosquito
	Krefeld/Uerdingen	7	6	1	5.4	8	Mosquito
	Aachen	1	1		0.9	8	Mosquito
10	Met. Recce.	2	2		-	8	Mosquito
10/11	Berlin	21	13		10.9	8	Mosquito
	Aachen	4	3		2.7	8	Mosquito
	Minelaying	23	22		(52 mines)	1,3,6	Wellington Stirling Halifax
	Met. Recce.	1	1		-	8	Mosquito
	R.C.M.	2	1		-	100	Wellington
	S.O.E.	28	-	1	-	3	Lysander Hudson Stirling Halifax
11/12	Brunswick	11	10		8.1	8	Mosquito

Date	Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
11/12	Aachen	4	4		3.6	8	Mosquito
	Elberfeld	8	2		1.8	8	Mosquito
	Duisburg /Hamborn	4	1		0.9	8	Mosquito
	Minelaying	52	45		(152 mines)	1,3,4,6	Wellington Stirling Halifax
	Met. Recce.	1	1		-	8	Mosquito
	Leaflets, France and Low Countries	6	5		-	91	Whitley
	Intruder Patrols	6	4		-	100	Mosquito
	R.C.M.	5				100	Wellington Halifax
	S.O.E.	27	-		-	3	Lysander Hudson Stirling
12	Met. Recce.	1	1		-	8	Mosquito
12/13	Antheor Viaduct	11	9		5.3	5	Lancaster
	Duisburg/Hamborn	4	4		3.6	8	Mosquito
	Elberfeld	8	1		0.9	8	Mosquito
	Minelaying	25	23	1	(109 mines)	3,4,6	Stirling Halifax
	Intruder Patrols	6	3		-	100	Mosquito
13	Met. Recce.	1	1		-	8	Mosquito
13/14	S.O.E.	19			-	3	Stirling
15	Met. Recce.	2	2		-	8	Mosquito
15/16	Berlin	891	761	42	2642.6	All Groups	Mosquito Lancaster Halifax
	Frankfurt-Am-Oder (Diversion)	24	24		94.2	8	Lancaster
	Aachen	2	2		1.8	8	Mosquito
	Fighter aerodromes in Holland	19	15		13.3	8	Mosquito
	Intruder Patrols	14	8	1	-	100	Mosquito
	R.C.M.	9			-	100	Halifax Wellington Mosquito
	S.O.E.	48	48	1	-	31	Stirling Hudson Halifax
	Minelaying	59	54		(153 mines)	1,3,8	Wellington Stirling Halifax
	Met. Recce.	1	1		-	8	Mosquito
17	Met. Recce.	1	1		-	8	Mosquito
18	Met. Recce.	2	2		-	8	Mosquito

Date	Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
18/19	R.C.M.	4	4		-	100	Wellington
19	Met. Recce.	2	2		-	8	Mosquito
19/20	Leipzig	823	650	78	2555.2	All Groups	Mosquito Halifax Lancaster
	Berlin (Diversion)	15	14	1	5.2	8	Mosquito
	Aerodromes in Holland	16	14		12.6	8	Mosquito
	Northern France (Crossbow targets)	3	3		2.0	8	Mosquito
	Aachen	3	3		2.3	8	Mosquito
	Mine-laying	49	49		(180 mines)	3,8	Stirling Halifax
	R.C.M.	5	3		-	100	Wellington Halifax Mosquito
	Intruder Patrols	12	8		-	100	Mosquito
	Met. Recce.	2	1		-	8	Mosquito
20	Met. Recce.	1	1		-	8	Mosquito
20/21	Stuttgart	598	544	9	2052.9	All Groups	Mosquito Halifax Lancaster
	Munich Diversion	7	5		3.4	8	Mosquito
	Enemy Aerodromes	24	22		17.1	8	Mosquito
	Minelaying	34	31	1	(167 mines)	1,3	Wellington Stirling
	R.C.M.	3	3		-	100	Mosquito Wellington
	Intruder Patrols	7	4		-	100	Mosquito
	Met. Recce.	1	1		-	8	Mosquito
21	Met. Recce.	1	1		-	8	Mosquito
21/22	Stuttgart	6	5		4.1	8	Mosquito
	Duisburg/Ruhrort	3	3		2.7	8	Mosquito
	Northern France (Crossbow targets)	8	8		7.2	8	Mosquito
	Met. Recce.	1	1		-	8	Mosquito
	Minelaying	41	36	1	(193 mines)	1,3,4,6	Wellington Stirling Halifax
	Leaflets, Northern France	10	10		-	91,92	Wellington
	Intruder Patrols	3	1		-	100	Mosquito
	R.C.M.	1	-		-	100	Wellington
22	Met. Recce.	1	1		-	8	Mosquito
22/23	Stuttgart	10	8		6.0	8	Mosquito

Date	Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
	Aachen	3	1		.9	8	Mosquito
	Duisburg/Hamborn	8	4		3.3	8	Mosquito
	R.C.M.	2	-		-	100	Wellington
	Minelaying	111	-	Recalled		3,4,6,8	Stirling Halifax
	Met. Recce.	1	1		-	8	Mosquito
23/24	Dusseldorf	17	14		15.3	8	Mosquito
	Intruder Patrols	4	1		-	100	Mosquito
	R.C.M.	1	1		-	100	Wellington
	Leaflets, Northern France	3	3		-	92	Wellington
	Met. Recce.	1	1		-	8	Mosquito
24	Met. Recce.	1	1		-	8	Mosquito
24/25	Schweinfurt	734	635	33	2262.1	All Groups	Mosquito Lancaster Halifax
	Sweep over N. Sea (Diversion)	165	165		-	1,6,91, 92,93	Various, including non-operational units.
	Kiel	7	7		8.3	8	Mosquito
	Aachen	8	8		5.5	8	Mosquito
	Enemy aerodromes	13	11		9.5	8	Mosquito
	Minelaying	115	94	2	(237 mines)	1,3,4,6	Wellington Stirling Halifax
	R.C.M.	8	7		-	100	Mosquito Wellington Halifax
	S.O.E.	6			-	3	Halifax
	Intruder Patrols	14	6	1	-	100	Mosquito
25	Met. Recce.	2	2		-	8	Mosquito
25/26	Augsburg	594	507	21	1828.3	All Groups	Mosquito Lancaster Halifax
	Saarbrucken and Mannheim	5	5		9.0	8	Mosquito
	Schweinfurt	5	5		2.6	8	Mosquito
	Aachen	5	4		3.0	8	Mosquito
	Enemy Aerodromes	15	12		10.8	8	Mosquito
27/28	Minelaying	131	96	3	(227 mines)	1,3,4,6	Wellington Stirling Halifax
	Intruder Patrols	11	3	1	-	100	Mosquito

1944
February

Date	Target or Purpose	Despatched	Attacking	Missing	Tonnage	Groups	Aircraft
28	Met. Recce.	4	2		-	8	Mosquito
28/29	Leaflets, Douai, Lille, etc.	8	6		-	92	Wellington
	Met. Recce.	1	1		-	8	Mosquito
29/1 March	Dusseldorf	15	12		15.8	8	Mosquito
	Northern France (Crossbow targets)	1	1		-	8	Mosquito
	Leaflets, Northern and Central France	20	18	1	-	91,92	Wellington Whitley
	R.C.M.	2	2			100	Wellington
	S.O.E.	16				3	Hudson Halifax

APPENDIX 11
SECRET

MONTHLY AVAILABILITY OF OPERATIONAL AIRCRAFT, CREWS AND AIRCRAFT WITH CREWS

FEBRUARY 1943 - FEBRUARY 1944

(A) Aircraft

Month	Lancaster	Halifax	Stirling	Wellington	Mosquito	Other Aircraft	Total
1943							
February	176	134	81	147	32	78	648
March	234	148	101	197	31	60	771
April	258	174	114	164	34	61	805
May	308	188	110	123	31	81	841
June	339	232	119	126	31	-	847
July	330	243	134	97	35	-	839
August	339	242	130	70	38	-	819
September	340	184	131	42	36	-	733
October	383	242	176	25	43	-	869
November	463	218	178	16	48	-	923
December	439	249	102	11	49	10	860
1944							
January	508	267	102	7	45	18	947
February	556	309	91	7	43	21	1027

(B) Crews

Month	Lancaster	Halifax	Stirling	Wellington	Mosquito	Other Aircraft	Total
1943							
February	186	160	90	183	33	120	772
March	215	165	96	220	40	82	819
April	244	163	100	193	36	85	821
May	304	191	108	157	36	115	911
June	366	236	120	133	31	-	886
July	406	257	119	93	36	-	911
August	469	285	130	74	48	-	1006
September	441	240	142	44	46	-	913
October	478	324	148	30	51	-	1031
November	531	333	139	17	58	-	1078
December	554	337	109	11	59	13	1083
1944							
January	584	360	109	7	69	19	1148
February	561	384	98	6	79	26	1154

(C) Aircraft With Crews

Month	Lancaster	Halifax	Stirling	Wellington	Mosquito	Other Aircraft	Total
1943							
February	160	126	71	137	29	70	593
March	199	135	86	184	27	52	683
April	208	149	97	158	29	53	694
May	272	171	97	121	25	78	764
June	319	214	110	117	24	-	784
July	321	230	108	89	27	-	775
August	335	236	114	68	34	-	787
September	323	180	119	38	35	-	695
October	376	242	143	25	42	-	828
November	347	217	132	15	46	-	757
December	421	246	94	11	45	10	827

/1944

(C) Aircraft With Crews (Contd.)

Month	Lancaster	Halifax	Stirling	Wellington	Mosquito	Other Aircraft	Total
1944							
January	482	261	98	7	44	15	907
February	513	298	87	6	43	17	984

* "Other Aircraft" includes the Special Duty Squadrons.

From December, 1943 onwards, other types in No. 100 Group are included.

From February, to June, 1943, other types in No. 2 Group are included.

APPENDIX 12

SECRET

U.S. VIII BOMBER COMMAND DIARY OF OPERATIONS
FEBRUARY 1943 - FEBRUARY 1944

February, 1943.

Date	Target or Purpose	Despatched (1)	Attacking	Tonnage (2)	Losses
4.	Emden	57	39	85.0	5
14	Emden	65	-	-	-
15	Dunkirk (armed raider)	22	21	55.3	2
16	St. Nazaire	68	65	142.9	8
26	Wilhelmshaven	77	65	146.6	1
27	Brest	62	60	138.4	-
March, 1943					
4	Hamm	17	16	35.7	4
4	Rotterdam	49	28	62.5	1
6	Lorient	66	63	138.8	3
6	Brest	15	15	39.7	-
8	Rennes	57	54	120.3	2
8	Rouen	15	13	34.8	2
12	Rouen	63	63	133.0	-
13	Amiens	76	44	115.2	-
18	Vegesack	97	97	239.3	2
22	Wilhelmshaven	88	84	224.0	3
28	Rouen-Sotteville (Marshalling Yard)	76	70	275.0	1
31	Rotterdam (Shipyards)	100	33	88.4	4
April, 1943					
4	Paris (Renault)	85	85	224.1	4
5	Antwerp (Erla)	87	82	217.0	4
16	Lorient	68	59	131.2	1
16	Brest	22	19	46.4	3
17	Bremen (Focke-Wulf)	110	107	240.6	16
May, 1943					
1	St. Nazaire	67	29	50.9	7
4	Antwerp (Ford & G.M. Plants)	79	65	144.2	-
13	Meaulte-Potez (Repair Depot)	90	88	212.6	3
13	St. Omer (Longuenesse)	36	31	65.5	1
14	Kiel (Germania Werks)	131	126	267.1	8
14	Ijmuiden (Power House)	12	11	9.6	-
14	Antwerp (Ford & G.M. Plants)	43	38	79.4	1
14	Courtrai	39	34	67.3	2
15	Heligoland	109	76	166.0	5
15	Emden	63	59	122.3	-
17	Lorient	127	118	260.7	6
17	Bordeaux	36	34	92.4	4
17	Ijmuiden & Haarlem	10	-	-	10
19	Kiel	107	103	211.5	6
19	Flensburg	56	55	119.6	-
21	Wilhelmshaven	81	77	172.3	7
21	Emden	46	45	101.3	7
29	St. Nazaire	148	147	247.3	8
29	La Pallice	36	34	88.4	-
29	Rennes (Naval S.)	69	57	113.8	6

/June, 1943

(1) Americans defined as "despatched" those aircraft which passed a point halfway to the enemy coast.

(2) Converted from American (Short) to English (Long) Tons.

June, 1943

Date	Target or Purpose	Despatched	Attacking	Tonnage	Losses.
11	Wilhelmshaven	226	168	332.1	8
13	Bremen	131	102	232.3	4
13	Kiel Harbour	65	44	89.0	22
15	Le Mans	31	-	-	-
22	Huls	205	183	359.3	16
22	Antwerp (Ford & G.M.)	93	88	193.7	4
25	Targets of Opportunity	238	167	357.1	18
26	Targets of (Convoy)	12	-	-	-
26	Villacoublay	222	12	25.7	5
26	Poissy		6	2.2	-
26	Tricqueville Airfield		39	88.5	-
28	St. Nazaire	162	158	268.7	8
28	Beaumont	45	43	92.1	-
29	Villacoublay	98	-	-	-
29	Beaumont	37	-	-	-
29	Le Mans	84	76	119.7	-

July, 1943

4	Le Mans	109	105	270.1	4
4	Nantes	63	61	151.8	3
4	La Pallice	79	71	122.8	1
10	Le Bourget	86	-	-	2
10	Villacoublay	77	34	66.4	1
10	Caen	43			
10	Abbeville	60	36	57.3	-
14	Villacoublay	112	101	272.2	3
14	Amiens-Glisy	54	53	74.0	1
14	Le Bourget	75	52	109.7	4
17	Hanover	231	15	33.3	1
	Rheine		34	67.0	1
	Hamburg		-	-	-
	Convoy		1	2.0	-
17	Amsterdam	41	21	46.0	-
24	Heroya	177	167	370.0	1
24	Bergen	75	-	-	-
24	Trondheim	42	41	105.6	-
25	Hamburg	234	68	154.9	8
	Heide		14	3.1	7
	Kiel		67	236.5	1
	Warnemunde		33	107.0	2
	Wustrow		18	46.9	1
26	Hamburg	57	54	112.7	2
26	Hanover	103	96	151.1	16
	Targets of Opportunity				
26	" (Convoy	53	49	98.1	6
26	" (Wilhelmshaven				
28	Kassel	154	58	113.9	7
28	Osochersleben	99	37	58.5	15
29	Kiel	102	95	182.3	4
29	Heligoland	53	48	106.9	2
29	Warnemunde	58	54	115.2	4
30	Kassel	152	134	277.6	12

Monthly Totals to the end of July, 1943.

February	331	250	568.2	23
March	703	580	1506.7	22
April	372	352	859.3	28
May	1385	1015	2639.0	79
June	1447	1037	2070.4	83
July	2247	1275	3483.6	109

/August, 1943.

APPENDIX 12
SECRET

August, 1943

Date	Target or Purpose	Despatched	Attacking	Tonnage	Losses
12	Ruhr Targets	330			25
	Bochum, Gelsenkirchen)		133	269.6	
	Recklinghausen)		106	158.7	
	Bonn)				
	Targets of Opportunity in the Ruhr		4	8.9	
15	Airfields in Occupied France:-	327			
	Flushing/Vlissingen		91	192.0	
	Poix, Amiens/Glisy		56	61.7	
	Vitry		61	62.5	
	Merville)		82	41.3	
	Lille/Vendeville)			46.2	
16	Airfields in Occupied France:-	246			
	Le Bourget		168	354.8	
	Poix, Abbeville/Drucat		66	70.1	
17	Schweinfurt	230	183	378.9	36
17	Regensburg	146	127	266.5	24
19	Airfields in Occupied Belgium & Holland:-	170			
19	Gilze/Rijen		38	43.0	1
19	Flushing		55	117.8	3
24	Villacoublay	110	86	229.7	-
24	Diversion	36	35	-	-
24	Conches & Evreux/Fauville	42	22	22.0	1
27	Watten (France)	224	187	368.0	4
31	Airfields in France & Belgium:- (Amiens/Glisy).	319	105	276.9	4

September, 1943

Date	Target or Purpose	Despatched	Attacking	Tonnage	Losses
2	Airfields in France & Belgium	319			
	Denain/Prouvy		16	42.0	-
	Mardyck		18	48.2	-
3	Meulan-Les-Mureaux	65	38	101.3	-
	Paris (Renault Works)	65	20	75.9	5
	St. Andre De L'Eure)		28	72.5	-
	Romilly Surseine)	168	100	262.7	4
	Evreux/Fauville)		12	30.8	4
6	Targets of Opportunity	338			45
	Stuttgart		46	145.1	
	Strasbourg/Kehl		67	144.2	
	Offenburg M/Yd		51	106.1	
	Dieppe/St. Aubin airfield		14	30.8	
	Conches airfield		9	15.6	
	Orleans/Bricy		6	13.4	
	Chartres, Karlsruhe etc.		68	136.7	
	Diversion	69	60	-	-
7	(Brussels/Evere	114	105	277.5	-
	(Bergen/Alkmaar airfield Convoy	29	22	41.0	-
	Watten	147	58	102.7	-
9	(Industrial Targets in Paris				
	Beaumont-Sur-Oise airfield	87	68	176.1	2
	Beauvais/Tille airfield	63	59	75.8	-
	Lille/Nord airfield	37	37	47.0	-
	Lille/Vendeville airfield	56	52	66.5	-
	St. Omer (Two airfields)	38	28	58.4	-
	Abbeville/Drucat airfield	40	35	40.3	-
	Vitry-En-Artois airfield	56	51	67.1	-
15	Romilly-Sur-Seine	93	87	283.5	-
	Paris X	66	61	162.3	2
	Paris /	86	78	204.5	3

/Chartres airfield

September, 1943 (Contd.)

