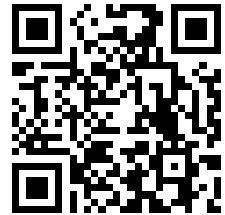
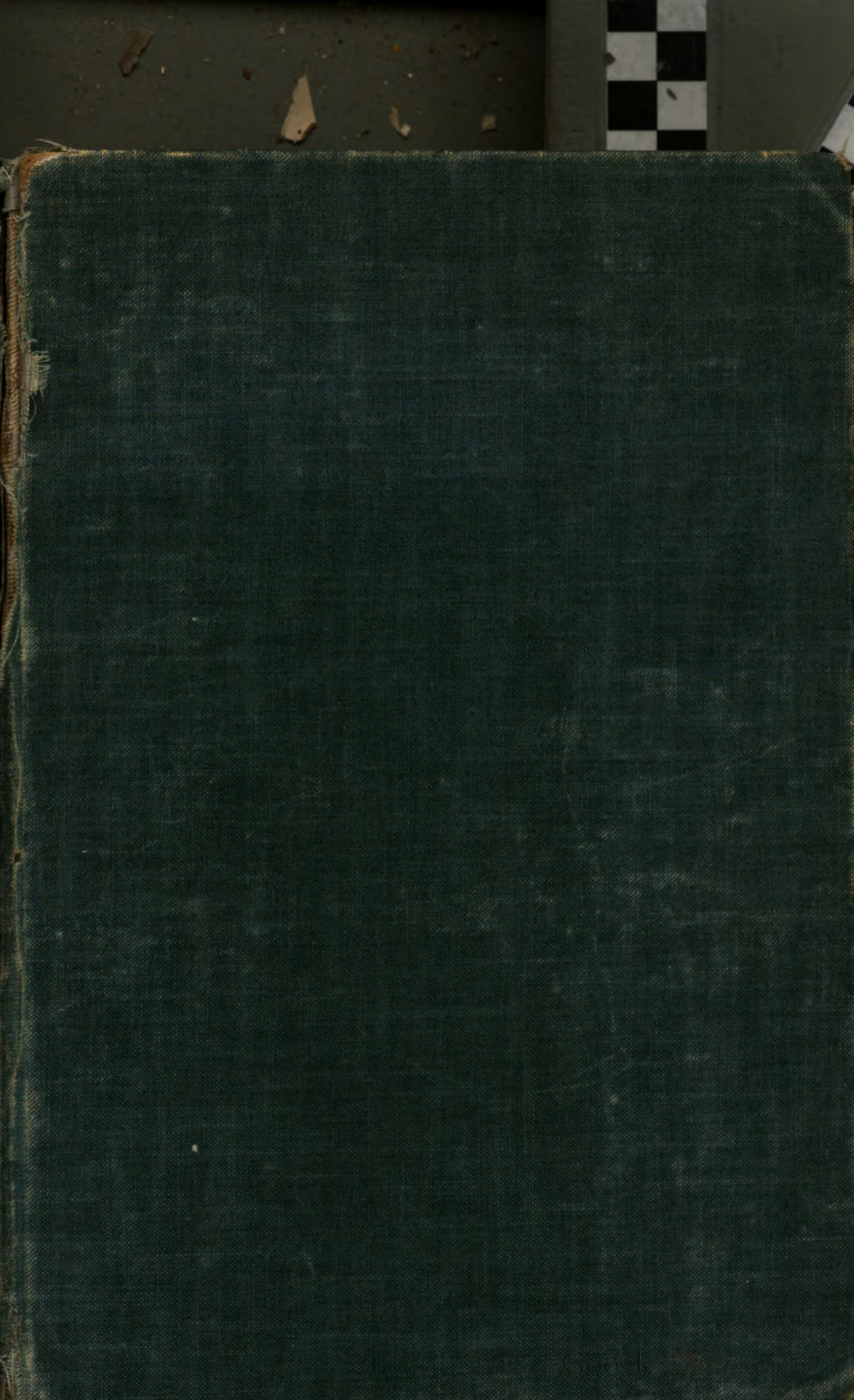

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THE DEFENCE
OF THE
UNITED KINGDOM

BY
BASIL COLLIER

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PREFACE

THE DEFENCE of the United Kingdom is a wide subject. Hitherto no official historian, at least in recent times, has approached it from an inter-service viewpoint. In apportioning my space between its various aspects, in deciding what to include and what to leave out, I have had no modern precedent to guide me. I have made my own choice within the framework of limitations necessarily imposed on a contributor to a series of inter-related volumes, and with valuable assistance from the Editor and his Advisory Panel of senior officers drawn from all three fighting Services. I have been given full access to official records, but in making use of them have respected the requirements of military 'security' and the constitutional principle which forbids discussion of individual differences of opinion within Cabinets or disregard of Civil Service anonymity.

During the Second World War three great dangers confronted the United Kingdom. The first was starvation through severance of our sea communications—a potent threat to a country long accustomed to import much of its food and to pay for it largely from the proceeds of an export trade involving a constant outward flow of manufactured goods and an inward flow of raw materials. The second danger was invasion, which came nearer in 1940 than at any time since the Napoleonic Wars, or perhaps, if we disregard the bloodless landing of William of Orange in Tor Bay, since the perilous days of the Armada. The third danger was air attack. At no stage did bombing seriously threaten the country with defeat through collapse of the national will to fight; but in 1940 the German air force made a formidable attempt to crush the air defences as a prelude to invasion—or even, as some of our opponents hoped, to the unopposed occupation of a land already subjugated by Reichsmarschall Göring and his airmen.

At the outset of my task it was made clear to me that I should be expected to give little space to the defence of ocean trade in view of a decision to devote a number of volumes to the war at sea. I have willingly left it to a naval colleague to review, with expert knowledge, the progress of the struggle against the submarine, the surface raider and the long-range ocean-going aircraft. Inevitably I have made some references to these matters; and I am grateful to Captain Roskill for showing me parts of his draft and reading parts of mine. These references are, of course, much briefer and less numerous than they would have been but for the decision to treat the war at sea as

a separate subject. It would be regrettable if their brevity and rarity were thought to imply that, in the opinion of any responsible historian, the defence of ocean trade can safely be ignored by strategists concerned with the defence of the United Kingdom. In fact no aspect of home defence, in the widest and best sense of that term, has been more important in modern times.

Defence against invasion is likewise a field where the interests of the historian of home defence may impinge on those of the naval historian. Just as one of the two great tasks traditionally devolving on the Royal Navy is to protect the merchant shipping which links Britain with the outside world, so the other is to challenge any attempt to land a hostile force on these shores. Both are strategically offensive, although often they provide opportunities for offensive tactics. A measure designed to serve one of these purposes frequently serves the other also. Destroyers and aircraft watching off the East Coast for an invader, battleships and cruisers chasing commerce-raiders in the South Atlantic, ships of the line engaging the enemy in Aboukir Bay or off Cape Trafalgar may alike, in the eyes of a strategist to whom the seas are one, be engaged in defence of the home country. But a writer on home defence may need to accept a narrower definition of his province. In practice I have suffered no hardship from this restriction. Notwithstanding the impossibility of drawing a continuous line of demarcation between defence against invasion and the defence of trade, it was always clear that many naval measures, related to home defence in its wider interpretation, might be touched upon in the present volume but could be best described at length elsewhere, and that others—including some whose manifest aim was home defence in the narrower sense—ought to be regarded as common ground.