Date	Target or Purpose	Despatched	Attacking	Tonnage	Losses
15	Chartres airfield	65	47	126.0	1
16	Nantes (Port and airfield)	147	131	343.7	7
	La Pallice (Port and airfield)	105	72	160.0	4
	Cognac/Chateaubriand airfield	43	21	47.0	-
Night 22/23	Hanover	5	5	13.4	-
23	Nantes (Shipping & Port)	117	46	119.8	-
(Morning)	Vannes/Meucon airfield	67	55	147.3	-
	Kerlin/Bastard airfield	63	53	138.6	1
23 After-noon)	(Nantes and Rennes	91	80	206.2	2
	(Diversion	26	24	-	-
Night 23/24	Mannheim	5	4	6.2	-
26	G.A.F. Targets in N.France	55	-	-	-
					Abandoned
	Reims/Champagne airfield	84	40	105.4	-
	Target in N.E. France	63	-	-	-
					Abandoned
	Diversion	37	-	-	-
27	Emden and Targets of Opportunity	305	244	612.2	7
	Diversion	24	-	-	-
Night 27/28	Hanover	5	4	9.0	1

* Caudron-Renault Works. S.A.Andre Citroen Works & Renault-Billancourt Works.

/ Hispano-Suiza Plant, & C.A.M. Works.

October, 1943

2	Emden	347	337	851.1	2
	Airfield in Holland	21	-	-	Abandoned
Night 2/3	Munich	2	2	4.5	-
4	Frankfurt, Heddenheim and Wiesbaden	104	93	176.3	5
	Frankfurt (City)	51	37	78.8	3
	Saarlautern & St.Dizier airfield	115	105	182.1	4
	Sarreguemines & Saarbrucken	53	47	91.8	-
	Diversion	38	-	-	4
Night 4/5	Frankfurt	3	1	2.3	1
Night 7/8	Leaflets - Paris	4	4	(240352 leaflets)	-
8	Bremen (Shipyards)	118	63/	-	9
	Bremen (Weser Fleugzeugbau factory)	56	33	-	-
	Bremen (City)	170	156+41		14
	Vegesack	55	29	76.3	3
	Vegesack	-	19 from /	50.9	-
Night 8/9	Leaflets Rennes	2	2	(266336 leaflets)	-
9	Anklam	115	106	165.6	18
	Marienburg	100	96	194.6	2
	Danzig	* 51	23	44.8	2
	Gdynia	112	109 + 18 from *	275.0	6
10	Munster	274	138	378.6	30
	Diversion	39	-	-	-

/14 Schweinfurt

October, 1943 (Contd.)

Date	Target or Purpose	Despatched	Attacking	Tonnage	Losses
14	Schweinfurt	291	229	431.0	60
	Diversion	29	-	-	-
20	Duren	212	96	186.6	9
	Diversion	70	-	-	-
Night 20/21	Leaflets - Rouen & Paris	5	5	(876,960 leaflets)	-
Night 24/25	Leaflets - Caen, Rouen & Paris	4	4	(643,500 leaflets)	-
November, 1943					
3	Wilhelmshaven	566	539	1294.8	7
Night 3/4	Leaflets - Antwerp, Rotterdam	2	2	(1,592,000 leaflets)	-
5	Gelsenkirchen	380	328	660.0	7
	Munster	122	102	258.5	3
Night 5/6	Leaflets - Paris, Amiens, Rouen, Caen	5	5	(1,004,000 leaflets)	-
Night 6/7	Leaflets - Paris	2	2	(440,000 leaflets)	-
7	Wesel	61	54	111.6	-
	Duren	61	58	75.1	-
Night 7/8	Leaflets - Paris	2	2	(312,000 leaflets)	-
Night 10/11	Leaflets - Paris, Le Mans, Rennes, Rouen	5	5	(1,000,000 leaflets	-
11	Munster	167	58	109.0	4
	Wesel	175	-	(Abandoned due to weather.)	-
Night 11/12	Rees (Special photo: & instrument flight) (Primary Emmerich not attacked.)	1	1	1.8	-
Night 12/13	Emmerich (as above)	1	1	1.8	-
13	Bremen	272	114	234.0	16
16	Rjukan (Power Plant)	199	176	392.2	1
	Knaben (Molybdenum Mine)	189	128	279.5	1
18	Oslo/Kjeller a/d	102	78	187.0	9
Night 18/19	Leaflets - (Paris, Orleans, (Chartres, Rennes, (Le Mans.	5	5	(980,000 leaflets)	-
19	Targets of Opportunity. W. Germany (German Dutch Border)	167	130	251.6	-
Night 19/20	Leaflets - (Amiens, Reims, Ghent, (Brussels, Amsterdam, (Hague.	6	6	(2,316,000 leaflets)	-
Night 24/25	Leaflets - (Lille, Brussels, Ghent, (Charleroi Area	7	7	(2,400,000 leaflets)	-
Night 25/26	Leaflets - (Rheims, Paris, Amiens, (Evreux, Rouen, (Chartres.	7	7	(1,376,000 leaflets)	-
26	Bremen	505	422	1075.8	25
	Paris	128	-	- (Returned due to weather)	4
Night 28/29	Leaflets - (Gosselies, Brussels (Ghent, Antwerp, Liege, (Rotterdam.	7	7	(1,640,000 leaflets)	
29	Bremen	360	138	366.2	13
Night 29/30	Leaflets - (Paris, Rheims, Le Mans, (Orleans, Chartres, (Amiens, Rouen.	8	8	(1,600,000 leaflets)	
Night 29/30	Emmerich (Special equipment)	1	1	1.8	-

/30 Solingen

November, 1943 (Contd.)

Date	Target or Purpose	Despatched	Attacking	Tonnage	Losses
30	Solingen	381	78	197.6	3
Night 30/1 Dec.	Leaflets - (Paris, Rouen, Tours (Krefeld, Opladen	6	6	(1,407,500 leaflets)	-

December, 1943.

Date	Target or Purpose	Despatched	Attacking	Tonnage	Losses
1	Leverkusen (not attacked) Solingen	215 84	261	672.2	24
Night 2/3	Leaflets - (Bremen, Oldenburg, (Hamburg.	5	5	(2,090,300 leaflets)	-
Night 2/3	Huls (Special equipment)	1	1	1.8	-
Night 3/4	Leaflets - Rouen, Lille, Paris	4	4	(800,000 leaflets)	-
Night 4/5	Leaflets - (Le Mans, Orleans, (Tours, Laval	4	4	(800,000 leaflets)	-
5	G.A.F. Northern France				
	La Rochelle, Paris, Ivry, etc.	216	-	-	Abandoned
	Cognac/Chateaubriand airfield	94	2	3.6	1
	Bordeaux/Merignac airfield	236	1	.2	8
Night 10/11	Knapsack	1	-	-	Abandoned
Night 10/11	Leaflets - (Rouen, Paris, Caen, (Amiens, Ghent	6	6	(1,200,000 leaflets)	-
11	Emden	583	523	1256.5	17
Night 11/12	Leaflets - (Laval, Rennes, Le Mans (Nantes	4	4	(800,000 leaflets)	-
Night 12/13	Leaflets - (Paris, Amiens, Orleans,	4	4	(800,000 leaflets)	-
13	Bremen	182	174	408.1	-
13	Kiel	528	349	787.3	5
Night 13/14	Leaflets - (Le Mans, Rennes, Tours, (Nantes, Orleans	5	5	(1,000,000 leaflets)	-
16	Bremen	631	528	1162.1	10
Night 16/17	Leaflets - (Hanover, Brussels, (Lille	4	4	(1,952,000 leaflets)	-
Night 19/20	Leaflets - (Paris, Amiens, (Chartres	5	5	(1,000,000 leaflets)	-
20	Bremen	546	465	981.7	27
Night 20/21	Leaflets - (Lille, Lens, Ghent, (Brussels	5	5	(1,000,000 leaflets)	-
22	Osnabruck	351	130	474.2	17
	Munster	228	167	346.8	5
Night 22/23	Knapsack	1	1	1.8	-
Night 22/23	Leaflets - (Paris, Amiens, (Chartres, Orleans, (Rennes	6	6	(1,212,000 leaflets)	-
24	Military Installations in France (Pas de Calais area)	722	670	1558.2	-

/Night 27/28

December, 1943 (Contd.)

Date	Target or Purpose	Despatched	Attacking	Tonnage	Losses
Night 27/28	Leaflets	7	7	(1,392,000 leaflets)	-
Night 27/28	Quadrath area	1	1	1.8	primary not attacked bombs on Dusseldorf
Night 29/30	Quadrath	1	1	1.8	
Night 29/30	Leaflets - (Hanover, Osnabruck (Hildesheim, Zwolle, (Amiens	6	6	(2,840,000 leaflets)	-
30	Ludwigshaven	710	653	1244.6	23
Night 30/31	Leaflets - (Antwerp, Ghent, Lens, (Brussels, Cambrai	5	5	(1,000,000 leaflets)	-
31	Ball-Bearing plants - France				
	Paris (Ivry)	125	121	311.8	1
	Bordeaux	175	-	* (attacked secondary Cognac)	
	Blockade Runner	57	-	-	Abandoned
	Cognac	61	257	see 571.0	23
	St. Jean d'Angely	94	69	* 163.2	1
	La Rochelle	60	-	* (attacked secondary Cognac)	

Monthly Totals August-December, 1943.

August	2180	1607	2967.9	109
September	3243	2120	4862.8	88
October	2441	1793	3875.5	176
November	3900	2468	5408.3	93
December	6073	4444	10344.7	162

January, 1944

Night 2/3	Leaflets - (Bremen, Rennes, (Nantes, Paris, Brest	5	5	(1,200,00 leaflets)	-
Night 3/4	Special Target in Germany	1	-	-	Abandoned
4	Kiel	494	445	879.4	16
	Munster	75	66	171.4	2
Night 4/5	Leaflets - (Orleans, Lorient, (Rouen, Tours	4	4	(800,000 leaflets)	-
Day 5	Tours	79	78	158.9	1
	Elberfeld	78	-	-	-
	(Secondary Targets, Neuss, Dusseldorf, etc.)		73	173.2	2
	Kiel	247	215	456.3	10
Night 6/7	Leaflets - (Amiens, Lille, (Raismes, Cambrai, (Rheims/Champagne	5	5	(984,000 leaflets)	-
7	Ludwigshaven	502	409	900.9	12
Night 7/8	Leaflets - (Paris, Chartres, Caen (Evreux	5	5	(1,080,000 leaflets)	-
Night 8/9	Leaflets - (Antwerp, Brussels, (Rennes, Nantes, Brest	5	5	(2,752,000 leaflets)	-

/Night 10/11

January, 1944 (Contd.)

Date	Target or Purpose	Despatched	Attacking	Tonnage	Losses
Night 10/11	Leaflets - (Rouen, Le Mans, (Orleans, Tours, (Chateauroux	5	5	(4,800,000 leaflets)	-
11	Oschersleben	177	150	285.1	34
	Halberstadt	114	52	111.3	8
	Brunswick	372	47	92.8	18
			114 Osnabruck	223.3	
14	Crossbow - Pas-de-Calais area	552	512	1337.5	3
Night 14/15	Leaflets - (Amiens, Cambrai, (Lille, St. Omer	4	4	(948,000 leaflets)	-
Night 14/15	Special operation. Wesel	2	1	1.8	-
Night 25/26	Leaflets - (Caen, Chartres, Rheims, (Brest, Chateauroux	5	5	(1,200,000 leaflets)	-
Night 25/26	Special operation. Aachen	1	1	1.8	-
Night 27/28	Leaflets - (Paris, Rennes, Le Mans, (Orleans	5	5	(1,400,000 leaflets)	-
28	Military Installation. Pas-de-Calais	54	31	80.8	-
Night 28/29	Leaflets - (Caen, Cambrai, (Amiens, Rouen, Rheims	5	5	(1,360,000 leaflets)	-
29	Frankfurt	863	803	1688.8	29
Night 29/30	Leaflets - (Lille, Nantes, (Raismes, Lorient, (Tours	5	5	(1,200,000 leaflets)	-
30	Brunswick	777	699	1446.4	20
Night 30/31	Leaflets - (Caen, Chartres, (Le Mans, Brest, (Chateauroux	5	5	(1,200,000 leaflets)	-
Night 30/31	Special operation. Duren	1	1	1.8	-
31	Military Installation. Pas-de-Calais	74	74	189.5	-
31	Gilze-Rijen airfield (Thunder bombers)	75	70	15.6	6

February, 1944.

3	Wilhelmshaven	724	552	1151.3	4
Night 3/4	Leaflets - (Paris, Rennes, (Orleans, Amiens, (Rouen, Rheims	7	7	(1,680,000 leaflets)	-
4	Frankfurt	748	373	838.4	20
	Leaflets - (Tours, Lille, (Raismes, Nantes, Cambrai, (Lorient, Antwerp	7	7	(2,416,000 leaflets)	-
5	Chateauroux/La Martinerie airfield	50	49	129.0	-
	Avord airfield	53	50	131.9	-
	Tours airfield	103	90	233.2	2
	Orleans/Bricy airfield	60	60	151.3	-
	Chateaudun airfield	61	61 + 8 from Tours	180.3	-
	Romilly airfield	182	-	339.3	-

/Night 5/6

February, 1944 (Contd.)

Date	Target or Purpose	Despatched	Attacking	Tonnage	Losses
Night 5/6	Leaflets - (Monceau, Sur Sambre (Brussels, Antwerp, (Ghent	5	5	(1,200,000 leaflets)	-
6	Evreux/Fauville airfield		40	126.8	-
	St. Andre de l'Eure airfield	189	60	159.0	3
	Chateaudun airfield	303	37	83.0	1
	Caen/Carpiquet airfield		60	148.6	-
	Military Installations	150	9	22.5	1
Night 7/8	Leaflets - (Liege, Antwerp, (Ghent, Monceau-sur- (Sambre	6	6	(1,452,000 leaflets)	-
8	Military Installations Pas de Calais	127	110	328.1	-
	Frankfurt	236	88	191.6	13
Night 8/9	Leaflets - (Caen, Rouen, Amiens (Rennes, Paris	6	6	(1,440,000 leaflets)	-
10	Brunswick	169	141	312.2	29
	Gilze-Rijen airfield	81	27	63.4	-
Night 10/11	Leaflets - (Rouen, Antwerp, Caen, (Rennes, Amiens	5	5	(1,040,000 leaflets)	-
11	Frankfurt	223	157	346.4	5
	Military Installations Pas de Calais	201	94	244.6	1
Night 11/12	Leaflets - (Ghent, Antwerp, (Brussels, Monceau-sur- (Sambre	5	5	(2,476,000 leaflets)	-
12	Military Installations Pas de Calais	99	97	249.0	-
13	Military Installations Pas de Calais	469	404	946.0	4
14	Gilze-Rijen airfield (Fighter Bomber)	48	46	12.1	-
15	Military Installations Pas de Calais	54	52	131.4	-
15	Coxyde airfield (Fighter Bomber)	59	34	7.6	-
Night 15/16	Leaflets - (Lille, Le Mans, (Cambrai, Chartres, (Rheims, Orleans.	6	6	(1,200,000 leaflets)	-
20	Leipzig, Bernberg, & Oschersleben	417	275		7
	Gotha, Brunswick, Oschersleben	272	163	1980.0	8
	Tutow area, Rostock area and Targets of Opportunity	314	105		6
Night 20/21	Leaflets - (Tours, Brest, (Lorient, Nantes	4	4	(800,000 leaflets)	-

/21 G.A.F.

February, 1944 (Contd.)