Accordingly the knowledge that naval measures to resist invasion were not my exclusive province has not debarred me from treating them at such length as I have thought appropriate. If my treatment appears more summary than the traditional rôle of the Royal Navy as the country's prime defender against an assailant who comes by sea may seem to warrant, the reason is simply that I have judged it unnecessary, and even undesirable, to dwell long on that aspect of my subject. The essence of naval planning is that plans should be elastic. To give more prominence than I have given to measures contemplated, at one stage or another, by the Admiralty and naval Commanders-in-Chief for the reception of an invasion fleet that never sailed might have been misleading. What shape would have been assumed by such naval actions as might have followed the sailing of that fleet, who can say? Perhaps the one assertion that can be made with confidence is that it would not have conformed to preconceptions which the wisest did not allow to take possession of their minds.

In the outcome the issue of invasion or no invasion was decided not at sea but in the air. It is conceivable that, if the Luftwaffe's attempt to gain air superiority over southern England and the English Channel had succeeded, Hitler might still have hesitated, as did his predecessors from Parma to Napoleon, to trust his transports to waters not commanded by his fleet. More probably he would have chanced his arm as he did in Norway, France and Russia. What is certain is that the victory won by our air defences deprived him of all choice.

While, therefore, I have given a good deal of my space to the enemy's preparations to land troops in this country and—with the proviso made above—to steps taken by the Royal Navy and Home Forces to oppose them, I have given still more to air attacks on the United Kingdom and corresponding measures of air defence. If the Battle of Britain was not the most important action ever fought by British arms—and posterity may well deem it so—its effects were certainly no less momentous than those of the most striking victories of Hawke or Nelson. I have thought it right to review the battle in some detail, and no less desirable to sketch, against the background of political events, the period of preparation that began with the adoption of a scheme of air defence soon after the end of the First World War.

Strategically, the succession of night attacks on this country which began before the daylight battle was well launched and continued almost until the end of the war with Germany was less important. A German victory in the daylight battle might have made the United Kingdom indefensible; the night 'Blitz' and its aftermath never brought the enemy within sight of inflicting a decisive stroke. But the raids had such profound and memorable effects on the lives of most of us that to slight them would have been a blunder. The flying bomb and the long-range rocket failed, in their turn, to bring much comfort to the enemy; but their novelty, their challenge to the ingenuity of those called upon to assess and act upon the threat they offered, their potential value to an enemy more favourably placed than were the Germans by the time they brought them into use, all qualify them for much more than passing mention. Some account of their early development seemed essential; and here I was fortunate in having access not only to much published and unpublished material about the rocket but also to new matter kindly laid before me by Dr. Fritz Gosslau, who was closely associated with the birth and progress of the rival weapon.

Civil defence is the subject of a volume with that title, contributed by Major Terence H. O'Brien to the United Kingdom Civil Series of official histories edited by Sir Keith Hancock. I have therefore made only brief references in my volume to civil defence matters,

notwithstanding their obvious relevance to my subject. Major O'Brien generously allowed me to see his book while it was yet unpublished; he also read the draft of some of my chapters and shared with me his knowledge of certain facts and figures of interest to both of us.

Unpublished documents have provided the bulk of my sources and have been placed unreservedly at my disposal. Detailed citation in a published volume of documents not generally available for study would serve no useful purpose even if it were desirable on other grounds; for the benefit of students who have access to the sources references are given in a limited number of copies which such readers will be able to consult. Nevertheless I must record here my particular debt to the authors of certain monographs and narratives prepared in the Cabinet Office Historical Section and the Air Historical Branch of the Air Ministry under the direction of Brigadier H. B. Latham and Mr. J. C. Nerney respectively. Mr. Nerney and his staff have been indefatigable in searching the records on my behalf and he has given me much help and encouragement. For valuable comments and for checking certain facts and figures—for whose accuracy, however, I alone am answerable—I am grateful to Rear-Admiral R. M. Bellairs of the Historical Section of the Admiralty, to Brigadier Latham and Mr. Nerney and to many other officers and officials, some of them unknown to me, in various departments of the administration. My task would have been impossible without the generous help of Mr. Brian Melland of the Cabinet Office and Squadron Leader Louis Jackets of the Air Historical Branch, who have sought out and translated or digested for my benefit a vast mass of material. I owe thanks, too, to others who have worked under their supervision, and in particular to Mr. R. R. A. Wheatley for a paper on German invasion plans, on which I have drawn in Chapters XI and XIV.

I have had the advantage of receiving comments and suggestions from Commanders-in-Chief, Chiefs of Staff, members of wartime governments and other actors in my story who very kindly read my drafts in whole or part. I cannot sufficiently express my gratitude to them for the generous gift of their time and special knowledge. Several of these commentators, and also some distinguished wartime leaders who had no opportunity of reading my drafts, were good enough to discuss points with me and give me the benefit of their experience. Such contributions did much to amplify, and sometimes correct, impressions drawn from documentary sources or from observation at a less exalted level. These generous helpers do not, of course, share the responsibility of Editor and author for statements made and views expressed. If I do not mention here the names of most of them, it is because I believe they would rather rest content with

private gratitude than figure in a list whose length might tire the reader's patience. Even so I venture to record my appreciation of the pains taken to elucidate particular topics by Lord Hankey, Field-Marshal Lord Ironside, General Sir Bernard Paget and Lieutenant-General Sir John Swayne.

Reference is made in footnotes to published works in rare cases where such material has been relied upon as a primary source, or where courtesy demands that course. I apologise to any authors whose brains I may unwittingly have picked without acknowledgement.

The sources of the illustrations are given in the appropriate list. To all those concerned I tender thanks. For providing most of the photographs I am indebted to the Director General of the Imperial War Museum, and for doing much to guide my choice to the Deputy Director, Mr. A. J. Charge. The maps were drawn under the direction of Colonel T. M. M. Penney of the Cabinet Office, who has been most helpful.

My biggest debt is to the Editor.

B. C.

Falmer,
Sussex.

22nd October, 1956.

CHAPTER I

RETRENCHMENT AND AIR DEFENCE

(1918-1932)

(i)

AT a quarter past eleven on the morning of the first Sunday in September, 1939, the Prime Minister, Mr. Neville Chamberlain, announced in a broadcast to the nation that Great Britain was at war with Germany for the second time within a generation. In the course of a brief speech he reminded his audience that there were worse things than war; but his tone bore witness to a keen awareness of the evils that war would bring. Mr. Chamberlain was known to have longed ardently for peace; and his voice seemed that of a tired man, at least temporarily cast down by the knowledge that all his efforts to secure what he had set his heart upon had failed to achieve their purpose.

It seems safe to assert that the Prime Minister's lack of enthusiasm for the tasks which German intransigence had forced upon the country were shared by at least the majority of its inhabitants. In the national mood there was none of the elation which, twenty-five years earlier, had led to patriotic demonstrations accompanied by expressions of the hope that a reluctant government would not condemn the country to an inglorious peace. To men and women keenly alive to the horrors and privations of the last war and its aftermath, the coming struggle promised only greater horrors, worse privations and an uncertain outcome.

A few minutes after Mr. Chamberlain had finished speaking, the 'warbling note' of the air-raid warning signal was heard in London and many other parts of the United Kingdom, including Scotland. Among the emotions which the sound provoked, surprise can scarcely have played much part, since for years past writers and speakers had predicted that the next great war would begin with a devastating air assault on this country and especially on the capital. British statesmen, moved either by enthusiasm for policies which promised avoidance of war, or by a simple desire to warn the public of the dangers they might run, had not always concealed the dismay

with which the prospect filled them. As it happened, the United Kingdom was provided with a system of air defence potentially far superior to that possessed by any other country, though as yet it fell short of completeness; but the general public knew little of its merits, had heard much of its shortcomings, and were not unreasonably sceptical of its ability to protect their lives and property in the event of such an onslaught. Accordingly many Londoners, taking up the gas-masks which were their sole portable armour against the threatened hail of high-explosive bombs, prepared themselves, as best they might, for the spectacle of a vast city crumbling into ruin.

In the light of after-knowledge, it is quite clear that these fears were premature and much exaggerated. As we now know, the German Government had no intention of launching an immediate assault on London. So far as the United Kingdom was concerned, the only warlike measures which they sanctioned on or before the outbreak of hostilities were attacks on ships and naval harbours, coupled with the laying of mines in British coastal waters. Their military advisers, though indeed attracted by the policy of 'strategic bombing' adopted by the British Air Staff and publicised by the Italian General Douhet and other writers on air warfare, had been led by recent experience in Spain to modify their outlook, so that for the present they tended to regard their air force chiefly as a means of clearing the way for an advancing army. The warning which came pat on Mr. Chamberlain's announcement was not occasioned by an oncoming German striking force, but by a harmless passenger machine of whose approach the appropriate authority had not been warned. Yet so firmly did many people in this country expect the enemy to follow the predicted course that, when cancellation of the warning followed an interval unpunctuated by any hostile demonstration, their relief was tinged with an uneasy wonder which was anything but reassuring.

To trace the origin and development of this attitude on the part of the British public as a whole is a task which scarcely lies within the context of this volume. How far it was shared by those responsible for shaping the national strategy, to what extent it influenced their actions and how far, if at all, preoccupation with one form of potential attack diverted attention from other dangers, are, on the other hand, questions which the historian of home defence must certainly consider. And as these questions are linked with issues of long standing, we must begin by retracing our steps at least as far as the years when attention was first paid to the problem of reshaping the national strategy after the First World War.

(ii)

At the end of the First World War the British Army numbered about three million officers and men; the Royal Navy had at its disposal more than four thousand ships and small craft, including some sixty battleships and battle-cruisers; and the newly-autonomous Royal Air Force mustered a first-line strength of some three thousand aircraft and had more than twenty thousand aircraft in reserve. Almost from the beginning of the century fear of invasion had exercised the minds of British strategists much as fear of air attack was to exercise the minds of their successors; and this preoccupation had markedly affected the disposition of the country's armed resources during the greater part of the war period. From 1914 until the spring of 1918 the United Kingdom was guarded not only by an elaborate system of naval patrols and local naval defence schemes, the whole backed by the powerful Grand Fleet in Scottish waters, but also by an army numbering between three hundred thousand and half a million men. About a third of these formed a strategic reserve or 'Central Force', while the rest manned fixed defences and provided local guards. In addition the home defence establishment at the close of hostilities included sixteen squadrons of fighter aircraft, 480 anti-aircraft guns and 706 searchlights, the whole endowed in recent months with a system of centralised control akin to that familiar to a later generation. Without its aid—for German air attacks had ceased before its introduction—the air defences had succeeded in accounting for about one in twenty of the hostile aircraft that came within their reach.

By the middle of the war a number of serving officers and others had begun to think—and sometimes to say—that the forces deployed to meet the risk of seaborne attack on the United Kingdom were excessive; and when it was over, German military historians declared that invasion in face of British naval power was at no time seriously contemplated by their country's High Command. The fact remains that, from 1914 until a few months before the Armistice, no substantial transfer of troops from this country to France or any other foreign theatre was sanctioned by the responsible authorities until the needs of home defence had been considered.¹

For obvious reasons, the bulk of the resources assembled by the nation to fight the war did not long survive its close. Once the Armistice was signed, huge armaments ceased to be an asset and became a burden which, alike on social, financial and economic grounds, could no longer be supported. With few exceptions, the members of a

¹ Robertson, Field-Marshal Sir William, *Soldiers and Statesmen 1914-1918* (1926), Vol. II, p. 8.

Citizen Army were eager to return to their peacetime jobs before they were supplanted; and a country dependent for half its food on imports only to be paid for by a thriving export trade in goods and services had every reason to beat swords into ploughshares as rapidly as possible. That, even so, there was something to be said for the retention of a substantial army for home defence, and of a system of air defence capable of affording a security analogous to that provided by the peacetime navy, was not unknown to statesmen of the day; but little support for such measures could be expected from an electorate eager to taste the fruits of victory. Moreover, much was hoped from the ill-fated League of Nations, which might make arms unnecessary by settling international disputes without recourse to war.

In the outcome, the process of demobilisation and retrenchment which followed the Armistice not only swept away most of the additions made to the country's armed strength in the past few years, but also threatened the underlying fabric of establishments authorised in time of peace. For a country like Great Britain, concerned not merely to guard her homeland but also to protect a widespread Commonwealth or Empire, the assessment of her military needs was a complex problem, which sometimes led to paradoxical solutions. Thus it was accepted that, in time of peace, the strength of the army retained in the United Kingdom must be governed as a rule by the need to maintain reliefs for garrisons abroad, and only exceptionally by reference to any situation likely to arise at home. It follows that, while encroachments on the home defences in the post-war years could be upheld on the ground that invasion and seaborne raids were exceedingly unlikely—and while in practice the deciding factor was usually the extent to which successive governments were willing to impose taxation for unwelcome purposes—where the army was concerned their logical justification was the absence of any major threat to the Dominions and dependencies, coupled with the readiness of some of them to take an increasing share in their own defence.

The fact remains that, for some years after the collapse of Germany, a direct assault on the United Kingdom by seaborne forces could be virtually ruled out; and, reasonably enough, the Allied victory was followed by a massive reduction of the forces more specifically intended to meet that contingency. Within a few months of the Armistice, thousands of yards of barbed wire erected along the South and East Coasts in recent years were torn down, miles of trenches were filled in, and about a hundred thousand Territorials hitherto employed for coast defence were diverted to other duties or disbanded. At a few commercial and naval harbours the guns and searchlights comprising the 'fixed defences' were retained in the hands of skeleton garrisons assigned to 'care and maintenance'. In theory the defences so distinguished could be rapidly returned to active service in an

emergency; but in practice their armament was already on the verge of obsolescence, so that they would be of limited value unless it was replaced or modified in the light of recent developments in naval gunnery. Strong objections to modification or replacement were, however, made not only on the score of expense, but also on the ground that a number of strategists believed that coast-defence artillery had had its day and should be superseded by other weapons. As we shall see in later chapters, the outcome was a long period of controversy, during which the coast defences were neither superseded nor made efficient.