Date	Target or Purpose	Despatched	Attacking	Tonnage	Losses
21	G.A.F. Installations	861			16
	Brunswick		81	178.6	
	Achmer airfield		114	284.4	
	Diepholz airfield		180	389.5	
	Luftwaffe airparks		193	504.9	
Night 21/22	Leaflets - (Paris, Rouen, Caen, Amiens	5	5	(1,000,000 leaflets)	-
22	(Halberstadt, Aschersleben, Bernberg and airfields in Denmark	600			41
	Aschersleben		34	69.7	
	Bernberg		47	102.7	
	Halberstadt		18	44.2	
	Airfields in Denmark			recalled	
Night 23/24	Leaflets - (Le Mans, Rennes, Orleans, Chartres, Lille	5	5	(1,000,000 leaflets)	-
24	Schweinfurt	266	236	507.5	11
	Gotha	239	169	341.1	33
	Rostock	304	259	543.4	5
25	(Augsburg				
	(Stuttgart	268	243	541.2	13
	Furth	196	161	374.7	6
	Regensburg	290	266	571.2	12
Night 25/26	Leaflets - (Toulouse, Grenoble, Caen, Chartres, Raismes	5	5	(1,000,000 leaflets)	-
28	Military Installations				
	Pas de Calais	81	49	117.0	-
	Military Installations				
	Pas de Calais	266	109	279.5	7
Night 28/29	Leaflets - (Rouen, Rennes, Paris Amiens, Le Mans	5	5	(1,400,000 leaflets)	-
29	Brunswick	226	213	401.8	1
29	Military Installations				
Night	Pas de Calais	48	38	100.4	-
Night 29/1Mar.	Leaflets - (Lille, Rheims, Cambrai, Chateauroux, Orleans	5	5	(1,000,000 leaflets)	-
	Total January, 1944.	4192	3733	7164.7	148
	Total February, 1944.	9013	5563	12,958.8	249

APPENDIX 13

SECRET

SUMMARY OF ATTACKS ON G.A.F. TARGETS BETWEEN 1ST MARCH, 1943 AND 15TH JANUARY, 1944

(Note: All populations and Key Point Ratings given are based on those stated on P.8 of Bombers Baedeker Part I)

1	2	3	4	5	6	7	8
Town	Population	Total K.P.R.	Wt. of attacks Tons claimed	Built-up area destroyed	G.A.F. Targets	Dist. of Target from Town Centre	Damage to Factories
Augsburg	186,000	40	NIL	NIL	Me. 210	3 m.	NIL
Berlin	4,400,000	545	22915	16.5 + 4 raids	D.B. Engines Marienfelde D.B. Engines, Genshagen B.M.W. Engines, Basdorf V.K.F. Ball Bearings, Erkner	7 m. S. 15 m. S.S.W. 16 m. N. 16 m. E.S.E.	Severely damaged NIL NIL NIL
Bernburg	40,000	18	NIL	NIL	Ju. 88	3½ m.	NIL
Bremen	383,000	108	342		F.W. Assembly, Neuenland F.W. Comp. Hasstedt F.W. Comp. Hemlingen F.W. Comp. Kirchweg	2½ m. 4 m. 5 m. ?	Destroyed by USA NIL NIL NIL
Brunswick	196,000	61	2095	Not known	Me. 110 Ass. Waggum Aero-engine, Nildersachsischen/ Querum Me. Comp. Wilhelmitor Me. Comp. Neupetritor	4 m. 2 m. 1½ m. 1½ m.	Damaged by USA Not known
Dessau	200,000	51	NIL	NIL	Ju. Comp. and Research	1 m.	NIL
Eisenach	50,000	28	NIL	NIL	B.M.W. Aero-engines B.M.W. Engines - Stockhausen	NIL 2 m.	NIL NIL
Frankfurt	570,000	153	2949	Not known	V.D.M. Props. Heddernheim Comp. Opel, Russelsheim	4½ m. 15 m. S.W.	Severely damaged by USA Damaged prior to 14.2.43
Friedrichshafen	25,000	32	NIL on these works	NIL	Dornier, Lowenthal Dornier, Manzell Dornier, Allmansweiler	1 m. 2½ m. 1 m.	NIL NIL NIL
Gotha	51,000	13	NIL	NIL	Me. 110 Assembly	1½ m.	NIL
Hamburg	1,800,000	216	9573	71.5	Aero-engine Klockner-Moorfleth V.D.M. Props. Bahrenfeld	5 m. 5 m.	NIL NIL
Hanover	450,000	103	8365	31	Tyres - Continental Vahrenwalder Str. Tyres - Continental Nordhafen	NIL 4 m.	Severely damaged by RAF & USA NIL
Kassel	216,000	69	3440	84	F.W. 190 Ass. Waldau Comp. Waldau Comp. Bettenhausen Aero-eng. Altenbauna	2¼ m. 2¼ m. 1½ m. 5 m.	Damaged by USA Damaged by USA Severely damaged NIL
Leipzig	720,000	121	2544	20	Me. 109 Ass. Erla, Mockau Comp. Erla, Heiterblick Comp. Erla, Abtmanndorf Comp Erla, Werke 5 D.K.F. Ball Bearings	3½ m. 4 m. 3 m. Town centre 3½ m.	(World Fair Components Factory virtually destroyed.) NIL NIL NIL Severely damaged NIL

/Munich

SUMMARY OF ATTACKS ON G.A.F. TARGETS BETWEEN 1ST MARCH, 1943 AND 15TH JANUARY, 1944 - CONTINUED

1	2	3	4	5	6	7	8
Town	Population	Total K.P.R.	Wt. of attacks Tons claimed	Built-up area destroyed	G.A.F. Targets	Dist. of Target from Town Centre	Damage to Factories
Munich	820,000	67	2162	4	B.M.W. Aero-engines B.M.W. Aero-eng. - Allach Dornier, Oberpfaffenhofen	3 m. 8 m. 15 m. W.S.W.	Severely damaged NIL NIL
Oschersleber	16,000	5	By USA only	NIL	Ago Fighter Ass.	1 m.	Severely damaged by USA
Regensburg	87,000	21	By USA only	NIL	Me. Assembly, Pruffening Me. Assembly, Obertranbling	2 m. 5 m.	Destroyed by USA NIL
Schweinfurt	60,000	44	By USA only	10.5	Kugelfischer, Ball Bearings V.K.F. I Ball Bearings V.K.F. II Ball Bearings	1½ m. ½ m. 1½ m.	Severely damaged by USA Severely damaged by USA Destroyed by U.S.A.
Stuttgart	450,000	121	3330	3.5	D.B. Eng., Unterturkheim R.Bosch - old works R.Bosch - Feuerbach V.K.F. Norma, Ball Bearings	3 m. NIL 3 m. 2½ m.	Severely damaged NIL Slightly damaged Severely damaged
Warnemunde	10,000	5	By USA only	-	Arado assembly	NIL	Destroyed by USA
TOTAL	10,730,000	1821					
TOTAL ATTACKED BY R.A.F.	10,005,000	1564	57715				

APPENDIX 14
SECRET

TOWNS IN GERMANY OF 50,000 INHABITANTS OR MORE ATTACKED BY THE R.A.F. AND NOT INCLUDED IN THE AIR MINISTRY'S LIST OF MAIN TOWNS ASSOCIATED WITH THE G.A.F.

(NOTE: Population and Key Point ratings as given on page 8 of Part I of Bombers Baedeker except where otherwise stated.)

Town	Population	Total K.P.R.	Percentage of total built-up area destroyed	Remarks
Aachen	164,000	20	51	
Bochum	320,000	174	46	Excludes K.P.R. of 58 given to Gelsenkirchen
Cologne	906,000	126	54	See Note "A"
Darmstadt	110,000	29	Nil	See Note "A"
Dortmund	550,000	110	34.5	
Duisburg	440,000	239	7.9	Excludes K.P.R. of 48 given to Oberhausen. See Note "A"
Dusseldorf	530,000	132	42	See Note "A"
Essen district	1,139,000	212	43	See Note "A"
Gelsenkirchen	323,000	58	Nil	
Hagen	214,000	71	22	
Kiel	235,000	72	5.8	See Note "A"
Krefeld	170,000	36	41.5	See Note "A"
Mannheim	430,000	131	53	
Munchen-Gladbach/ Rheydt	210,000	12	40	
Munster	143,000	16	6.5	See Note "A"
Nurnberg	450,000	59	18.5	See Note "A"
Oberhausen/ Mulheim	194,000	48	29.5	
Remscheid	107,000	12	83	See Note "A"
Stettin	380,000	55	7.9	
Wilhelmshaven	140,000	34	6.5	
Wuppertal	411,000	33	74	See Note "A"
Total	7,566,000	1,679	33.4%	

Note "A": These towns contain factories identified with the production of aircraft components.

G.225497/DEW/11/49.

REPORT

BY

CHIEF OF THE AIR STAFF

AND

COMMANDING GENERAL U.S.EIGHTH AIR FORCE

ON

PROGRESS MADE BY THE R.A.F.AND U.S. EIGHTH AIR FORCE

IN THE COMBINED BOMBER OFFENSIVE

INDEX

APPENDICES NOT ATTACHED.

G.225497/DEW/11/49.

APPENDIX 15
SECRET

PROGRESS MADE BY THE R.A.F. AND U.S. EIGHTH AIR FORCE IN THE COMBINED BOMBER OFFENSIVE

Period Covered

1. This report covers the period from 4th February to 31st October, 1943. The former is the date of issue to Bomber Command and the Eighth Air Force of the directive No. C.C.S.166/1/D approved by the Combined Chiefs of Staff on 21st January, 1943. This directive is attached as ..... Appendix 'A'

Method of Employment of the Forces

2. The forces concerned have operated in accordance with that directive and a supplementary directive issued on the 10th June, 1943, by the Chief of the Air Staff, in order to implement the Combined Bomber Offensive Plan as approved by the Combined Chiefs of Staff. This directive is attached as ..... Appendix 'B'

3. The primary object of the bomber offensive from the United Kingdom as stated in the earlier directive was :-

> "The progressive destruction and dislocation of the German military, industrial and economic system and the undermining of the morale of the German people to a point where their capacity for armed resistance is fatally weakened."

The primary object of the subsequent directive remained as set out above. In view, however, of the increasing strength of the German fighter forces, and in order to check their growth and reduce their strength, it was decided that first priority should be accorded to the attack of these forces and the industry on which they depended.

4. At the beginning of the period covered by this report the Eighth Bomber Command, while in process of developing their offensive power, were employed mainly in the attack of submarine construction yards and operating bases. From the beginning of April, with the formulation of the Combined Bomber Offensive Plan, their effort was directed increasingly to the destruction of the G.A.F. fighter forces. In the summer months the R.A.F. Bomber Command, being limited in radius of action by the available hours of darkness, concentrated upon the destruction of the Ruhr/Rhineland industries, and the undermining of the morale of the workers of that area. With the incidence of longer nights they have been able to make a more direct contribution to the reduction of the G.A.F., and vastly to extend their efforts on the enemy's military, industrial and economic systems as well as on enemy morale generally, by the destruction of a number of towns and cities of critical importance in the enemy's war economy.

5. The British and U.S. medium bombers and British fighter-bombers have been used mainly against enemy airfields in diversionary attacks, so timed and directed as to reduce the concentration of fighters which could oppose the passage of the heavy formations.

6. British and U.S. fighters have been used increasingly to cover the bomber formations, both on the outward and return passage, to the limits of their range. By the use of long range tanks, American fighters have been able to give effective fighter cover to targets as far afield as Bremen and the Ruhr.

Forces Employed

7. The strategic bomber forces available during the period under review are shown in ..... Appendices 'C' & 'D'
The effort of the medium and light bomber and fighter aircraft in support of the Combined Bomber Offensive, is shown in .... Appendices 'K','L','M', & 'N'.

/Assessment

Assessment of Results Achieved

8. In assessing the results of the Combined Bomber Offensive it will be appreciated that our sources of information are necessarily limited; a complete and accurate picture of results achieved is not possible. We are dependent to a large extent on air photography but much damage sustained in air bombardment is not revealed by air photography. Assessments of results based on photographs, even when interpreted in the light of known effects produced by the enemy attacks on objectives in the United Kingdom, are liable to large discrepancies. Comparison is the more difficult since the scale of enemy attack on this country, even when the enemy was making his heaviest raids in 1940 and 1941, was far smaller than we are now delivering on objectives in Germany. Moreover, his general economic structure is far weaker and less resilient than was that of the United Kingdom at that time. Viewed as a whole, however, all evidence points to the fact that conditions in Germany are resolving themselves into an ever more acute conflict of priorities, and a marked deterioration in morale.

General Results on Towns and Cities.

9. With photographic cover as the basis of calculation, it is estimated that of the towns of outstanding importance in the enemy's war economy 19 have been virtually destroyed, 19 seriously damaged and 9 damaged. The term "destroyed" can be taken as expressing devastation to a degree which makes the objective a liability to the total German war effort in excess of any remaining assets; "serious damage" implies urban destruction greater than the most serious damage experienced in the United Kingdom.

10. This degree of devastation of industry and urban areas is illustrated by the following figures of acreage devastated by our own attacks on Germany and by enemy attacks on the United Kingdom :-

Coventry	-	120 out of 1,922 acres devastated
Hamburg	-	6,200 out of 8,382 acres devastated
Cologne	-	1,785 out of 3,320 acres devastated
Essen	-	1,030 out of 2,630 acres devastated
Elberfeld	-	825 out of 1,068 acres devastated

An impression of the degree of devastation of some of these cities can be gained from the Specimen photographs following ..... Appendix 'V'

General Results of Precise Day Attacks.

11. VIII Bomber Command have concentrated their attacks upon individual targets, as well as individual industries, selected in the light of their critical importance to the German war effort. Damage to such targets must, therefore, have proportionately greater effect upon the German military machine as a whole than damage achieved in the course of area attack, which normally embraces a wide range of unrelated industries. Thus the attacks on the ball-bearing industry at Schweinfurt and the synthetic rubber plant at Hüls have undoubtedly produced far reaching effects throughout the range of German war industry.

12. Similarly the ability to concentrate a series of daylight attacks on a single vital system, as in the case of the attacks made upon the fighter factories at Regensburg, Kassel, Oschersleben, Marienburg, Anklam, Warnemunde and Wiener Neustadt are likely to have produced effects within that industry far in excess of the sum of the visible damage. Thus by means of precise and selective attack it may well be possible to reduce below a critical level an individual industry without which Germany cannot continue her military resistance.

A list of selected photographs of attacks on precise targets follow..... .....Appendix 'W'.

/Effects

Effects on Enemy's War Economy Generally.

13. The general effect of our bomber offensive against Germany are indicated briefly in the following extracts from a Joint Report by the Ministry of Economic Warfare and the Air Ministry Intelligence Branch :-

Overall Effects

(i) (a) "It is difficult to estimate the overall effect in quantitative terms, but it is considered to be now in the region of 10% of the total war potential. A total decline of 20% in overall effort may well be fatal."

(b) "The effects of bombing do not fall evenly on the various parts of the enemy's war potential, and, to some extent, they are redistributed according to the immediate requirements of the consumers of war material having the highest priority in Germany."

(c) "There is the very much greater decline in some individual industries (e.g. ball-bearings and rubber), which may be near the point where they could cause the collapse of the whole war machine."

Effects on manpower.

(ii) "The employment of a considerable and increasing number of full-time adult personnel in anti-aircraft and civil defence, factory repair and reconstruction, and first-aid to housing, represent a serious drain on Germany's industrial manpower that might otherwise have been employed on production."

Effects on Fighter Aircraft Production

(iii) "Damage to assembly factories alone ... has resulted in the production loss of 880 single-engined fighter aircraft, and production in October was between 600 and 700 against an estimated planned production of 1,000."

"Single-engined fighter production in the months of September and October was on a lower level than in the month of July, notwithstanding the high degree of priority accorded to single-engined fighter production and the considerable planned expansion in output."

Effects on Morale

(iv) "The maintenance of morale is the greatest single problem confronting the home authorities. The full effects of air attack since the devastation of Hamburg have become known in all parts of the country. The increasing death roll is the important factor and coupled with military failures, the general attitude is approaching one of "peace at any price" and the avoidance of the wholesale destruction of further cities in Germany."

"Damage to housing, combined with evacuation, has resulted in the final saturation of all suitable accommodation in Germany. In the coming winter the problem of housing evacuees, many of whom have hitherto been in temporary dwellings unsuitable to winter conditions, will put upon the home administration a burden that it may not be able to support."

"... The housing situation and the general morale are both so bad that either might cause a collapse before industry became unable to sustain the war effort."

/Effects

Effects on the General Military Situation.

14. The bomber offensive has made a significant contribution to the success of the Allied military operations on the Mediterranean and Russian Fronts. The enemy has been compelled to withdraw fighters from the support of his armies to counter the threat from the West. A year ago 38% of his fighter strength was deployed on the Western Front. With the growth of the bomber offensive the proportion had risen to 45% in April and is now 63%. The changes in this situation are outlined in ..... Appendix 'U' The repercussions upon the armies in the field of this denial of the essential minimum of air support have been far reaching in their general effect on the conduct of enemy military operations, particularly on the Russian Front where our Allies have now achieved outstanding air superiority as a direct result of our efforts on the Western Front. The very fact of these changes which have been imposed on the enemy is an indication that he is forced to defend his home front even at the cost of serious military reverses.

15. The reduction of supplies of weapons, technical equipment and transport vehicles consequent upon our sustained and damaging air offensive has doubtless played a great part in further restricting the enemy's military capabilities.

Effects on U-Boat War.

16. The attacks by the VIII Bomber Command on submarine construction yards and operating bases, coupled with the area attacks upon industrial centres by the R.A.F. Bomber Command, have reduced the scale of U-Boat activity. It is estimated that attacks on U-Boat construction and components manufacture have in 1943 caused a direct loss of at least 22 U-Boats out of a total of about 200 that would have been launched by the end of October. The delayed action of attacks on areas producing materials and components appears now to be having an effect on the average rate of completion. See .....Appendix 'O'

Detailed Estimates of the Total Effects of the Bomber Offensive.

17. Estimates of the total effects of the Bomber Offensive are given in the following reports :-

(i) Joint report by the Ministry of Economic Warfare and the Air Ministry Intelligence Branch dated 4th November, 1943 .... Appendix 'O'

(ii) Summary of conclusions on effects of bombing offensive on German war effort in 1943 up to July by the British War Cabinet Joint Intelligence Sub-Committee ..... Appendix 'P'

(iii) Summary of conclusions on effects of bombing offensive on German war effort for the period July to October, 1943, by the British War Cabinet Joint Intelligence Sub-Committee ..... Appendix 'Q'

(iv) Joint Report by the Air Ministry Intelligence Branch and the Political Warfare Executive on Allied Air Attacks and German Morale ..... Appendix 'R'

Scale of Effort.