Retrenchment had, however, more far-reaching consequences than impoverishment of the coast defences, awkward though that proved to be when the fear of invasion was revived in 1940. A long-cherished principle of British strategy, never formally abandoned in the post-war period and afterwards reaffirmed in the light of fresh considerations, was that the defence of the United Kingdom would be gravely prejudiced if the Low Countries fell under the sway of a first-class power even potentially hostile to Great Britain. Yet within a few years of the Armistice the British Army found itself so circumscribed by financial limitations that the despatch of a substantial Expeditionary Force to prevent such an occurrence, or assist a Continental ally in doing so, seemed quite out of the question. Ultimately such a force was indeed made ready and despatched; but the long years of deprivation did not make its creation any easier, nor did they tend, in the meantime, to foster a resolute diplomacy or a sturdy body of tactical and strategic doctrine. The navy, too—in theory always ready to protect the country against unexpected dangers—was in practice so curtailed by retrenchment that at one stage some ships nominally in full commission could not be fully manned without reservists intended for wartime expansion. Moreover, as we shall see, the grand strategy entailed by post-war diplomacy was such that a crisis at home might well find the bulk of our naval strength in a distant theatre.

As a newcomer with no pre-war peace establishment to serve as a standard for its post-war needs, the Royal Air Force was in some ways still more badly placed than the other services to resist the onslaught of retrenchment. By 1921 its whole strength barely sufficed to meet the needs of the army and navy for direct support, so that nothing remained for independent tasks which its leaders wished to tackle. As for the air defences—at that time primarily the concern of the War Office, although the air force was responsible for providing fighter squadrons—they were so vigorously pruned that, within two years of the Armistice, nothing was left of them except a substantial quantity of stored equipment, a small Anti-Aircraft School, and the nucleus of an Anti-Aircraft Brigade (later known as the 1st Air Defence Brigade)

intended to support an army in the field. By the end of 1920 not a gun or a searchlight was deployed for the defence of London, and not one fighter squadron was specifically assigned to home defence.

(iii)

In the main, the size and scope of the national defences during the period of rather more than a decade which began with the Armistice and ended with Japanese defiance of British interests at Shanghai were governed by political considerations. These embraced a variety of social, financial and economic factors, besides others not so easily defined. But if, with few exceptions, purely strategic arguments were not decisive in this field, it does not follow that no account was taken of them. Since the early years of the century elaborate machinery for the study and discussion by ministers, service experts and officials of questions of national defence in time of peace had existed in the Committee of Imperial Defence, with its permanent secretariat and sub-committees. In 1919 this complex was once more set in motion, although the main committee did not meet till 1920. In the meantime the first post-war Coalition Government, under Mr. Lloyd George, had adopted, for the purpose of preparing revised financial estimates to meet the sudden cessation of hostilities, the assumption that no measures need be taken in contemplation of a major war involving the British Empire during the next ten years. Whatever its value as a temporary expedient, the 'ten-year rule'—as it soon came to be called—was worse than useless as a long-term basis for strategic planning, since it begged the question which strategic planning is called upon to answer. Nevertheless so comfortable was the rule to the ears of many whose sense of logic would seem, in this instance, to have been overpowered by their reluctance to face unwelcome issues, that successive governments continued to affirm it implicitly or explicitly until 1932. On the other hand, the rule was seldom applied with the strictness which might have helped to reveal its inherent fallacy.

The first great question—described by Mr. Lloyd George as the most important and most difficult the Committee of Imperial Defence had ever had to face—which arose in the post-war years concerned the future of the navy and of British naval strategy. Some critics argued that the big, heavily armed 'ship of the line' or 'capital ship', which had been the keystone of our naval armament for several centuries, had outlived its usefulness, and that the country would do better to invest its diminished wealth in submarines and aircraft. After hearing evidence from several sources the Government rejected that view, and came to the conclusion that the capital ship remained a

major instrument of policy. But they still had to decide what policy they wished the navy to promote. In 1920 the chief naval powers other than Great Britain were Japan and the United States. Both countries had gained in strength and political importance since 1914; both were manifestly contemplating programmes of naval and commercial expansion which threatened to bring them into conflict, and which separately challenged the supremacy hitherto exercised on the High Seas and in the world's markets by Great Britain. Of the two, America was financially the stronger and technically the more advanced. Had they applied the traditional touchstone of British policy as their predecessors had done in face of German naval ambitions earlier in the century, the Government could scarcely have avoided the conclusion that they must meet the challenge by building ship for ship with the United States and preparing bases for a possible Atlantic war. But there were a number of objections to that course, of which by no means the least weighty was that the vast resources of a competitor whose growing population would enable her to raise huge sums by taxation made a favourable outcome to such an armaments race unlikely. After long debate the Government decided not to put the matter to the test unless attempts at accommodation failed. In due course, therefore, the country accepted at Washington a naval bargain designed to keep expenditure within close limits, but one which carried a grave risk of conflict with Japan.

The effects on every aspect of the national and Imperial defences, including the home defences, were profound. For the next decade and more, virtually all strategic planning was overshadowed first by the assumption that no major threat would arise for at least ten years, secondly by the belief that the ultimate danger lay in the Far East. Accordingly a problematical Far Eastern strategy had first claim on such sums as successive governments were willing to allot to any far-reaching measure of readiness for war. Chief among the measures contemplated were the construction and defence of a great new naval base at Singapore, and with it the accumulation of stocks of oil intended to enable the Admiralty to send the main fleet to Far Eastern waters with a reasonable assurance that it would be fit to fight when it arrived. In theory, home defence and the defence of maritime trade continued to rank equally as first charges on the navy; but in practice the naval strength available at home if the main fleet went to Singapore would suffice to defend the country only if European navies remained weak or their possessors friendly. Meanwhile, for want of a better yardstick, preparations for home defence were measured in most respects by the admittedly improbable assumption of attack by France, since France was the strongest European power after the defeat of Germany and the collapse of Russia. Reviewing the whole field of national and Imperial defence

in 1921, the Committee of Imperial Defence came therefore to the understandable conclusion that no comprehensive revision of the army's plan of home defence was needed. And a later ruling that, at worst, the army might have to repel landings by the equivalent of one division scarcely controverted that conclusion.

Such, then, was the prevailing climate of strategic thought during the years when the demands of economy, retrenchment and reform were suffered to reduce the national defences to a level which appears in the light of present knowledge dangerously low. In the circumstances discussion of defensive measures, except in the Far East, was bound to seem unreal. If the only redoubtable European country was France, who had long since abandoned her maritime ambitions and was clearly far more concerned with her eastern frontier than with the fogbound island off her northern coast, there could be little danger in lowered naval and military establishments, obsolescent coast defences and inadequate equipment. And indeed there was no immediate danger in these things as long as that assumption remained valid. The long-term disadvantage of such an outlook was, however, that on the triple pretext that economy was paramount, the threat unreal and the remedy uncertain, measures whose value was not dependent on the direction from which attack might come were postponed until their cumulative cost became prohibitive. Like a man who dreads an annual visit to the dentist, successive governments postponed attention to the coast defences, for example, until their overhaul appeared so great a task that the only course they could contemplate was a further postponement attended by still more drastic penalties.