18. The effort of the combined strategic bomber forces during the period under review totalled 61,690 sorties. They consisted of :-

45,844 night sorties

15,846 day sorties

61,690 Total

19. The detailed statistics of scale of effort are given in ..... Appendices 'E','F','H'&'I'.

/Casualties

Casualties Involved.

20. The number of strategic bombers missing during the period under review was :-

R.A.F.	1,784 (Averaging 198 a month with a cumulative percentage rate of 3.9%).
VIII Bomber Command	698 (Averaging 78 a month with a cumulative percentage rate of 4.4%).
Total =	2,482 (Cumulative percentage rate 4%).

21. Notwithstanding these casualties, and the higher rate incurred in deep daylight penetrations into Germany, the morale of crews remains high. It appears to be governed only by the degree of success achieved.

22. The casualties for heavy, medium and light bombers and fighters are given in ..... Appendices 'E','G','H' & 'J'.

Enemy Efforts to Counter the Bomber Offensive.

23. The enemy has been unsuccessful in his attempts to counter effectively the bomber offensive, and there is as yet no indication that he can develop new methods which will defeat our offensive. His efforts have taken the form of :-

(i) Increased production of fighters at the expense of bombers.

(ii) Redistribution of fighter and other defence resources to meet the threat.

(iii) New tactics and weapons.

24. The increasing effort devoted to fighter production continues. This is shown graphically in ..... Appendix 'S'. Single-engined fighter production, on which our attacks have so far been concentrated, has been reduced materially, but production of twin-engined fighters has increased. Bomber production continues on a reduced scale. The first line strengths of the German fighter and bomber forces are shown at ..... Appendix 'T'.

25. The German fighter force has been increasingly concentrated on the Western Front until it has now reached a figure of 1,800. The redistribution of fighter forces following on our bomber offensive is shown in ..... Appendix 'U'.

26. The deep daylight penetrations into Germany of the U.S. bombers have forced the enemy to deploy his defences in depth. Although he has disposed on the Western Front the maximum possible number of fighters, this in itself does not meet his needs, and he has been forced to increase their mobility, and to employ increasing numbers of twin-engined fighters. He can now concentrate against bomber formations penetrating deep into Germany, fighters from an area extending from the West of Paris to the Baltic. The main counter to this mobility continues to be feints and diversionary attacks.

27. At night the use of "Window" and other radio counter-measures has largely neutralised his controlled night fighter system. He has been forced to adopt a new system of concentrating large forces of single-engined and twin-engined fighters which "freelance" over what he

/assumes

assumes will be the target. This opens up exceptional opportunities for feint attacks, and these have already been exploited with success; the enemy night defence system has frequently been thrown into great confusion.

28. Flak and searchlights have equally been disorganised by "WINDOW", the use of which, coupled with the expected presence of night fighters over the target, has restricted flak activity to barrage fire below the level of the bomber stream. This has increased the reliance and hence the strain on the fighter defences. Our new tactics have substantially reduced the percentage success of the enemy's night fighter sorties, and up to date he has found no method of meeting the situation, except to increase continuously the number of fighters available for the purpose.

29. The day and night fighters responsible for the defence of Germany have now been placed under a single command, and are required to deal with both the U.S. attacks by day and the R.A.F. attacks by night. This system of employment in a dual role may produce weaknesses during periods of sustained day and night attack.

30. The principal new weapon developed for day use by the enemy is the rocket, mounted mainly on twin-engined fighters. This weapon has been used effectively in massed attacks delivered from the rear of the bomber formations and from beyond the range of the .50 calibre tail guns. Such attacks have been co-ordinated with single-engined fighter attacks from other quarters. Rocket equipped aircraft are extremely vulnerable to our fighters and although their employment is increasing, the most dangerous enemy of the day bomber remains the single-engined cannon fighter.

31. In the face of these new tactics and new weapons the bombers have continued to operate successfully and have every expectation of being able so to continue.

RECOMMENDATION

32. All evidence indicates that the Combined Bomber Offensive is achieving a profound effect upon Germany's war economy, and upon the morale of her people. In the continuation of the offensive toward a decision, time is a vital factor. The offensive should be pressed on, in accordance with the existing directives, with all vigour, and its intensity increased.

7th November, 1943.

APPENDIX 16
SECRET

SPECIMEN REPORT TO THE PRIME MINISTER BY THE CHIEF OF THE AIR STAFF

Prime Minister.

1. The following points of interest emerge from an analysis of the work of Bomber Command during December.

(a) Operations were greatly restricted by weather and the total effort, amounting to 4,155 sorties, was the lowest since January 1943. It compares with 5,265 sorties in November and 7,865 in August, the greatest number ever despatched. The number despatched in December 1942 was 2,229.

(b) Four heavy attacks were made on Berlin and one each on Leipzig and Frankfurt. The number of sorties despatched against Berlin was 2,050; i.e., just on half the total effort on all operations during the month.

(c) 11,802 tons of bombs were dropped, including 11,318 tons on Germany (of which 7,110 tons on Berlin). The comparable figure for November, when the present offensive against Berlin began was 14,495 tons, including 12,925 on Germany (6,990 on Berlin).

(d) The bad weather during the month also contributed to a sharp rise in the over-all rate of loss from all causes to 5.3% from the 4% experienced in November. This increase was due partly to a rise in the crash rate directly attributable to bad weather at bases (1.1% compared with .7% in November) and partly to the greater preparedness of the enemy defences against attacks on Berlin. Excluding crashes, the rate of loss directly due to enemy action rose to 4.2% from 3.3% in November. Against Berlin alone, the over-all rate of loss was 6.6% compared with 5.3% in November.

(e) There was a slight fall in the loss rate of the Pathfinder Force, the December figure being 2.6% compared with 2.8% in November. The corresponding figures for the main force (bombing operations only) were 5.3% and 3.5%. The low loss rate in the Pathfinder Force is partly accounted for by the extremely small losses suffered by the Mosquitos (.8% compared with 3.6% for the heavy bombers of the P.F.F.) and partly by the higher standard of skill and the greater proportion of scientific aids in the Pathfinder squadrons.

(f) Mine-laying was again carried out in all areas from the Belts to the Bay of Biscay, but the effort was restricted by bad weather, only 800 mines being laid compared with the monthly average during 1943 of 1,151. The loss rate was 2.7% compared with 2.6% in November.

(g) The effort of the Lancasters was again high in proportion to their numbers. Although they numbered only 53% of the operational strength of the Command they dropped 82% of the total bomb tonnage for the month. Against Berlin, 84% of all the sorties during the month were made by Lancasters. The result of this tremendous effort was a sharp rise in the Lancaster casualty rate from 4.1% in November to 6% in December. The Halifax rate also rose from 4.7% to 6.7%. In the Stirling squadrons, however, as a result of their exclusion from all bombing except against CROSSBOW targets, there was a fall in the loss rate from 5.7% to 3.9%.

/(h) In terms

(h) In terms of the weight of bombs dropped per aircraft lost, the record of the Lancasters showed a considerable falling off, the figure for December being 64 tons compared with 122 tons in November. This decline in apparent effectiveness is undoubtedly a reflection of the increasing strength of the enemy defence of Berlin and other targets of deep penetration. The Halifaxes dropped 29 tons per aircraft lost compared with 63 tons in November. The Stirlings, limited as they were to attacks on Crossbow targets, dropped 229 tons per aircraft lost.

2. In spite of the bad weather and the increasing strength of the enemy defences, the weight of attack on Germany was well maintained, Berlin receiving a heavier hammering than ever before. The increase in the casualty rate judged against this background was not excessive, but it points to the need for the highest possible production of Lancasters and Halifaxes if we are to achieve the planned expansion and at the same time maintain an increasing weight of attack.

(Signed) C. Portal

26th January, 1944.

C.A.S.

APPENDIX 17
SECRET

PROGRESS OF R.A.F. BOMBER OFFENSIVE AGAINST GERMAN INDUSTRY

1st March, 1943 to 31st December, 1943
(excluding Berlin attacks of 23rd/24th December and 29th/30th December for which no photographic cover is available.)

PART 1 - EFFECTS IN THE TOWNS ATTACKED

This paper is a development of the earlier paper dated 30th November, 1943, entitled "Progress of the R.A.F. Bomber Offensive against Germany", which surveyed the progress of the offensive from the outbreak of war down to 31st October, 1943 in terms of built-up areas destroyed. It is now possible to carry the preliminary survey a step further by presenting an estimate of the degree to which this destruction has achieved its purpose, namely, the smashing of the enemy's war effort by the crippling of his essential industries.

2. It must, however, be emphasised at the outset that this paper deals only with the effects on industry, and, in particular, takes no account of the progressive breaking-down of enemy morale, the effects of which cannot be expressed in figures. Consequently they remain hidden, like the submerged mass of an iceberg, but may still bulk larger than all the effects of the offensive which it is possible to calculate.

3. The estimates are based on figures issued by the Research and Experiments Section (R.E.8) of the Ministry of Home Security, who have calculated the industrial loss inflicted on the enemy, raid by raid, from the 1st March to the 31st December, 1943. This loss is expressed in the number of man hours (or, more conveniently, man-months) (a) directly lost as a result of damage to industrial property and plant, and (b) diverted from effective production as a result of damage to non-industrial property, the total being related to the total number of man-months which would have been available in each town for the enemy's war effort if the attacks had not been delivered. In this way the effects can be assessed in much the same manner, as they were when measurable areas of devastation were set against the total built-up area. The "Labour Target" now takes the place of the "Area Target", its dimensions being the number of industrial workers (which means exclusively factory workers) multiplied by the period of time which is being considered, in this case, 10 months.

4. It must be clearly understood that these basic figures of R.E.8 are an absolute minimum. The reasons for this are given in the attached Explanatory Notes, where R.E.8's methods of calculation are detailed, and it is explained that these estimates of necessity fail to take into account several most important effects quite apart from morale, which if it were possible to calculate them, might well increase the present estimates by one hundred per cent. It would therefore be entirely misleading to take the figures here given as the complete picture of industrial loss, since they claim only to be a statement on production hours lost from ascertainable and calculable causes. Even of the unsubmerged portion of the iceberg, half may be obscured from view.

5. A complete list of the 29 towns attack during the period under review is given in the basic schedule at Appendix "A" together with all relevant figures for these towns, and the "Labour Results" achieved. Figures for "Area Results" have also been included for purposes of comparison in the schedule at Appendix "B" and in Graph 1 at Appendix "C". The figures

/given

given in this schedule are summarised in the table below:-

Industrial population (i.e. factory workers) in towns attacked	3,357,300
10 months' potential industrial effort	33,573,000 man months
Labour loss during 10 months under review	12,103,000 man months
Labour loss during 10 months as a percentage of 10 months' effort	36.1%
One year's potential industrial effort by the towns attacked	40,287,000 man months
Labour loss as a percentage of one year's effort	30%

6. As a result of Bomber Commands attacks during the ten months 1st March to 31st December, 1943, in which a total of 116,500 tons of bombs were dropped on the twenty-nine individual industrial centres attacked, it will be seen from the above total that the enemy has irretrievably lost, 1,000,000 man years. This represents no less that 36% of the total industrial effort which would have been put out by these towns during this period if they had remained unmolested.

7. Even if these results be measured against a full year's output as a more usual standard of reckoning, they still amount to the loss of 30% of a year's total industrial effort. This is actually slightly higher than the percentage of built-up area destroyed, which during the ten months under review amounted to 29.1% of the total area attacked.

8. There is, in fact, a very close conformity throughout the period under review between the percentage of the total built up area destroyed, and the percentage of a year's industrial output in man-months lost to the enemy in all the towns attacked, as is shown by Graph. 11 at Appendix "C". This does not mean that the total industrial loss is felt exclusively in the attacked towns, since workers in Silesia may have to put aside their normal work in order to replace industrial plant destroyed in the Ruhr. But as a rough and ready guide to the industrial loss inflicted at any time, the percentage of total area destroyed applied to the number of industrial workers in the towns attacked, will give the percentage of a year's output lost by an equivalent number of German workers, wherever they may be situated.

9. Expressing these losses in another way, two thousand four hundred million man hours have been lost for an expenditure of 116,500 tons of bombs claimed dropped, and this amounts to an average return for every ton of bombs, of 20,500 lost man-hours or rather more than one quarter of the time spent in building a Lancaster, including its engines and major components. Since the towns attacked contained a high proportion of important industries, it is reasonable to assume that the figure of man-hours lost will contain a high proportion of skilled workers' time. This being so, a Lancaster has only to go to a German city once to wipe off its own capital cost, and the results of all subsequent sorties will be clear profit.

10. These figures

10. These figures represent only a part of the industrial loss inflicted; even so, when they are averaged out over the industrial workers in the towns attacked, it will be seen that as a result of ten months of the continuing bomber offensive, every single industrial worker in the largest and most important industrial centres in Germany, including Berlin, lost at least four months' output out of a year. A year when every hour's work was desperately needed.

PART II. EFFECTS IN RELATION TO INDUSTRIAL EFFORT OF TOWNS SUITABLE FOR AREA ATTACK, AND OF GERMANY AS A WHOLE.

It has been stated that the result of 10 months' bombing of the 29 towns that Bomber Command was able to attack during the period, was a total loss to the enemy of 36% of the 10 months potential industrial output of the towns attacked, or 30% of their potential output over a full year. It is now necessary to carry this survey a stage further and show what the Command has achieved in relation to the industrial capacity of Germany as a whole, and also in relation to the capacity of all the towns which may be regarded as suitable targets for area attack. For the purposes of this estimate, these "Possible Target Towns" have been assumed by R.E.8 to be all German towns with a population of 100,000 or more, and within 600 miles range. The industrial capacity of these towns in man-months has been calculated, and the following table shows the achievements of the Bomber Offensive (during the period) in relation to these towns, and also to Germany as a whole (which here means the area of "Greater Germany" including Austria, the Sudetenland and the incorporated parts of Poland).

	Towns Attacked	"Possible Target Towns" in Germany with population of 100,000 or more, and within 600 miles range.	Greater Germany including Austria, Poland and Sudetenland.
Industrial population (i.e. factory workers)	3,357,300	4,480,000	14,000,000
Industrial population as percentage of that of Greater Germany	24%	32%	100%
10 months' potential industrial effort in man-months	33,573,000	44,800,000	140,000,000
1 year's potential industrial effort in man-months	40,287,600	53,760,000	168,000,000
Loss during 10 months (12,103,000 man-months) as a percentage of 10 months' effort	36.1%	27%	8.6%
Loss as percentage of 1 year's effort	30.0%	22.5%	7.2%

2. It must again be emphasised that the figures quoted for achievements are a bare minimum being only those which can be substantiated. Not only do they omit important factors which are incalulable, but there are also several other points which must be added before the achievements of the Bomber Offensive during the period can be seen in their true light. First, it will be seen

/that in

that in overall industrial capacity the towns attacked represent exactly 75% of the towns suitable as area targets. When the crude figures are adjusted in terms of Key Point Rating, which gives proper weight to the individual importance of factories, the proportion in the towns attacked becomes slightly higher, the total KPR of the towns attacked (2,667) amounting to 76% of that the "possible target towns" (3,515) and to 46% of the total urban KPR of the whole of Germany (5,826)

3. There is, however, even stronger evidence that the towns attacked have an importance in the enemy's war effort far greater than would appear from the table above. This is the fact that the great majority of the industrial population of the towns attacked are highly skilled workers in essential war industries of the first priority, whereas most of the remaining 76% of Greater Germany's total industrial population - those who live and work in the minor towns of Germany and incorporated territories - are engaged in small undertakings of importance only to the local population and of little military significance. This is clearly shown in diagrammatic form at Appendix "D", but a few figures may show the predominance of essential war industries in the towns attacked more clearly. Of the total number of industrial workers in the whole of Greater Germany employed in the most important war industries, the following are the percentages found in the towns attacked:

Electrical Engineering	-	56% of the whole of Greater Germany
Machine Tools	-	55% " " " " " "
Rubber products	-	55% " " " " " "
Aero-engines	-	48% " " " " " "
Locomotives & waggons	-	32% " " " " " "
Single-engine fighter aircraft	-	31% " " " " " "
Chemicals & explosives	-	30% " " " " " "
Engineering & Armaments	-	29% " " " " " "

4. These 29 attacked towns contain 24% of all the factory workers in all industries in Greater Germany and it will be seen that the figures for the eight industries above (all of which are closely connected with the direct propagation of the war) are in every case well above the overall figure of 24% which shows clearly that vital industries are congregated in the major towns.

5. On the other hand, the towns not attacked (which contain the remaining 76% of all the factory workers) contain also the highest proportion of the least essential industries as is shown by the following figures which are the percentage of the industries named in all the unattacked towns in Greater Germany.

Minor non-classified industries	-	89% of the whole of Greater Germany
Building construction	-	83% " " " " " "
Food industries	-	81% " " " " " "
Textiles and clothing	-	81% " " " " " "

6. It will be noticed that the function of these latter four groups of industries is primarily looking after the welfare of the people, while the former eight are essentially military, a point which refutes recent criticisms in the House of Lords that Bomber Command's offensive was directed against the people rather than against machines of war.