(iv)

When the Government adopted the principle that measures of home defence in the post-war period, insofar as they were governed at all by purely strategic factors, should be based on the hypothesis of war with France, they by no means accepted the implication that an armed dispute with the sharer of so many recent trials was even remotely probable. On the contrary, that contingency seemed almost inconceivable. Acceptance of the hypothesis as a working assumption implied no more than recognition that defensive preparations must be measured by some standard, and that the most convenient standard—at least on the short view—was the potential striking power of the nearest and strongest European country. But when the assumption came to be applied to the shaping of the air defences, the process led to some conclusions which had scarcely been foreseen.

For long periods during the lifetime of the first post-war Coalition Government some of the most important functions of the Committee

of Imperial Defence were entrusted to a Standing Sub-Committee headed by Mr. A. J. Balfour, the former Conservative Prime Minister. Inasmuch as Mr. Balfour had played a leading part in the formation of the Committee of Imperial Defence some twenty years earlier, the choice was appropriate. On the other hand, it could be argued—and was argued by some critics of the Government—that so large a measure of responsibility for national and Imperial defence ought not to be exercised by anyone but the Prime Minister in person.

It thus fell to Mr. Balfour to hear, in the first instance, the case for providing, in peacetime, a system of air defence to take the place of that created during the war years and perhaps too hastily abandoned when the war was over. The issue first arose in consequence of a claim made by the Air Ministry to a bigger share of responsibility for national and Imperial defence than that department had yet undertaken. The dangers of air attack had indeed been considered at least as long ago as 1912, when the decision was made to install a few guns for the defence of naval magazines near Chatham. Later it became clear that not only naval and military establishments but also centres of population must be protected, if only to ensure that the threat of air attack did not disrupt the productive effort of civilians deprived of the moral support which such protection gave, and that the authorities were not unduly hampered in their prosecution of the war by complaints from those whose lives and property might be assailed. The experience of the war showed that aircraft, though their obvious military function was reconnaissance, could in fact be used for a variety of warlike purposes. Among them were the reduction of gun-positions and other purely military targets normally tackled by artillery, and also the bombing of more distant objectives, such as factories and cities, which artillery could not reach. Apart from ethical objections to some of these employments, their expediency was sometimes questioned on grounds of extravagance and uncertainty of aim; but proponents of the bomber had much to say in support of their contentions. Within a year or two the usefulness of the aircraft as a direct means of assailing battlefield targets was widely (but not universally) conceded, though the value of what was called 'strategic' bombing of objectives far behind the lines remained a controversial issue.

In 1917 the 'strategic' school received powerful support from a memorandum written by Mr. Lloyd George and General Smuts as a corollary to one setting forth the administrative and logistic advantages of an air force separate from the other services. The authors, with little experience to guide them and writing undisguisedly in a prophetic strain, foresaw a day when bomber forces might strike decisive blows on their own account, reducing fleets and armies to a secondary

role. The sequel to the two memoranda was the creation of an autonomous air force, charged not only with the provision of squadrons for the direct support of fleets and armies, but also with that of a 'strategic' bomber force for use against such targets as those responsible for the higher conduct of the war might choose. A number of squadrons already earmarked for the bombing of Germany were then raised to the status of a distinct command, under an officer owing allegiance to the Supreme Commander, Marshal Foch, but with power to appeal to the War Cabinet in London. The designation 'independent bomber force', which was given to this formation, was perhaps unfortunate; for it seems to have led some critics to suppose that the necessity of subordinating the operations of the force to the broad pattern of Allied strategy had not been fully grasped.

The Armistice put an end to the independent bomber force. Nevertheless the Air Staff did not relinquish their opinion that direct support for ships and troops was not the only, or indeed the most important, function of air power. In the controversy about the future of the capital ship which arose some two years later, Air Chief Marshal Trenchard, then Chief of the Air Staff and formerly in command of the independent bomber force, found an opportunity to draw attention to the use that might be made of bombers in a war at sea. Soon afterwards he followed up his arguments by asking the Government to entrust to the air force certain specific tasks, including the primary responsibility for defending the home country against virtually all forms of direct assault, whether by sea or air. He did not claim that aircraft alone could repel invasion, but suggested that any ships or soldiers needed might be subordinated to the air force, just as air squadrons were subordinated to fleets and armies when predominantly naval or terrestrial actions were in view.

The weight of orthodox opinion, coupled with the considered view of the Government that the capital ship was still the mainspring of sea power, soon compelled the Air Staff to abandon the revolutionary proposal that the air force should replace the navy as the principal opponent of an assailant who came by sea. There remained the suggestion that they should undertake the duty of repelling one who came by air. Early in the recent war the air defences had been controlled by the Admiralty, but later their supervision had passed to the General Staff, who had performed the task with some success and who now showed little desire to relinquish it. Indeed their view was that, if an Air Ministry was necessary at all, its functions should be confined to the development of civil aviation and the provision of such aircraft or air formations as might be needed by the army and the navy. A further argument against the Air Staff's claim was that they had shown no eagerness to assume the burden in 1918, when the

Air Ministry came into being; but it lacked conviction, since circumstances may legitimately alter cases. When all was said, the fact that the Air Ministry had no responsibility for air defence, except the duty of providing squadrons for the purpose when they were demanded, remained an anomaly which at least deserved investigation.

In the course of the enquiry thus set in train, Mr. Balfour was much struck by the disparity between the country's air resources and those of the only foreign power within striking distance. France was understood to possess a mobile striking force of about three hundred bombers and three hundred fighters, apart from army support squadrons and a Colonial air force of some weight. The nearest equivalent in Great Britain amounted to fewer than forty aircraft. Admittedly the obvious function of the French air striking force was to prevent a violation by Germany of the Treaty of Versailles, and its use against the United Kingdom was exceedingly unlikely. But Balfour argued that even the bare possibility of attack by such a weapon was perilous. So huge a disparity between the striking forces of the two countries seemed to him bound to weaken British diplomacy, inasmuch as it enforced dependence on the goodwill of a neighbour. He asked his colleagues whether they were content to accept that situation, or alternatively were willing to provide a metropolitan air force strong enough to change it.

On close examination Balfour's arguments appear by no means overwhelming. His contention that 'a continuous torrent of high explosives at the rate of 75 tons a day for an indefinite period' would paralyse the War Office and the Admiralty and render London uninhabitable, either in fact or in the popular estimation, was not supported by much evidence available then or now, though the effects of such an onslaught on a city unprovided with active or passive defences would doubtless have been serious. Moreover his implied assumption that the only answer to attack by a foreign air force was the provision of a rival air force in this country, while it accurately reflected Trenchard's views, was open to some doubt. It could be argued—and was argued by the Admiralty—that, if the hypothetical enemy did indeed take so improbable a course, prompt naval action against her ports might well persuade her to call off the venture long before an 'indefinite period' of bombing had produced the effects foreseen by Balfour.

There were, however, other arguments for air expansion which may have influenced the Government quite as much as Balfour's warning. At home a section of the public which believed, with the Prime Minister and General Smuts, that the bomber might become the master-weapon of the future strongly supported the Air Staff's claim to substantial recognition; abroad, adherents of the 'strategic' doctrine of air power might interpret failure to give practical

expression to it as a sign of weakness on the part of a country hitherto regarded as its chief exponent. Finally the future of British commercial aviation, like that of its military counterpart, was clearly bound up with flourishing aircraft factories. Even on purely economic and financial grounds there was much to be said for nourishing a branch of industry which would certainly languish without orders from the air force.