7. In the light of these figures, the percentage (8.6%) destroyed out of 10 months industrial effort by the whole of Greater Germany acquires a very different significance. Even averaged out over the entire 14,000,000 industrial population of Greater Germany the loss is impressive enough, representing as it does the total loss of very nearly a complete month's work by every single factory worker, male and female, that the enemy can possible scrape together throughout the whole of his incorporated territories. But the loss has not, in fact, fallen upon all classes of industrial workers indiscriminately. It is the essential workers in vital war-industries that have been most affected, and those who have escaped the enforced idleness and wasted effort inflicted by the Bomber Offensive are predominatly those whose work contributes least to the war-effort.

/In other

In other words, the offensive has hit the enemy industrially just where it will hurt him most.

PART III - ESTIMATES OF FUTURE PROGRESS

As in the earlier paper on "The Progress of the Bomber Offensive, it is possible by examining the statistics of the progress achieved during the period 1st March - 31st December, 1943, to make a theoretical estimate of the progress that may be expected in the future given certain specified conditions, with the obvious proviso that any such estimate, being based on past performance, may be completely upset by unknown factors operating to change the method of attack.

2. However, before attempting any such estimates, it is necessary to draw some distinctions between the effects of raids expressed in terms of area destroyed and effects expressed in man-months lost.

There are three factors:-

(i)	Area destroyed.	This stays destroyed; the amount of re-building is insignificant compared with the extent of the destruction.
(ii)	Man-months lost.	These stay lost: time cannot be reversed to recover hours of forced idleness or hours wasted making goods and equipment that has been destroyed.
(iii)	Rate of production.	This is the level of industrial activity of a town at any moment, in a town subject to attack it is always changing, dropping suddenly after an attack and gradually recovering until, if there are no further attacks, it will again approach its pre-raid level.

3. It is this third factor, the change of "Rate of Production" which is due to the effects of the attacks gradually diminishing over the months following the attack, which has the greatest influence on estimates of future progress. R.E.8 estimate that the average time of recovery to normal is 9 raid-free months, more for heavy raids and less for light raids. Subsequent attacks however will pile a fresh "descending staircase" of man-months lost on top of the old one always with a slowly diminishing carry-over into subsequent months, and if the raids are heavy enough and frequent enough, the cumulative effect will be to turn the "descending staircase" into an "ascending staircase".

4. This process, which is not easily explained in words, will be better understood by referring to Graph 4 at Appendix E. The 1943 section (Black Line) shows how the man-month loss inflicted in each month was distributed over that and subsequent months, the cumulative effect, piling loss on loss, resulting in a series of steps which ascend steeply up to July, and descend less steeply from then on to the end of the year. The reason for this falling away is provided by the blue line, which indicates the month by month total bomb tons claimed dropped on the towns attacked. This rose to a peak in the summer and fell off again to some extent in the autumn and winter months. This seasonal decrease has allowed recovery to overtake loss, and the total man-month loss falling in each of the autumn and winter months therefore drops away again from the summer peak, though less steeply than it rose, owing to the carry-over.

5. At the bottom of the 1944 Section is shown how the effects of the 1943 raids would have spread over into 1944 had there been no further raids after the end of 1943. This indicates clearly the rapidity of industrial recovery if attacks were to cease altogether. Comparison between the area enclosed by this curve and by the curves above it, representing the estimated production levels under different conditions of continuing attack, shows the enormous disparity in production loss in the event of any let-up in the Bomber Offensive.

/6. The third

6. The third line (Red) in the 1943 section shows the cumulative total of industrial workers in all the towns attacked up to any month. It follows that the height of each month column from the base to the red line indicates the potential month's output (in man months) of all the towns attacked to that date, while the height of the same column from the base to the black line indicates the proportion of this monthly potential output that was, in fact, lost during that month. This proportion is expressed as a percentage figure at each step of the black line. Thus, for example, the total loss falling in July was equivalent to two-thirds of the potential output during July of all the 24 towns attacked to that date (which included both Hamburg and Berlin.

7. From these figures, it is possible to calculate theoretically what results may be expected from the continuing Bomber Offensive in 1944, but obviously it is necessary to make certain basic assumptions, these are:-

(i) That the adding of new towns to those already attacked will increase the total number of industrial workers attacked by an average of 22,000 per month.

(ii) That a flat average monthly tonnage of bombs will be dropped over the first nine months (i.e. the past tendency for there to be a seasonal rise and fall has been disregarded) and that the monthly tonnage will average out at one or other of the following figures:

(a) 14,000 tons
(b) 10, 000 tons
(c) 18,000 tons

(iii) That the "Labour Efficiency" (i.e. number of man-months lost per ton of bombs dropped) will remain constant over the period, and will correspond with an "Area Efficiency" (i.e. number of acres destroyed per ton of bombs dropped) of .221 which was the average "Area Efficiency" over the 5-month period June - October, 1943.

8. The basis for these assumptions is set out in the Explanatory Notes where it is also explained how it can be calculated that each of the three average monthly bomb loads assumed will inflict a loss of a certain number of man-months, per month, vis.

14,000 tons - 1,650 man months (In 1000's)
10,000 tons - 1,170 man-months (In 1000's)
18,000 tons - 2,130 man months (In 1000's)

How this loss will fall during the first 9 months of 1944 is shown by the three black lines across the middle of the 1944 Section of the curves at Appendix E.

9. It will be seen that the results of the 14,000 ton average monthly bomb-load is a steadily rising curve which gradually draws nearer to the total potential output per month represented by the red line at the top, so that the proportion of this output lost rises from 41% in January to 46% in September

10. The 10,000 ton average monthly bomb-load is, however, only sufficient to maintain the man-month loss at a constant figure, and since the red line is gradually rising all the time, the proportion of monthly potential output lost actually falls from 34% to 32% in September.

11. On the other hand, the 18,000 ton average monthly bomb load results in a "staircase" which rises much more steeply than the 14,000 ton curve, and shows an even greater rise in the proportion of monthly potential output lost - from 48% in January to 60% in September by which time the man-month loss per month will have risen above the peak figure of July, 1943.

12. Finally,

12. Finally, although the curves showing the estimated progress in 1944 are purely theoretical, they do establish beyond doubt that a reduction in the weight of attack below a certain figure (about 10,000 tons a month) will result not only in no increase in the monthly industrial loss but in an actual decrease in the proportion of monthly potential output lost from a gradually increasing total as new towns are attacked. Whereas any increase in the average monthly bomb load dropped results in a much more than equivalent increase in industrial loss.

Appendices

Appendix A	-	Schedule of basic figures
Appendix B	-	Schedule of Cumulative monthly totals
Appendix C	-	Graphs I and II showing Cumulative Progress
Appendix D	-	Diagram showing percentages of industries in towns attacked.
Appendix E	-	Graph IV showing monthly losses and estimated future progress.

Appendices C and E omitted.

Prepared by Air Staff Intelligence,

19th February, 1944

H.Q.B.C.

/Appendix 'A'

PROGRESS (MARCH - DECEMBER 1943) OF R.A.F. BOMBER OFFENSIVE AGAINST GERMAN INDUSTRY - BASIC SCHEDULE

APPENDIX "A"

Month (1943)	Town (Listed Only When First Attacked In Period	Bomb Tons Claimed Dropped in month	Gross Acres More Than 40% Built-up	Gross Acres Destroyed	Industrial Workers (Thousands)	Man-months In City Year (Thousands)	Industrial Man-month Loss Inflicted (Thousands)
March	Essen	2,151	2,630	875	144.3	1,731.6	
	Berlin	2,154	20,021	140	909.6	10,915.2	
	Duisburg	946	3,231	100	90.7	1,088.4	
	Hamburg	924	8,668	200	294.0	3,528.0	
	Stuttgart	821	2,587		112.3	1,347.6	
	Nurnberg	798	2,455	120	113.7	1,364.4	
	Munich	579	3,661	65	142.2	1,706.4	
	Bochum	153	640		55.9	670.8	
		8,526					
	Minor attacks	36					
	MONTH TOTAL	8,562	43,893	1,500	1,862.7	22,352.4	475
April	Mannheim	362	2,017	35	149.6	1,795.2	
	Stettin	847	1,455	50	33.6	403.2	
	Kiel	1,381	1,466	85	54.1	649.2	
	Frankfurt A/M	1,060	2,210		128.5	1,542.0	
		3,650					
	Other major attacks	5,282		320			
	Minor attacks	210					
	MONTH TOTAL	9,142	7,148	490	365.8	4,389.6	428
May	Dortmund	3,818	1,930	655	94.6	1,135.2	
	Dusseldorf	2,038	3,115		126.5	1,518.0	
	Wuppertal/Barmen	1,895	1,000	655	52.4	628.8	
		7,751					
	Other major attacks	4,053		141			
	Minor attacks	51					
	MONTH TOTAL	11,855	6,045	1,451	273.5	3,282.0	1,161
June	Munster	187	997		12.1	145.2	
	Oberhausen	645	510	50	35.1	421.2	
	Cologne	2,445	3,320		151.1	1,813.2	
	Krefeld	2,068	1,704	706	42.4	508.8	
	Mulheim	1,643	295	238	30.4	364.8	
	Wuppertal/ Elberfeld	1,746	1,068	870	54.2	650.4	
	Gelsenkirchen	1,391	757		42.7	272.4	
		10,125					
	Other major attacks	3,697		1,498			
	Minor attacks	110					
	MONTH TOTAL	13,932	8,651	3,362	368.0	4,416.0	1,156

Month 1943	Town (Listed Only When First Attacked In Period	Bomb Tons Claimed Dropped in Month	Gross Acres More Than 40% Built-up.	Gross Acres Destroyed	Industrial Workers (Thousands)	Man-months In City Year (Thousands)	Industrial Man-month Loss Inflicted (Thousands)
July	Aachen	875	1,030	526	30.4	364.8	
	Remscheid	778	339	281	35.9	430.8	
		1,653					
	Other major attacks	13,543		6,140			
	Minor Attacks	97					
	MONTH TOTAL	15,293	1,369	6,947	66.3	795.6	3,319
August	Munchen Gladbach	2,353	1,176	471	26.3	315.6	
	Other major attacks	9,813		335			
	Minor attacks	140					
	MONTH TOTAL	12,306	1,176	806	26.3	315.6	1,271
September	Hannover	4,861	2,632		110.7	1,328.4	
	Other major attacks	6,947		1,402			
	Minor attacks	279					
	MONTH TOTAL	12,087	2,632	1,402	110.7	1,328.4	1,198
October	Hagen	1,150	602	131	40.2	482.4	
	Kassel	3,440	961	622	61.2	734.4	
	Leipzig	1,085	3,203		182.6	2,191.2	
		5,675					
	Other major attacks	7,155		1,500			
	Minor attacks	258					
	MONTH TOTAL	13,088	4,766	2,253	284.0	3,408.0	1,420
November	(No New Towns attacked)						
	Major attacks	12,490		2,274			
	Minor attacks	157					
	MONTH TOTAL	12,647		2,274			907
December	(No New Towns attacked)						
	Major attacks	7,477*		1,541*			
	Minor attacks	147					
	MONTH TOTAL	7,624*		1,541*			768*

* Excludes 2 attacks on Berlin (23/24 - 12 and 29/30 - 12) not yet covered by photographs.

PROGRESS (MAR-DEC. 1943) OF R.A.F. OFFENSIVE AGAINST

GERMAN INDUSTRY - CUMULATIVE TOTALS

APPENDIX B

Month (1943)	Attack Cumulative total bomb tons claimed dropped on towns attacked.	Area Target Cumulative total acreage (40% or more built-up) of towns attacked.	Area Results Cumulative total acreage destroyed within "Area Target".	Labour Target Cumulative total man-months (thousands) in 1 year's industrial effort by towns attacked.	Labour Results Cumulative total man-months (thousands) lost out of "Labour Target".	Area Success Percentage destoyed of built-up area attacked (Area Target). (Area Results ÷ Area Target).	Labour Success Percentage lost of man-months attacked (Labour Target). (Labour Results ÷ Labour Target).
March	8,562	43,893	1,500	22,352.4	475	3.4%	2.1%
April	17,707	51,041	1,990	26,742.0	903	3.9%	3.4%
May	29,559	57,086	3,441	30,024.0	2,064	6.0%	6.9%
June	43,491	65,737	6,803	34,440.0	3,220	10.3%	9.3%
July	58,784	67,106	13,750	35,235.6	6,539	20.5%	18.5%
August	71,090	68,282	14,556	35,551.2	7,810	21.3%	21.9%
September	83,177	70,914	15,958	36,879.6	9,008	22.5%	24.4%
October	96,265	75,680	18,211	40,287.6	10,428	24.0%	25.9%
November	108,912	75,680	20,485	40,287.6	11,335	27.1%	28.1%
December	116,536*	75,680	22,026*	40,287.6	12,103*	29.1%*	30.0%*

*Excludes 2 attacks on Berlin (23/24.12 and 29/30.12) not yet covered by photographs.

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APPENDIX 17
SECRET

PROGRESS OF R.A.F. BOMBER OFFENSIVE AGAINST GERMAN INDUSTRY

EXPLANATORY NOTES

APPENDIX D

1. Scope

(i) The period covered by this paper is limited to 1st March - 31st December, 1943 because this is the period for which estimates of labour losses are available. Eighty-five per cent of the results achieved by Bomber Command to 31st December, 1943 have occurred during this period.

(ii) The survey covers 94 major attacks on 29 German towns, namely:-

Aachen	Essen	Kiel	Munster
Berlin	Frankfurt A.M.	Krefeld	Nurnberg
Bochum	Gelsenkirchen	Leipzig	Oberhausen
Cologne	Hagen	Mannheim	Remscheid
Dortmund	Hamburg	Mulheim	Stettin
Duisburg	Hannover	Munchen-Gladbach	Stuttgart
Dusseldorf	Kassel	Munich	Wuppertal/Barmen
			Wuppertal/Elberfeld

(iii) These 94 attacks comprise all major attacks on German towns delivered during the period with the exception of two major attacks on Berlin (23/24.12 and 29/30.12) excluded since photographic cover is not yet available.

2. Sources

(i) Weight of Attack - A.M. War Room Monthly Summary of Operations. (N.B. All weights given are those claimed dropped on the towns attacked).

(ii) Area Target and Area Results - H.Q.B.C. Damage Diagram Albums. (N.B. Target Areas of Berlin and Hamburg are the revised figures as given in Supplement 1 (dated 3rd February, 1944) to "Progress of R.A.F. Bomber Offensive against Germany").

(iii) All figures relating to Industrial workers, Industrial loss etc.- Research and Experiments Section (R.E.8) Ministry of Home Security.

3. Definitions

(i) Labour Target (for each town) is arrived at by multiplying the number of industrial workers (which here signifies factory workers only and excludes such other labour as that employed in docks or transportation) by the number of months being considered the product giving the number of man-months in the potential industrial effort (or output) by the town over the period considered.

8 man-hours = 1 man-day

25 man-days (200 man-hours) = 1 man-month

12 man-months (300 man-days, 2,400 man-hours) = 1 man-year

12 man-months x town's industrial population = 1 city-year

(ii) Labour

(ii) Labour Results - the number of man-months lost or diverted from effective production. These are calculated by R.E.8 from the area of visible damage seen in post-raid photographs. The total is made up of two parts:

A. Direct loss, resulting from material damage to industrial property, in 3 categories:-

(a) Loss of production.
(b) Industrial building repairs and replacement.
(c) Loss of plant and stock.

B. Indirect loss, resulting from material damage to non-industrial property, in 3 categories:-

(a) Absenteeism, interruption of services, etc.
(b) Repairs to houses.
(c) Replacement of house-furnishings, clothing, etc.

Allowance has only been made for time lost in carrying out such repairs and replacements as it is believed will actually have to be carried out during the war.

4. Limitations of R.E.8 Calculations

The losses in man-hours calculated on the basis of the six factors listed above do not represent the full story, since no method has yet been devised for calculating the following additional factors, which are therefore not taken into account:-

(i) The loss of production in undamaged factories resulting from the hold-up of supplies from damaged factories.

(ii) Loss of production resulting from general disorganisation and the breakdown of administrative machinery.

(iii) Destruction of stocks in retail shops.

(iv) Visible damage does not represent quite all the damage since photographic cover of a town is rarely complete, and damage to important factories on the outskirts of a town may well be missed and repairs carried out before subsequent cover is obtained. There may also be some cases in which repairs have rendered damage invisible when post-raid photographic cover is long delayed.

(v) All calculations made by R.E.8 are based on experience in this country and are therefore likely to be an absolute minimum since such experience is no longer a reliable guide in dealing with destruction on the scale meted out to the Germans during 1943.

Certainly the first two, and probably the fifth of these factors are major omissions. To quote a single example to support this, one ground report assessed the loss of output in all factories in Berlin, resulting from administrative disorganisation alone, after the raids of November and early December, as 40% of normal output.

5. Estimates of Future Progress

(i) Carry-over of industrial loss, and consequent rate of recovery.