In the light of such considerations the Government decided, in the spring of 1922, to meet the Air Ministry's desire for the leading role in air defence, and a few months later accepted a scheme for the provision of a metropolitan air force of fourteen bomber and nine fighter squadrons. The proportion of bombers to fighters reflected the Air Staff's faith in the axiom that offence was the best means of defence.

The transfer of responsibility for the air defences from the War Office to the Air Ministry was left to the two departments to arrange as best they might.

Outwardly, the simplest method would have been for the former to hand over to the latter all the air defence formations hitherto at its disposal; but in practice that course would have led to many difficulties. The army's anti-aircraft artillery and searchlight units were the nucleus of a formation intended to guard an Expeditionary Force during mobilisation and in the field; hence their loss would have deprived the service of resources needed for a purpose clearly distinct from home defence. Again, the officers and men concerned could not have been transferred *en bloc* to a new master without some hardship and much administrative complication; at the same time the air force was not itself in a position to man the formations, and had little experience of anti-aircraft gunnery. Finally, a transaction on that scale would have saddled the Air Ministry with burdens from which it might well shrink, especially as the Air Staff held that excessive preoccupation with purely defensive measures was to be avoided as inimical to development of the offensive arm which they regarded as the best means of deterring an aggressor or defeating him.

The outcome was an arrangement which substituted one set of problems for another. The departments agreed to adhere to methods previously contemplated, insofar as the War Office would continue to provide and man such guns and searchlights as might be necessary for air defence at home, and the Air Ministry to provide and man the fighter squadrons needed to complete the purely defensive component of the system. In addition the Air Ministry would furnish an offensive component in the shape of a substantial bomber force. As the Air Ministry were now to be the masters, the War Office would consult them about the 'primary disposition' of the guns and searchlights, and the principles governing their employment. Operational control of the whole complex would be exercised by an air officer.

Although perhaps the best that could be made, this bargain was not in all respects a satisfactory one for either party. On the one hand, the Air Ministry assumed a welcome yet onerous responsibility for the functioning of the system, without gaining effective control over the technical development of that part which was manned by soldiers; on the other, the War Office lost the power of deciding when guns should fire or searchlights be brought into action, but not the burden of providing, manning and financing them. To promote co-operation in matters of research, development, 'primary disposition' and tactical employment, an existing sub-committee of the Committee of Imperial Defence, hitherto concerned only with home ports, was renamed the Home Defence Committee and given power to consider questions of air defence. In practice, neither the War Office nor the Air Ministry found much occasion during the next few years to remit such problems to that body. During that time those which called for joint consideration were either discussed informally or entrusted to small committees set up as the need arose.

The Government's decision to adopt the plan for a metropolitan air force found the War Office and the Air Ministry in the thick of negotiations connected with the transfer of responsibility. A joint-service committee had recently been established under Air Chief Marshal Trenchard to discuss the creation of a bomber force and the organisation of a defensive zone. Its first step was to instruct a sub-committee to consider the second point. The sub-committee, headed by Air Commodore J. M. Steel of the Air Ministry and with Colonel W. H. Bartholomew of the War Office as leading representative of the War Office, went on the assumption that the nine fighter squadrons recently sanctioned by the Government would be available by 1925. Their plan, to which we shall revert, may be regarded as the direct, though somewhat remote, forebear of the system which enabled the country to survive the German onslaught in 1940.

(v)

The twenty-three squadron scheme of air expansion was accepted and announced by the Coalition Government in August, 1922. Its obvious weakness was that it fell short of the situation it was outwardly designed to meet. Ostensibly at least, its purpose was to protect the country against a possible attack by some three hundred bombers supported by the same number of fighters. Yet it made provision for only nine regular and five auxiliary bomber squadrons with a total establishment of 158 aircraft. If Balfour's warning provided any real basis for the existence of the force, that number was manifestly inadequate. According to the sponsors of the scheme, the

strength could be swelled in an emergency by reserves and training units; but any emergency which justified so desperate an expedient would have to be both very grave and of very brief duration.

That the scheme would be open to such criticisms did not escape the Government when they adopted it; but on several grounds they were reluctant to aim higher. One good reason was that the Air Ministry believed that rapid expansion would be difficult, and had indeed begun by putting forward a still more modest programme. On that ground alone, ministers may well have felt that small beginnings were preferable to an ambitious project for which recruits and political support might not be forthcoming. Perhaps an even stronger argument was that, as the danger of attack by France was merely hypothetical, the size of the French air striking force was not a true criterion of this country's needs; but to put the matter thus might have invited the rejoinder that, if that were so, the case for a metropolitan air force had not been made out. In the light of subsequent events we may perhaps conclude that at any rate the number of squadrons proposed was not too great, especially as henceforward the metropolitan air force formed the main reserve for air formations overseas.

Within the next few months new factors threw fresh doubt on the adequacy of the proposals. Towards the end of 1922 the Coalition Government was replaced by a Conservative Government led first by Mr. Bonar Law and later by Mr. Stanley Baldwin. Thus the scheme came under the eyes of an administration keenly critical of much that had been done or left undone in the field of national and Imperial defence. Soon afterwards Franco-British relations were temporarily overclouded by differences of outlook on the reparations problem; and after French troops had occupied the Ruhr, a serious dispute with our Continental neighbour, though still unlikely, may well have struck observers as rather less so than it had seemed six months before.

Soon after taking office the new administration appointed a committee under Lord Salisbury 'to enquire into the co-operation and correlation between the Navy, Army and Air Force from the point of view of National and Imperial Defence generally'. The Government had in mind such questions as the advantages and disadvantages of a suggested Ministry of Defence, and the possibility of improving on existing arrangements for the provision and employment of air squadrons working with the fleet. But they asked the committee to deal also with 'the standard to be aimed at for defining the strength of the Air Force for purposes of Home and Imperial Defence'. After hearing evidence from Air Chief Marshal Trenchard, who stressed the potentialities of the bomber and mentioned indications that the French were planning a big expansion of their air force, Lord Salisbury