In individual cases the rate of recovery is bound to vary, since in area attacks the damage is spread over many different types of property, some of which will be repaired with all speed, while repairs to others will be longer postponed. It is however possible to strike an average which is calculated by R.E.8 as follows:-

/AVERAGE

AVERAGE DISTRIBUTION OF INDUSTRIAL LOSS FALLING IN POST-RAID MONTHS

One half-month period	% of total loss	Whole month period	% of total loss
1	36.5	1	48.2
2	11.7		
3	8.8	2	16.8
4	8.0		
5	5.5	3	10.6
6	5.1		
7	4.2	4	8.1
8	3.9		
9	3.6	5	7.0
10	3.4		
11	2.5	6	4.5
12	2.0		
13	1.0	7	2.0
14	1.0		
15	0.7	8	1.4
16	0.7		
17	0.7	9	1.4
18	0.7		

This is an average rate for all towns and may vary between towns depending on the weight of attack.

5. (ii) Assumptions on which estimates are based

A. Average monthly increase in number of industrial workers attacked

This is arrived at in the following way. A consideration of the main towns (within bomber range) not yet attacked, taken in conjunction with the current Directif, indicates that the Area Target may be expected to increase, over the first 9 months of 1944, by an average of 500 acres a month.

At the end of 1943, the total Area Target and the number of industrial workers in the 29 Towns attacked (for the 10 months period) stood as follows:-

Area Target - 75,680 acres. Industrial Workers - 3,357,300

Thus it is seen that 500 acres in the Area Target corresponds with approximately 22,000 industrial workers.

/B. Calculation

B. Calculation of man-month loss inflicted by assumed monthly bomb-tonnage.

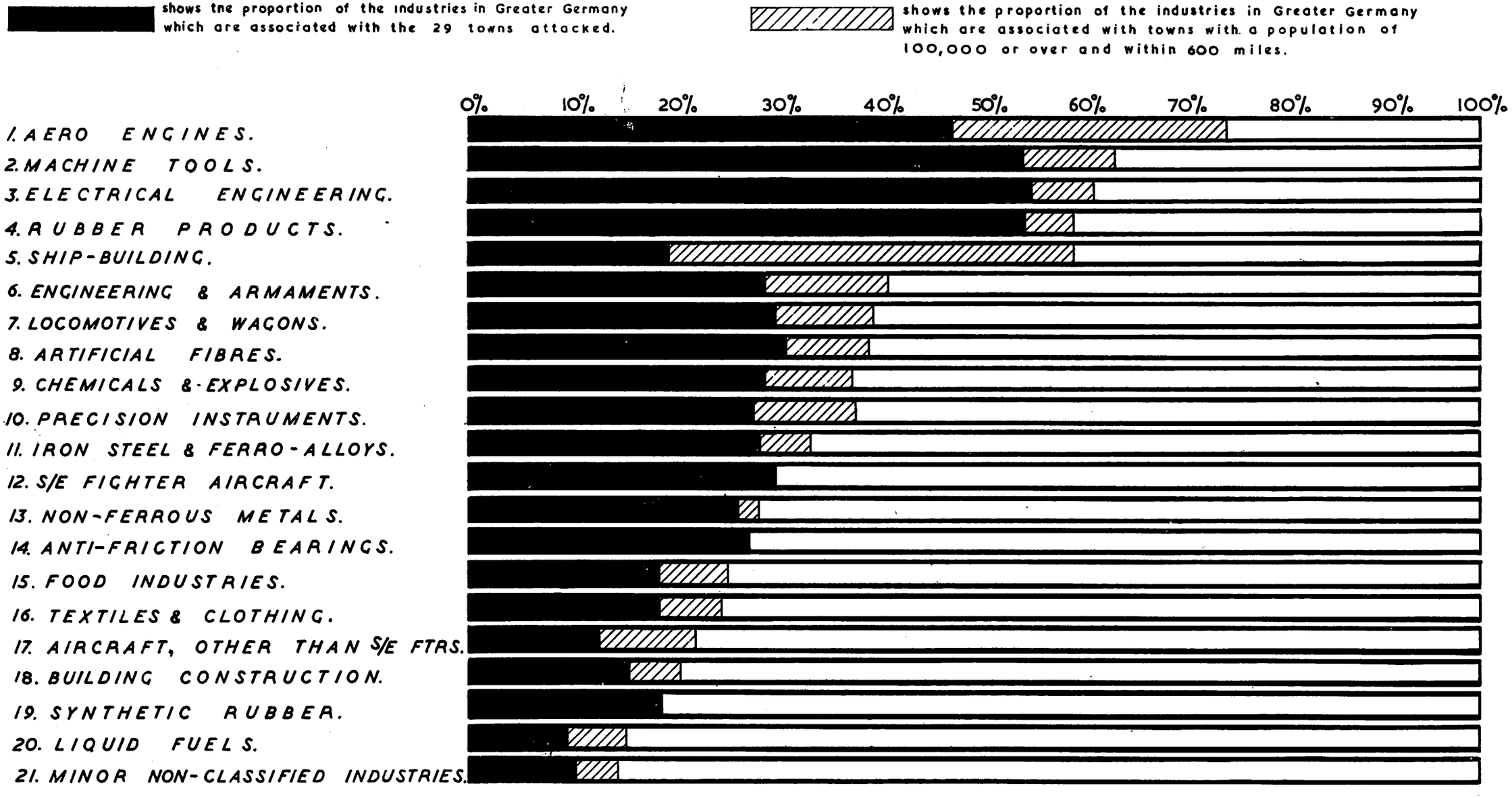
The assumed "Area Efficiency" (i.e. acres destoryed per ton of bombs dropped) is .221 which was the average Area Efficiency over the 5 month period June-October, 1943, and was the efficiency assumed in estimating future progress in the previous paper. The number of acres destroyed by any given bomb-load can therefore be calculated by multiplying the bomb-load by .221 (e.g. 14,000 x .221 = 3,100 acres). From this figure of acres destoryed, the man-month loss can be calculated by a simple ratio, i.e. during the period under review, the destruction of 22,000 acres corresponded with a man-month loss of 12,000,000. Therefore the man-month loss due to the assumed bomb loads is the acres destroyed (calculated by the method explained above) multiplied by $\frac{12,000,000}{22,000}$.

SECRET.

PROGRESS (MAR-DEC. 1943) OF R.A.F. BOMBER OFFENSIVE AGAINST GERMAN INDUSTRY.

APPENDIX 17.

APPENDIX D.-GRAPH 3.



A.H.B.I DIA. NO. 195.

DAMAGE TO GERMAN TOWNS FROM BRITISH AND ENEMY SOURCES

Date	Town	Source	Number Attacking	Tonnage		Enemy Losses		Houses Destroyed	Houses Severely Damaged	Factories Plants, etc.	Public Utilities, etc.	Remarks
				H.E.	Incendiary	Killed	Wounded					
1943 February 2/3	Cologne	British	137	186	129,438					1		Large fires started; bombing scattered; target partially obscured by cloud.
		Enemy	10 - 15	57	7,661	14	63	65	291		1 water main.	Main attack fell in N. and W. of town.
February 4/5	Turin	British	157	275	106,646							Attack well concentrated; fires in vicinity of F.I.A.T. factory and in S.E. and E. of town.
		Enemy	70	60	Several Thousand	47	103					Heavy damage, mostly residential.
February 14/15	Cologne	British	204	570	147,546							Bombing through ten-tenths cloud, large fires seen. Photo recc. not carried out.
		Enemy	Approx. 30	91	15,277	76	135	99	184	70 partly damaged	Gas, water	Residential areas most seriously affected.
February 14/15	Milan	British	122	80	81,109							Highly concentrated attack. Widespread fires throughout the city.
		Enemy	36			133	442	75	350		Railways	Damage to centre and outskirts.
February 14/15	Spezia	British	4	4								At least one bomb believed to have hit the aiming-point.
		Enemy	20			3	24					5 bombs fell in inhabited areas. Slight damage.
February 25/26	Nuremburg	British	282	351	146,892							Poor concentration, chiefly in three areas from three to five miles from the target, and in wooded areas surrounding the town.
		Enemy		117	13,150	17	74					Results not available.
Feburary 26/27	Cologne	British	386	691	231,340							Good concentration; large fires started. Defences saturated.
		Enemy	Approx. 30	136	17,000	97	148	290	236	5 (plus 4 minor plants)		Mainly residential areas in centre S, S.W., and W.
March 8/9	Nuremburg	British	294	327	169,581			Several hundred		6 engineering 1 steel 1 chemical 1 electrical engineering	Railways Gasworks Public buildings.	Severe industrial damage in S. of town.
		Enemy		490	5,293	343	143					Raid fell N. and S. of town. Considerable damage.
March 9/10	Munich	British	218	263	214,671					Engineering Metal works	Gas works	Bombing fairly concentrated. 8 a/c missing.
		Enemy	80 - 100	200	70,978	205	405	404	1,684	51	Railways Public buildings	Damage to N., W., and S.W. 3 a/c claimed.

/ April 4/5

Date	Town	Source	Number Attacking	Tonnage		Enemy Losses		Houses Destroyed	Houses Severely Damaged	Factories, Plants, etc.	Public Utilities, etc.	Remarks
				H.E.	Incendiary	Killed	Wounded					
April 4/5	Kiel	British	507	1,333	237,286							Target obscured by ten-tenths cloud. No night photographs. Day recce. showed scatted bombing and little damage.
		Enemy	Approx. 125	55	2,300	25	54				Railways Naval Dockyard.	Considerable damage to buildings.
April 16/17	Mannheim/ Ludwigshaven	British	205	717	29,275					I.G. Farbenindustrie Tank components.	Dock areas.	Attack moderately successful. Chiefly residential damage in centre of city, and at Neckarstadt.
		Enemy (Mann heim)										No reports available.
		Enemy (Ludwig-shaven)		11	47		1		4			No large fires; some bombs fell in open country.
May 4/5	Dortmund	British	504	1,117	265,936			Over 1,100		28	2 collieries Communications	Extensive damage.
		Enemy									Gas, water, electricity	6 of the main streets were blocked for a considerable time.
May 12/13	Duisburg	British	483	1,575	428,224			Approx. 1,800		4 steel chemical munitions		Damage concentrated in the old town centre near the main station, and at Meiderich.
		Enemy		800 - 1000	100,000	271	529					Large fires and heavy damage in the centre of the town, in Neudorf, Ruhrort, Meiderich and Hamborn.
May 13/14	Bochum	British	355	985	165,036			About 400	About 200	1 steel 5 engineering		Principal damage in centre of the town and at Wectmar.
		Enemy		719	48,670	325	271	394	716	4 (steel, engineering, electrical).	Gas, water, electricity, Rail.	
May 16/17	Moehne Dam	British	8	11 (special mines)							Dam; 2 power stations, Viaduct, road and rail, Villages, etc.	Breach of 230' wide. Floods extended to Hattingen, Mulheim and Duisburg.
		Enemy	About 8			Approx. 996	Approx. 221 missing	79	57	Numerous, especially in Moehne valley, around Neheim, including 2 steel.	Dam, 2 power stations, Electric power plants, Water works, road and rail communications, viaduct.	Breach 76 metres wide, and 21 - 23 metres deep (by one bomb). Others fell in reservoir in front of dam. Effects of the flood felt far into the Dusseldorf area.
May 23/24	Dortmund	British	726	1,598	348,927			Over 2,000		34 3 steel	Road and rail transport	Severe damage in N. and N.E. 38 a/c missing.
		Enemy		1,700 to 2,750	120,000 to 150,000	584	1,340	1,848	1,582	29	Railway, communications	40 a/c claimed.
May 25/26	Dusseldorf	British	658	6,220	336,970					3		Damage slight and scattered, up to 10 miles South of the aiming-point.
		Enemy		70	37,541	23	36	85	246	1 steel		Damage in N. and S., and in residential areas.

/ May 27/28

Date	Town	Source	Number Attacking	Tonnage		Enemy Losses		Houses Destroyed	Houses Severely Damaged	Factories, Plants, etc.	Public Utilities, etc.	Remarks
				H.E.	Incendiary	Killed	Wounded					
May 27/28	Essen	British	461	1,070	235,186					Krupps, 4 factories	Road and rail communications.	
		Enemy		680	85,000	191	507	475	610	Krupps	Road and rail communications	200 large fires started.
May 29/30	Wuppertal	British	611	1,210	370,531	Approx. 2,450		34,000 units		114		Very concentrated attack; 90% of the fully built-up area destroyed. Total damage covered 1,000 acres.
		Enemy		1,653	185,984	2,593	6,850	4,661	3,391	307		One fire spread over 8 square kilometres.
June 11/12	Dusseldorf	British	655	1,717	351,303					64		Two-thirds of the central city area wholly destroyed. 26,000 families homeless.
		Enemy		1,298	224,812	1,189	2,768	3,879	3,273	60 destroyed 114 damaged	Road and rail communications.	Raid fell on town centre and W., in the vicinity of the river.
June 12/13	Bochum	British	436	1,301	244,103					Several	Railway	Undershot 6 to 9 miles. Heavy damage to the centre of the town.
		Enemy		832	100,000	277	512	479	916	Steel 24	Rail and road transport	
June 14/15	Oberhausen	British	146	412	95,420							Concentration believed good.
		Enemy				180	415	900	2,000	20	Rail and post-office.	
June 16/17	Cologne	British	165	803	91,130					1 chemical, extensive damage to various other industries.		Raid scattered; heavy damage to residential areas. 14 a/c missing.
		Enemy	About 100	358	26,078	147	213	405	1,285	16	Water mains, road and rail.	Raid heaviest in the centre of the city. 1 a/c shot down in the centre of the town.
June 21/22	Krefeld	British	619	1,859	364,519					23		More than half the town destroyed. Attack highly concentrated.
		Enemy		1,950	80,000	1,036	4,500	6,200	3,000	93 (including 60% of the Textile industry).	Gas, water, electricity	Severe damage to the centre of the town.
June 22/23	Mulheim	British	464	1,414	288,531					16 Iron and steel	3 railway stations.	Severe damage, mainly in the old town.
		Enemy	Several hundred	50,000						4 chemical	1 station, electricity	
June 24/25	Wuppertal	British	521	1,405	331,875					13 factories 137 minor concerns.		80% of residential and business property destroyed.
		Enemy		2,298	270,000	1,619	2,584	6,000	5,000	61		One fire covered 12 square kilometres.
June 25/26	Gelsenkirchen	British	394	1,078	267,308							Target obscured by cloud. No photo. reconnaissance results. Damage not considered extensive.
		Enemy		125	11,780	22	189	68	98	2 2 metal		

Date	Town	Source	Number Attacking	Tonnage		Enemy Losses		Houses Destroyed	Houses Severely Damaged	Factories, Plants, etc.	Public Utilities, etc.	Remarks
				H.E.	Incendiary	Killed	Wounded					
June 28/29	Cologne	British	510	1,433	300,635							Severe damage on the West bank of the river.
		Enemy	Approx. 300	1,151	162,038	3,460	5,000	6,388	3,521	43 destroyed 32 damaged.	Railway	Severe damage, especially in the city centre, and in the suburbs.
July 3/4	Cologne	British	559	1,230	331,773							Attack spread to the S. and S.W. and around Kalk railway station. 30 a/c missing.
		Enemy	Approx. 300	863	128,800	588	2,010	2,200	1,310	20 destroyed 18 damaged		Raid directed against the suburbs, on the right bank of the Rhine. 2 a/c shot down over the city.
July 8/9	Cologne	British	248	1,030	142,872							Severe damage East of the Rhine.
		Enemy		914	117,300	502	141	2,326	1,719	145 (including rubber and cable-works).	Road and rail communications and the port area.	Extensive damage.
July 9/10	Gelsenkirchen	British	376	1,199	225,036					Steel Glassware		Raid scattered, slight damage. 10 a/c missing.
		Enemy		60	5,430	40	44	12	35	8		4 a/c claimed.
July 12/13	Turin	British	264	480	98,417					1 steel 1 electric arsenal	Gas works, electricity	Excellent concentration slightly N. of the aiming-point.
		Enemy	"Large" Formation			402	601			Fiat. Oil depot Engineering.	Railways.	Heavy damage.
July 13/14	Aachen	British	333	478	186,498					80 (mostly engineering and textile)	Railways	More than half the town devasted. The greatest concentration was in the N.E.
		Enemy	150 to 200	504				2,341	1,336	Veltrup (Aero-engines) 16 textile.	3 railway stations gas, water, electricity.	The worst damage was in the centre of the town.
July 15/16	Transformer Plants in N. Italy.	British	19	321	270				1 to 2	1 factory	Transformer stations	Ground haze. 2 a/c missing. Attacks on Arquata Scrivia, Bologna, San Polo d'Enza.
		Enemy				14	42				Railways, electric power	2 a/c claimed. Genoa, small damage, Bologna, damage to power plants. Parma, no damage. Damage to two airfields.
July 24/25	Hamburg	British	728	3,331	349,975					Oil stores.	Blohm and Voss shipyards. Gas, railways, electricity.	Severe commerical and residential damage in districts W. of Aussen Alster.
		Enemy	100	2,680	238,875	150	2,500	6,770	6,356	4 factories 69 minor works	Docks, warehouses.	50% to 70% of city centre and Altona destroyed.
July 25/26	Essen	British	599	1,828	339,492					Krupps 19	6 stations	Bombing was concentrated within an area of 1½ x 4½ miles. Damage to Krupps was equal to the cumulative effect of all previous raids.
		Enemy		1,487	150,000	340	1,128	1,508	1,083	Krupps	Railways, including the central station.	