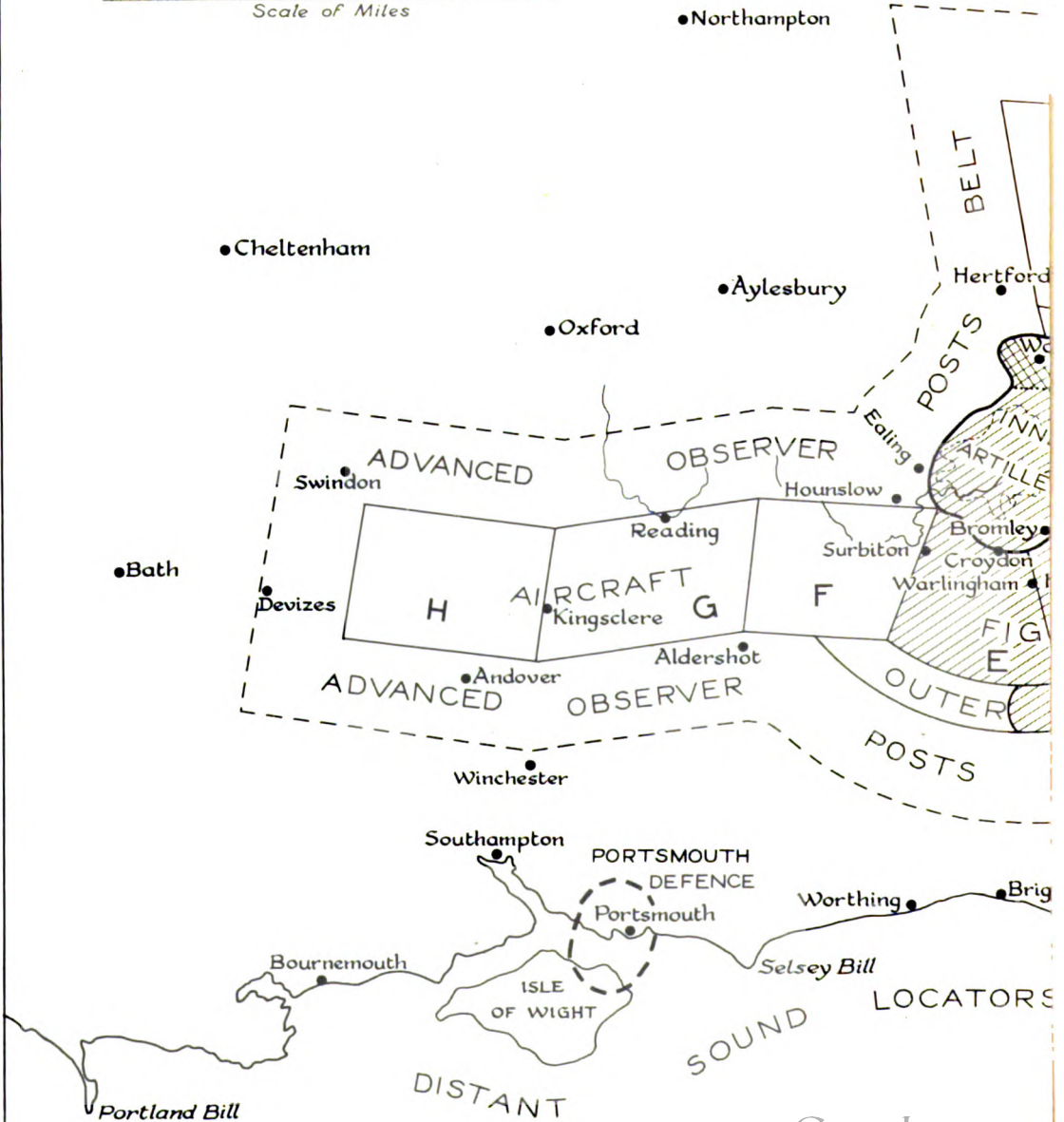
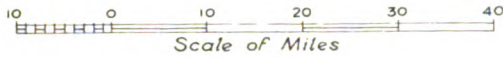
THE STEEL-BARTHOLOMEW PLAN

February 1923

The letters A-H denote sectors each to be manned by one fighter squadron under the 1922 scheme.

The single-hachured portion denotes the area to be fully manned by April, 1925 with formations already authorised. By that date fighter-sectors A,B,F,G,H would also be manned by their allotted squadrons but would be without searchlights.

The cross-hachured portions denote areas of peculiar vulnerability to be defended alternatively by guns or fighters according to weather and tactical conditions. Areas to be defended by guns and searchlights alone are denoted by heavy broken lines.



and his colleagues came to the conclusion that the existing disparity between British and French air power created a 'menacing' position calling for prompt action.

The sequel was the adoption by the Cabinet, on 20th June, 1923, of a new scheme of air expansion designed to provide in the first instance a metropolitan air force of fifty-two squadrons with a first-line establishment of 394 bombers and 204 fighters. The Government contemplated the attainment and maintenance of approximate numerical equality with the French air striking force, but expressed the hope that international agreement on the lines of the Treaty of Washington might help them or their successors to achieve it without cut-throat competition. While British and French diplomacy were out of step there was, however, little prospect of striking such a bargain.

The Air Ministry were thus faced with the creation of a force considerably larger than that hitherto envisaged. And while such an extension of their kingdom was doubtless welcome—the figure of roughly 600 machines as a first step was indeed that specified by Trenchard—its attainment was not likely to be easy. Early in November the Secretary of State for Air, Sir Samuel Hoare, reported that, notwithstanding the Government's avowed intention of achieving air parity with France as rapidly as possible, the earliest date by which the fifty-two squadrons could be ready was the end of 1928. By that time, if the Air Staff's fears were realised, the French air force would also have expanded, so that parity would still be lacking. Moreover the Government could feel no certainty that such popular support for air rearmament as was forthcoming in 1923 would sustain them or their successors in the future. Nevertheless the programme made such a good start that by the autumn of 1925 twenty-five of the fifty-two squadrons were in being.

Meanwhile the Steel-Bartholomew Committee had drawn up its defence plan. Although framed with the short-lived twenty-three squadron scheme in view, it deserves attention on its merits and as the ancestor of distinguished progeny. (See Map 1.) Its most important feature was an 'aircraft fighting zone' some fifteen miles deep and stretching round London from Duxford in Cambridgeshire to Salisbury Plain. The zone would be set well back from the coast in order that defending fighters might have time to reach the appropriate height while hostile aircraft were approaching. Warning of approaching raids would be given by distant sound-locators on the coast, and by a belt of advanced observer posts near the perimeter of the zone. The committee recommended that guns should be deployed both in an 'inner artillery zone' for the close defence of London, and also in an 'outer artillery zone' sandwiched between the aircraft fighting zone and the observer belt. Searchlights would be deployed in the inner artillery and aircraft fighting zones, but not in the outer

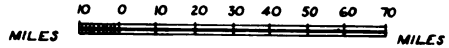
artillery zone, whose guns would fire only by day, and for the purpose of breaking up hostile formations and guiding fighters towards the enemy, rather than of engaging individual aircraft. Other 'inner' artillery zones would provide similarly for the close defence of major ports. Dependence on sound-locators and human observers was a limitation obvious enough to-day, but less apparent, and indeed less serious, at a time when aircraft flew comparatively slowly.

The Steel-Bartholomew Committee estimated that, besides the nine fighter squadrons contemplated in the twenty-three squadron scheme, eleven anti-aircraft brigades (later called regiments) and seven searchlight battalions, with an aggregate establishment of 264 guns and 672 lights, would be needed to make their plan effective. Six of the artillery brigades and three searchlight battalions less two companies would be forthcoming under arrangements already contemplated by the War Office, who had begun to form two Territorial air defence brigades and were willing to make the 1st Air Defence Brigade available for home defence meanwhile.¹ But while there was no lack of guns in store, the bringing of these units up to strength, to say nothing of the raising of the others needed to complete the plan, was bound to be a long-drawn business.