Date	Town	Source	Number Attacking	Tonnage		Enemy Losses		Houses Destroyed	Houses Severely Damaged	Factories, Plants, etc.	Public Utilities, etc.	Remarks
				H.E.	Incendiary	Killed	Wounded					
July 27/28	Hambourg	British	721	1,644	421,364					2 metal steel textile	Gas, electricity, railways.	Exceptionally severe damage.
		Enemy	500+								Harbour area	Raid fell E. of Alster, including the city centre, and harbour area.
July 29/30	Hamburg	British	699	1,647	440,739					Machine tools Rubber Chemical Engineering	Road and rail communications, gas-works.	Extensive devastation in N.E. districts.
		Enemy	800+									80% of the city area in ruins as a result of this and previous raids.
July 30/31	Remscheid	British	228	450	146,033					1 steel 2 engineering 49	Main railway station	90% of the central area (round the main station) demolished. 15 a/c missing.
		Enemy	200 - 250	450	81,000	101	250	2,500	1,500	100 (including 2 steel)		16 a/c claimed.
August 2/3	Hamburg	British	393	1,028	281,615					Numerous	Power stations	Cloud and thunderstorms. Only one half of the force reached Hamburg. Fresh damage W. and N.W. of Alster. Over ⅓ of Hamburg in ruins as a result of all raids.
		Enemy	300					76	44	Rubber Oil Foundry Tractor works	Electricity	Elmshorn area most seriously affected.
August 9/10	Mannheim Ludwigs-haven (Mannheim)	British	424	1,145	195,796					2 chemical 1 heavy armament 1 diesel-engine works		Attack scattered, owing to cloud over target.
		Enemy	80 - 100	46	3,000	81	574	653	473	51 (including grain-storage, iron-casting, celluloid, electrical, chemical, cable-works, petroleum).	Railway	Extensive damage in city centre.
August 10/11	Nuremburg	British	596	984	187,650					3 metal	Railways	Target obscured by cloud. Bombing extended to 12 miles S.E. of aiming-point. Damage to residential areas.
		Enemy	180 - 200	683	87,100	585	2,854	1,732	1,156	3 metal, iron, steel, machine-tool, aero-engine, 56 grain- storage depots.		Heavy damage in Johannis area.
August 12/13	Milan	British	477	852	147,577							Widespread damage, especially in the Northern sectors of the city.
		Enemy								(Engineering (Cableworks	Road and rail transport	Damage to centre and to suburbs, also to army barracks.
August 12/13	Turin	British	152	378	36,842					2	Railway	Attack well concentrated in the centre of the city.
		Enemy								F.I.A.T. Iron works.	Gas, electricity, rail-ways.	Heavy damage, many fires.

/ August 14/15

Date	Town	Source	Number Attacking	Tonnage		Enemy Losses		Houses Destroyed	Houses Severely Damaged	Factories, Plants, etc.	Public Utilties, etc.	Remarks
				H.E.	Incendiary	Killed	Wounded					
August 14/15	Milan	British	134	400	52,170					Breda works		Attack well concentrated. 1 a/c lost.
		Enemy	100							Oil refineries. Celluloid works.	Electricity	4 a/c claimed. Damage to barracks and public buildings.
August 15/16	Milan	British	186	464	76,788							Attack mainly on centre, S., and S.W. 7 a/c missing.
		Enemy	100			25	"many"			Barrack, Glass-works,	Railways	3 a/c claimed. Heavy damage to residential and public buildings. Large fires.
August 16/17	Turin	British	133	348	7,524					F.I.A.T. 2 factories	Railway	Haze over target. Concentrated attack. 4 a/c missing.
		Enemy				4	17			2 F.I.A.T. Barracks		2 a/c claimed.
August 22/23	Leverkusen	British	417	1,052 (Leverkusen area)	349,278					I.G. Farbenindustrie		Cloud ten-tenths. Poor concentration.
		Enemy		32	3,300	4	1	1		I.G. Farbenindustrie 1 textile	Railway	
August 23/24	Berlin	British	575	1,497	262,963							Damage centred around Charlottenburg. Damage slight.
		Enemy	300 to 400	1,171	270,400	854	2,308	2,115	2,452	67		Residential area heavily damaged.
August 27/28	Nuremburg	British	588	977	274,389					Metal works. Munitions	Railways.	Bombing to the E. and S.E. of town centre.
		Enemy	Approx. 300	1,389	72,500	73	203	468	410	2 metal 1 mineral oil	Central station	Bombing to the E., in the district of Laufamholz, which was 80% destroyed by H.E.s and incendiaries.
August 30/31	Munchen-Gladbach	British	589	1,514	491,724					144	Railways	More than 50% of the centres of Munchen and Rheydt destroyed.
		Enemy	200 - 300	951	95,000	315	1,984	1,848	2,390	208 (including paper-mills, cable-works, 2 textile mills, 31 grain-storage depots).	Gas-works, railways.	2 fires of 3 square kilometres each. Widespread damage.
August 31/1st September	Berlin	British	474	936	131,569							Raid scattered, mostly 8 to 30 miles S.S.W. of the aiming-point. Reconnaissance not carried out.
		Enemy	150	146	10,500	58	96	40	112	16	Railways	

/ September 3/4

Date	Town	Source	Number Attacking	Tonnage		Enemy Losses		Houses Destroyed	Houses Severely Damaged	Factories, Plants, etc.	Public Utilities, etc.	Remarks
				H.E.	Incendiary	Killed	Wounded					
September 3/4	Berlin	British	279	631	107,586					47 electrical and engineering, 65 other factories, oil storage depots.	Railways, 4 gas-works, 2 power-stations, Army barracks.	Damage principally in the Siemanstadt-Charlottenburg area. Reconnaissance covered this and the two previous raids. 2 Siemens plants severely damaged.
		Enemy	400	980	208,570	568	1,356	450	850	60 (including Henschel a/c., electrical, cable-works).	6 railway stations.	
September 5/6	Mannheim/ Ludwigs-haven	British	605	288	270,377					50+ (including I.G. Farbenindustrie, and Henrich Lang A.G.)	Railways, dock area.	Attack very successful. Over 46% of the built-up area devasted.
	(Mannheim)	Enemy		2,100	200,000	270	2,150	600	884	2 rubber, 1 paper-mill, 1 a/c works, 1 motor-works.	Electricity	
	(Ludwigs-haven)	Enemy		7	500			5	20	6 grain-stores		1 a/c claimed.
September 6/7	Munich	British	349	653	165,373							Attack fell on the S.W. of the city, and in the suburbs. No results observed, due to cloud. 16 a/c missing.
		Enemy	200 to 300	342	186,000	204	778	880	480	47	Railway	17 a/c claimed. Damaged in the S. and S.E. Greatest damage done by incendiaries.
September 15/16	Montlucon	British	348	1,095	114,374					Dunlop (Rubber) 1 factory	Railway repair shop.	
		Enemy	About 50	330		About 60				Rubber		More than 50% of the Dunlop factory destroyed by fire.
September 22/23	Hanover	British	632	1,658	517,072					51 1 oil		Damage chiefly by fire. Mainly in the suburbs of Dohren and Wulfel to the S.S.E. of the town centre.
		Enemy									Gas, water	S.E. of the town affected.
September 23/24	Mannheim Ludwigs-haven	British	539	1,249	355,785					I.G. Farbenindustrie Submarine engines Electrical equipment Mercedes-Benz, Chemical, rubber. Cable.	Electricity sub-stations Dock area.	A further 13% damage to the built-up area. 32 a/c missing.
	(Mannheim)	Enemy	300 to 400	645	160,000	83	335	300	450		Dock area gas works	Damage to the N. of the town.
	(Ludwigs-haven)											Fires in Oppau, Edigheim, and Frankenthal. Several a/c claimed.
September 29	Bochum	British	308	842	262,956					1 steel-works, 3 collieries, Krupps (synthetic oils) 4 factories	Railways, gas-works	Very severe damage concentrated in the W. and N.W. of the town.
		Enemy		400	130,000	90	68			Krupps (synthetic fuel) 2 iron	Gas, water, electricity Railways	City centre severely hit.

/ October 4/5

Date	Town	Source	Number Attacking	Tonnage		Enemy Losses		Houses Destroyed	Houses Severely Damaged	Factories, Plants, etc.	Public Utilities, etc.	Remarks
				H.E.	Incendiary	Killed	Wounded					
October 4/5	Frankfurt	British	406	633	233,354					Grinding-wheels, range finders, Welding, machine-tools.	Railways, dock area	Main attack fell on the town centre and the dock area.
		Enemy	400 - 500	3,929	251,703	565	2,150	1,546	811	94	Railways, dock area, shipping.	Town centre and N. and N.E. principally affected.
October 8/9	Hanover	British	430	1,127	338,776					62	Railways, gas	Raid extremely concentrated. 2 square miles of the city centre devastated. Linden severely affected.
		Enemy								2 armament 1 aluminium, 1 radio 1 rubber	Gas, water, electricity	Worst damage in the town-centre, and in the S. and S.E.
October 22/23	Kassel	British	385	969	460,111							Very concentrated attack. 7 a/c claimed, 42 a/c missing.
		Enemy				8,659+				Henschel (a/c) Junkers (a/c) Fieseler (a/c) Numerous other works.	Gas, water, electricity	Centre of the city devasted. Widespread fires.
November 3/4	Dusseldorf	British	525	1,004	534,237					21 (including 4 armaments, and a steel-works).	Gas, electricity, Railway.	Severe damage, mostly to the S. of the city area.
		Enemy								Steel, engineering machine-tools	Gas,	Damage to the city centre and round the main station.
November 18/19	Berlin	British	391	773	331,977							Cloud obscured the target. Attack scattered.
		Enemy	60 to 70	86	19,000	152	443				Gas-works, goods-station, Railways	Areas most affected were Penkow, Reinickendorf, Lichtenberg, and Horst-Wessel.
November 18/19	Mannheim/ Ludwigs-haven	British	303	485	203,727					I.G. Farbenindustrie 1 engineering, 1 tank components. 8 factories.		Attack not considered satisfactory. Majority of bombs fell in open country.
	(Mannheim)	Enemy	200 to 250	500 to 600		"A few"						Northern sector of the city seriously damaged.
November 22/23	Berlin	British	651	999	548,708							Only 25 a/c lost. Cloud prevented observation of results. Serious damage, chiefly by fire.
		Enemy	400	900-1,100	150,000+	1,757	6,922	2,791	2,835	23 destroyed, 116 damaged.	8 railway installations destroyed. 29 railway installations damaged.	Centre of city, and Charlottenburg hit.

/ November 23/24

Date	Town	Source	Number Attacking	Tonnage		Enemy Losses		Houses Destroyed	Houses Severely Damaged	Factories, Plants, etc.	Public Utilities, etc.	Remarks
				H.E.	Incendiary	Killed	Wounded					
November 23/24	Berlin	British	298	701	234,450							Cloud prevented observation of results. Damage believed heavy and well-concentrated. 20 a/c missing.
		Enemy		805	270,000	1,315	6,383	1,989	2,442	8 destroyed 42 damaged.	1 railway installation destroyed. 25 railway installation damaged. Communication.	About 20 a/c claimed. Damage worst in Wedding workers' quarter. About 400,000 homeless. Severe damage in the government quarter.
November 25/26	Frankfurt	British	227	480	142,959					9 factories		Target obscured by cloud. Attack scattered. Little damage.
		Enemy										Moderate damage.
November 26/27	Berlin	British	383	808	269,991					Reinmetall Borsig, Numerous armaments, electrical, engineering	Gas-works.	Attack concentrated. Severe damage in Reinickendorf-Tegel area.
		Enemy		710	110,100	470	2,091	981	1,070	11 destroyed (including Alkett munitions and Borisg munitions) 79 damaged.	3 railway installations destroyed. 24 railway installations damaged. Road transport.	Damage worst in Wedding and Reinickendorf districts, particularly the large munitions plants in Reinickendorf.
December 16/17	Berlin	British	390	740	364,254							Target obscured by cloud. Bombing spread E. and W. of built-up area. Damage believed severe.
		Enemy	200	760	154,500	796	545	266	181	4 destroyed (including 1 foundry) 22 damaged.	Railways	
1944 January 1/2	Berlin	British	359	729	352,312							Target obscured by cloud. 28 a/c missing. Attack scattered.
		Enemy	386	230	10,500	52	94	21	28	1 destroyed		Attack fell S. and S.E. 1 a/c claimed.
January 2/3	Berlin	British	284	407	190,835							Target obscured by cloud. Results not observed. Residential districts believed to be most seriously affected.
		Enemy	300	410	21,500	77	65	396	731			
January 5/6	Stettin	British	333	871	299,574					Sugar refinery, Cement-works.	Railway, Power-station.	The town centre suffered heavily from fire, also industrial concerns in Silberweise district. Incidents in the dock area. 15 a/c missing.
		Enemy	About 300	455	57,800	90	98	2,700	2,000	17 destroyed. 7 damaged.	Transportation.	16 a/c claimed. Attack centred on the docks. 31 vessels hit. 327 large fires.

/ January 20/21.

Date	Town	Source	Number Attacking	Tonnage		Enemy Losses		Houses Destroyed	Houses Severely Damaged	Factories, Plants, etc.	Public Utilities, etc.	Remarks
				H.E.	Incendiary	Killed	Wounded					
January 20/21	Berlin	British	642	1,251	536,113							Attack fell on the Eastern sector of the city. No photo. reconnaissance carried out.
		Enemy	687	710	124,500	243	258	1,027	877			
January 21/22	Magdeburg	British	530	1,162	517,055							Severe damage to engineering works, S.S.W. of the centre of the city.
		Enemy		214	5,023	65	347					27 large fires.
January 27/28	Berlin	British	449	1,122	295,240							Target obscured by cloud. Results not observed. 32 a/c missing.
		Enemy	Approx. 200	760	103,500	258	381					Damage to S.E. and E. of city. Also to industrial targets on both sides of the Spree. 2 a/c claimed.
January 28/29	Berlin	British	555	1,305	368,175							Considered the most concentrated of the series of attacks on Berlin. Reconnaissance not carried out.
		Enemy	591	1,000	270,000	90	292				6 gas-works. Road and rail transportation.	
January 30/31	Berlin	British	456	959	371,089							Large concentration of fires. Attack believed well placed. No reconnaissance carried out. 33 a/c missing.
		Enemy	479	2,000	560,000	102	107				Road and rail transportation. Gas-works Electricity power-station.	7 a/c claimed. Heavy attack; widespread fires.
February 15/16	Berlin	British	761	1,121	284,633					1 electrical 4 of priority 1+ 11 of priority 1 11 of priority 2 8 of priority 3 108 minor concerns	Gas, electricity, Transportation.	Wide area affected. 400 acres devastated. Districts most affected were Spandau, Charlottenburg and Walmersdorf.
		Enemy	806	488+								
February 25/26	Augsburg	British	507	1,270	290,402					1 machine works. 1 a/c factory 1 a/c component works Various textile, engineering and dye-works.		Over 60% of the town devasted. Severe damage to the industrial centre and in the N.E.
		Enemy										An a/c factory hit. Severe damage to the workers' quarters of the city.

BOMB DAMAGE STATISTICS

(1) German Casualties (Civilian)
from Statistisches Reichsamt figures

Year	Month	Number	Year	Month	Number
1943	February	310	1943	September	2,446
	March	2,596		October	10,784
	April	1,530		November	4,708
	May	6,308		December	3,410
	June	9,473	1944	January	4,311
	July	37,880		February	3,830
	August	3,302			

(2) German Casualties (General)
from German Air Ministry, Berlin

Year	Month	Killed	Wounded	Year	Month	Killed	Wounded
1943	February	500	Not available	1943	September	4,900	Not available
	March	2,900	"		October	9,900	18,300
	April	2,500	"		November	4,700	19,400
	May	7,700	"		December	4,000	10,100
	June	9,100	"	1944	January	5,200	9,500
	July	45,000	"		February	6,100	12,100
	August	8,200	"				

/(3) Relative

(3) RELATIVE EFFECTS OF H.E. AND INCENDIARY BOMBS ON SELECTED GERMAN TOWNS

1	2	3			4			5	6	7	8	9
Target	Date of Attack	Weight of Attack (Long Tons)			Estimated Weight on Target (Long Tons)			IB/HE RATIO	Visible Damage (1000 Square Ft.)			
		H.E.	IB	Total	H.E.	IB	Total		H.E.	Fire	Mixed	Total
Barmen (Wuppertal)	29/30 May, 1943	860	939.8	1,799.8	436	498	954	1.10	1,410	7,642	1,943	10,995
Bochum	13/14 May, 1943	559	433	992	157	121	278	0.80	848	1,658	98	2,604
Dusseldorf	3/4 Nov. 1943	883	1,207	2,090	201	271	472	1.30	1,024	4,097	433	5,554
Essen	5/6 Mar. 1943	554	577	1,131	183	197	380	1.10	1,443	7,271	281	8,995
	12/12 Mar. 1943	484	503	987	84	88	172	1.00	1,062	1,835	1,864	4,761
	3/4 April, 1943	462	420	882	173	159	332	0.90	.846	862	244	1,952
Frankfurt	4/5 Oct. 1943	461	586	1,047	180	229	409	1.30	1,240	2,810	367	4,417
Hamburg	24/25 July 1943) 27/28 " " 29/30 " " 2/3 August 1943)	4,170	3,770	7,940	2,664	2,346	5,010	0.90	12,891	61,046	23,118	97,055
Krefeld	21/22 June 1943	985.5	976.9	1,962.4	201	205	406	1.00	624	8,974	1,507	11,105
Munster	11/12 June 1943	116	46	162	73	29	102	0.40	211	496	74	781

Monthly Effort and Wastage

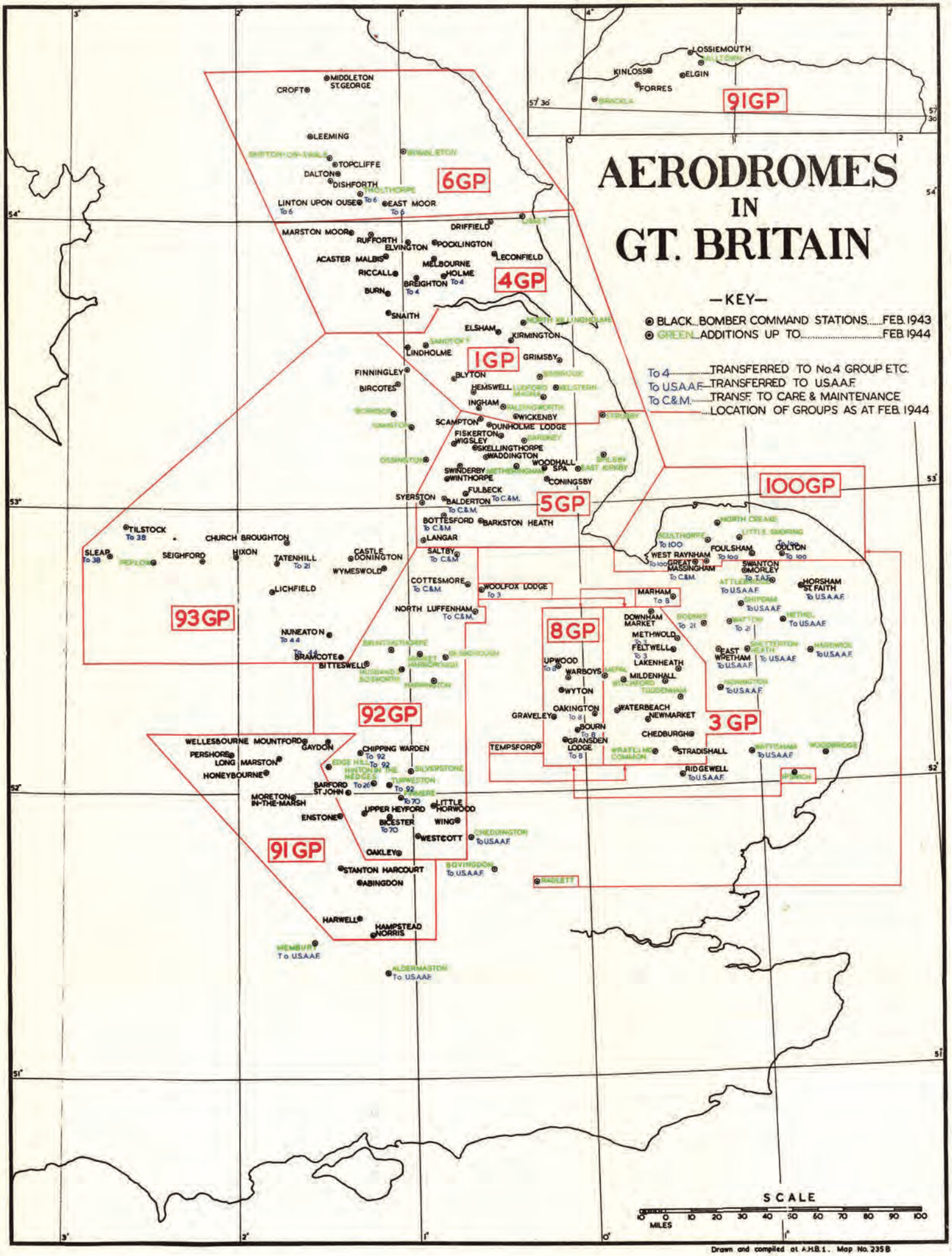
	Month	Bombing	Mining	Other Sorties	Total Sorties	Tonnage	A/C Lost
1943	February	4939	540	335	5814	10957.3	147
	March	4870	511	265	5646	10505.6	196
	April	5121	691	270	6082	11464.7	295
	May	5044	368	334	5746	12908.8	294
	June	5251	426	323	6000	15267.3	296
	July	5714	313	293	6320	16830.2	231
	August	7175	502	187	7864	20149.3	338
	September	5013	397	153	5563	14855.3	227
	October	4120	367	193	4680	13773.0	181
	November	4653	352	260	5265	14495.0	211
	December	3669	256	219	4144	11802.4	222
1944	January	5649	373	288	6310	18426.0	355
	February	4129	770	567	5466	12050.4	231

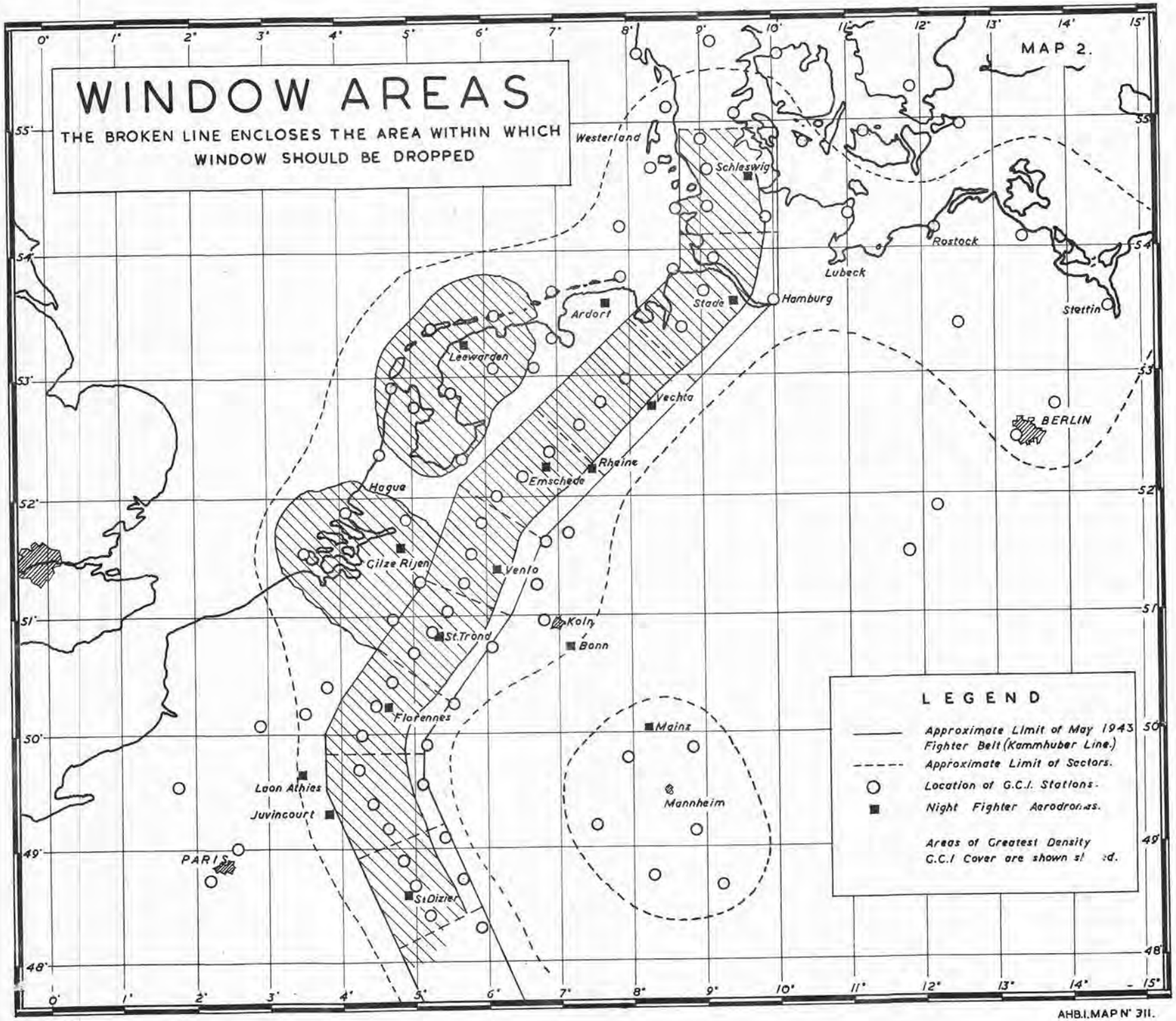
"A/C Lost" includes a/c missing and destroyed

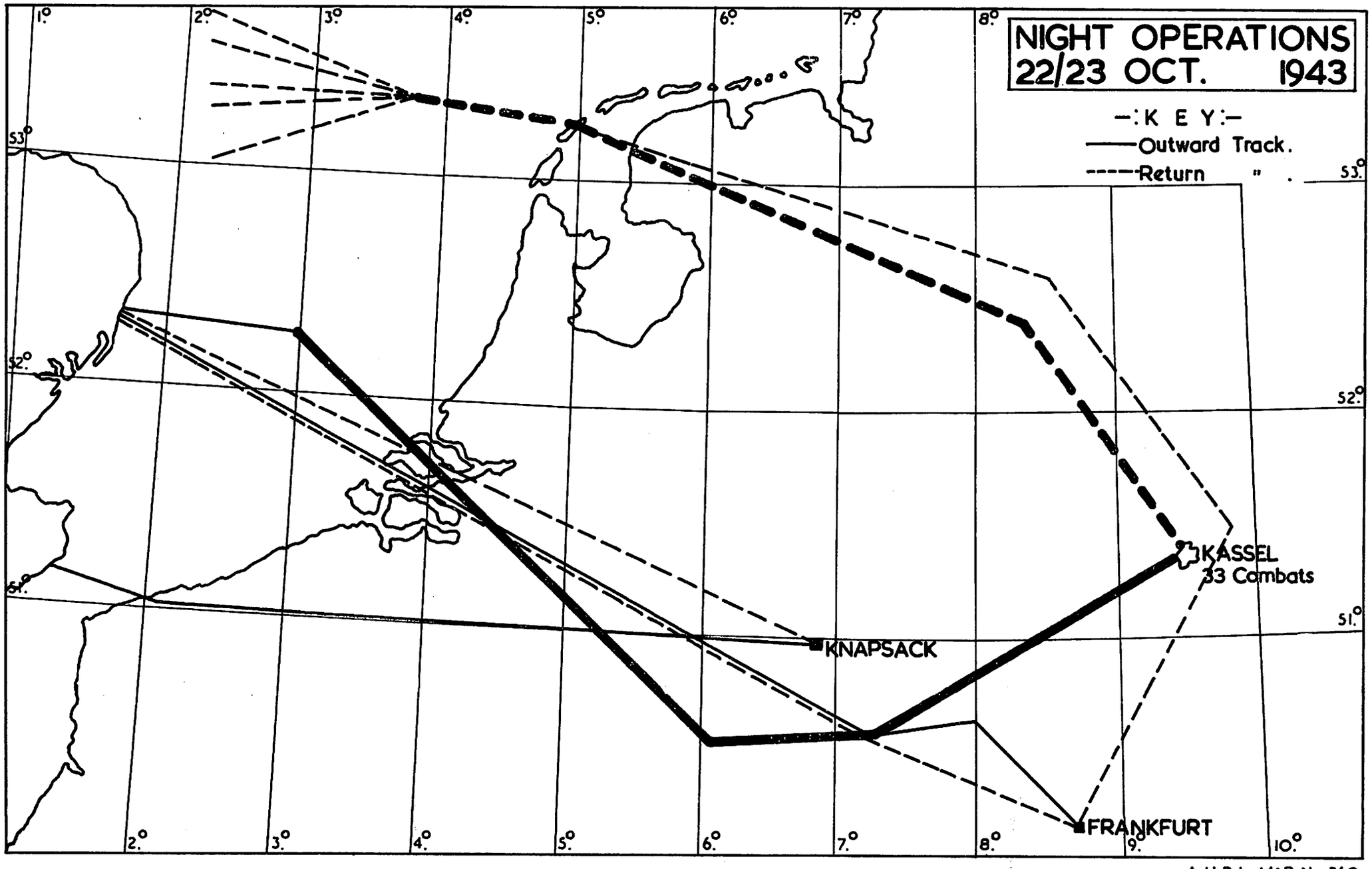
LOSSES BY TYPE OF AIRCRAFT

Monthly percentage of sorties missing and destroyed on night operations

	Month	Lancaster	Halifax	Stirling	Wellington	Mosquito	Total
	February	2.2	2.4	3.8	2.7	-	2.6
	March	3.1	4.2	4.5	3.2	1.1	3.5
	April	4.1	5.9	6.9	5.0	2.8	5.0
	May	3.7	7.4	6.1	5.1	1.7	5.1
	June	4.5	6.1	5.6	5.2	-	5.3
	July	2.9	4.8	5.2	3.4	1.6	3.6
	August	3.2	5.6	6.2	3.6	3.1	4.3
	September	4.2	5.0	4.6	1.0	1.4	4.1
	October	3.4	7.4	3.4	.8	1.4	3.9
	November	4.1	4.7	5.7	.7	1.6	4.0
	December	6.0	6.7	3.9	.5	.8	3.6
1944	January	5.9	10.8	1.0	1.6	.6	5.6
	February	5.0	5.4	1.6	.6	1.2	4.2


AERODROMES IN GT. BRITAIN
—KEY—
BLACK...BOMBER COMMAND STATIONS.....FEB. 1943
GREEN...ADDITIONS UP TO.....FEB. 1944
To 4.....TRANSFERRED TO No. 4 GROUP ETC.
To U.S.A.A.F.—TRANSFERRED TO U.S.A.A.F.
To C&M.....TRANSF. TO CARE & MAINTENANCE
.....LOCATION OF GROUPS AS AT FEB. 1944
91GP
6GP
4GP
1GP
5GP
100GP
93GP
8GP
92GP
3GP
91GP
LOSSIEMOUTH
KINLOSS
ELGIN
FORRES
MIDDLETON ST.GEORGE
CROFT
LEEMING
TOPCLIFFE
DALTON
DISHFORTH
LINTON UPON OUSE
EAST MOOR
DRIFFIELD
MARSTON MOOR
RUFFORTH
ELVINGTON
POCKLINGTON
ACASTER MALBIS
MELBOURNE
LECONFIELD
RICCALL
HOLME
BREIGHTON
BURN
SNAITH
ELSHAM
KIRMINGTON
LINDHOLME
GRIMSBY
FINNINGLEY
BLYTON
BIRCOTES
HEMSWELL
INGHAM
WICKENBY
SCAMPTON
DUNHOLME LODGE
FISKERTON
WIGSLEY
SKELLINGTHORPE
WADDINGTON
WOODHALL SPA
SWINDERBY
WINTHORPE
CONINGSBY
FULBECK
SYERSTON
BALDERTON
BOTTESFORD
BARKSTON HEATH
LANGAR
TILSTOCK
CHURCH BROUGHTON
SLEAP
SEIGHFORD
HIXON
TATENHILL
CASTLE DONINGTON
WYMESWOLD
SALTBY
LICHFIELD
COTTESMORE
WOOLFOX LODGE
NORTH LUFFENHAM
NUNEATON
BRAMCOTE
BITTESWELL
WELLESBOURNE MOUNTFORD
GAYDON
PERSHORE
LONG MARSTON
HONEYBOURNE
CHIPPING WARDEN
EDGE HILL
SILVERSTONE
BARFORD ST JOHN
MORETON-IN-THE-MARSH
ENSTONE
UPPER HEYFORD
LITTLE HORWOOD
BICESTER
WING
WESTCOTT
CHEDDINGTON
OAKLEY
STANTON HARCOURT
ABINGDON
BOVINGDON
RADLETT
HARWELL
HAMPSTEAD NORRIS
MEMBURY
ALDERMASTON
NORTH CREAKE
SCULTHORPE
LITTLE SNORING
WEST RAYNHAM
FOULSHAM
ODLTON
GREAT MASSINGHAM
SWANTON MORLEY
HORSHAM ST FAITH
MARHAM
DOWNHAM MARKET
METHWOLD
FELTWELL
LAKENHEATH
MILDENHALL
EAST WRETHAM
UPWOOD
WARBOYS
WYTON
OAKINGTON
GRAVELEY
BOURN
GRANSDEN LODGE
TEMPSFORD
WATERBEACH
NEWMARKET
CHEDBURGH
STRADISHALL
RIDGEWELL
SCALE
MILES
Drawn and compiled at A.H.B.1. Map No. 235B


WINDOW AREAS
THE BROKEN LINE ENCLOSES THE AREA WITHIN WHICH WINDOW SHOULD BE DROPPED
MAP 2.
Westerland
Schleswig
Rostock
Lubeck
Stettin
Hamburg
Stade
Ardorf
Leeuwarden
Vechta
BERLIN
Rheine
Emschede
Hague
Gilze Rijen
Venlo
Koln
Bonn
St.Trond
Florennes
Mainz
Mannheim
Laon Athies
Juvincourt
PARIS
St.Dizier
LEGEND
Approximate Limit of May 1943 Fighter Belt (Kammhuber Line.)
Approximate Limit of Sectors.
Location of G.C.I. Stations.
Night Fighter Aerodromes.
Areas of Greatest Density G.C.I Cover are shown s d.
AHB.I.MAP N° 311.



A.H.B.I. MAP No. 360.

APPENDIX "N"

3