Important progress was made in 1924, when a committee headed by Major-General C. F. Romer went to work on the basis of a revised plan which reflected the new and larger scheme of air expansion. Among the members was Major-General E. B. Ashmore, whose command of the air defences guarding London and the south of England during the later stages of the recent war had been followed by command of the 1st Air Defence Brigade. General Ashmore could be reckoned the country's leading authority on air defence and had viewed with much misgiving the disbandment of the air defences after the Armistice. The tasks expressly assigned to the committee were concerned mainly with the devising of a suitable system of command, of measures needed to give warning of approaching raids, and (with the assistance of an expert sub-committee) of communications commensurate with the extent of the defences now envisaged. But their report was of wider significance, since it embodied much that had been added after the laying of the foundations of the post-war system of air defence by the Steel-Bartholomew Committee. The plan as it now stood made provision for three bomber groups located in Oxfordshire or Gloucestershire, in East Anglia, and in the neighbourhood of Salisbury Plain, and for ten fighter sectors. (See Map 2.) Of the seventeen fighter squadrons comprised in the fifty-two squadron scheme, fourteen would be divided between the sectors; the remaining three would work from forward bases near the coast. A new

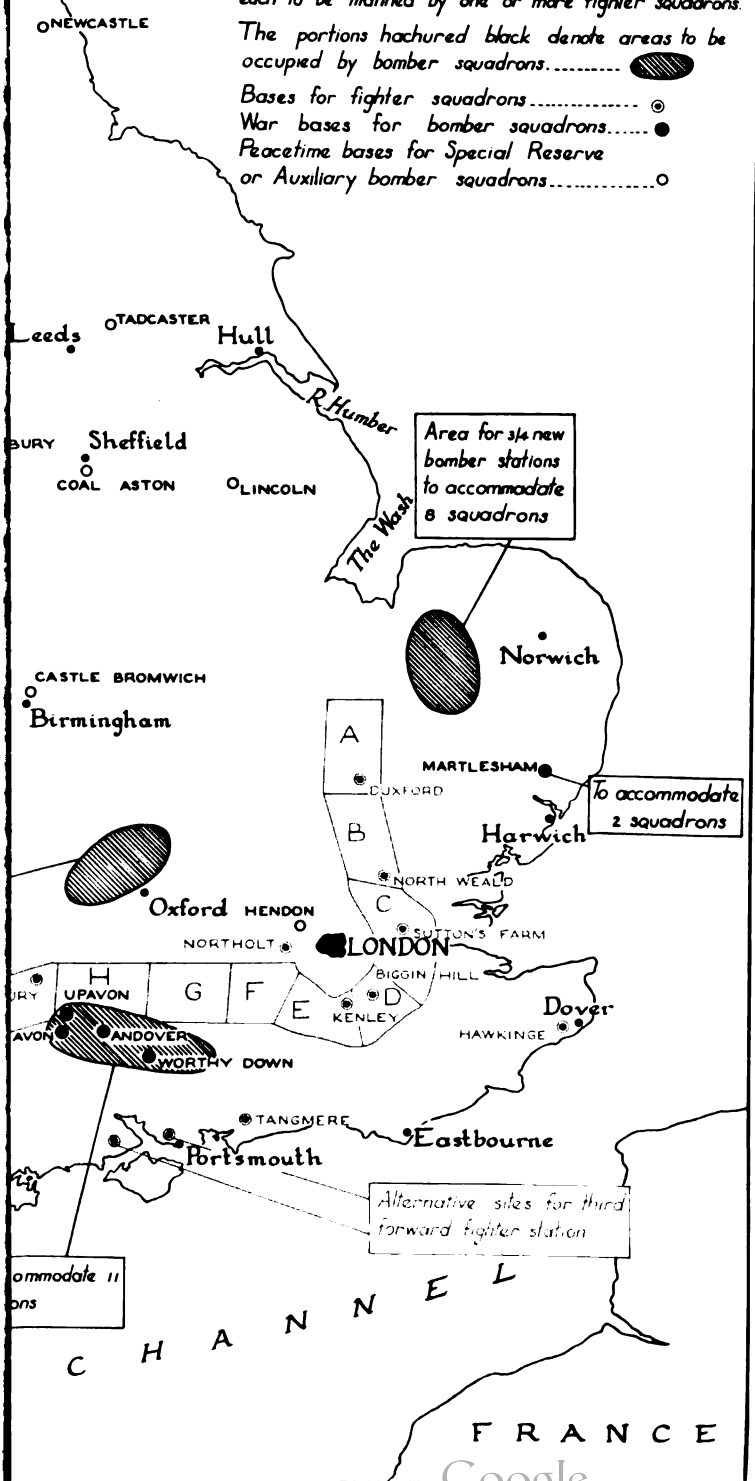
¹ The air defence brigades included both anti-aircraft 'brigades' and searchlight units.

Map 2 THE FIFTY-TWO SQUADRON SCHEME



Legend

The letters A,B,C,D,E,F,G,H,Y,Z denote sectors each to be manned by one or more fighter squadrons.
 The portions hachured black denote areas to be occupied by bomber squadrons.....
 Bases for fighter squadrons.....
 War bases for bomber squadrons.....
 Peacetime bases for Special Reserve or Auxiliary bomber squadrons.....



command called Air Defence of Great Britain would direct the operations of bombers, fighters, guns and searchlights, but would delegate immediate control of all but the bomber force to a subordinate command called Fighting Area. Executive orders to gunners and searchlight crews, however, would necessarily pass through army channels. The needs of the inner and outer artillery zones were assessed, as before, at 192 guns in eight brigades or regiments; but defended ports, to which the Steel-Bartholomew Committee had proposed to allot 72 guns and 168 lights, were no longer expressly included in the plan.

Among the consequences of the Romer Committee's report were the commencement of recruiting for a new Observer Corps, whose members would undertake the important task of reporting the movements of aircraft across those parts of the country which lay open to attack; and establishment of the new commands which the committee recommended. At the beginning of 1925 Air Marshal Sir John Salmond took up the post of Air Officer Commanding-in-Chief, Air Defence of Great Britain. Clearly the post would be a difficult one, for much that lay before him and his successors was uncharted country. The problems of air defence had changed considerably since the Armistice and were bound to change still more in the future. Moreover the instrument devised for their solution was both untried and inherently imperfect. The dual chain of command through air and army channels, which followed inevitably from the bargain struck in 1922, gave rise in practice to difficulties which only the personal qualities of those called upon to make the system work could overcome. Excessive delegation of authority to Fighting Area, on the other hand, was a weakness not difficult to remedy. Apart from all this, clearly many years of hard work would be necessary to complete the intricate network of communications needed for control in war, extend the observation system over the whole of the area threatened with air attack, and raise the Territorial units ultimately required to man the guns and searchlights. And a point which should have been obvious to all, but may not always have been grasped, was that until those things had been done, the progress of the fifty-two squadron scheme would remain a most misleading index of the country's ability to resist attack.

In the outcome progress in some of these fields was very slow. We have seen that by the autumn of 1925 nearly half the squadrons envisaged in the scheme of air expansion were in existence; but in other respects the air defences were still in their infancy when that stage was reached. The best part of another year was needed to extend the observation system round the coast from Suffolk to Hampshire. Recruiting for the two Territorial air defence brigades whose formation was announced in 1922 had made some progress, but both

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brigades were still much below establishment. And for many years to come such Territorial units as did exist were seldom able to take part in the annual air defence exercises, for their brief periods in camp were necessarily devoted largely to general military training and to gunnery exercises which could not be fitted into the Air Ministry's arrangements.

Meanwhile, relations between France and Great Britain had improved and the threatened expansion of the French airforce seemed to have been shelved. The prospect of an accommodation between France and Germany threw an unwonted gleam of sunshine on the European scene, presaging conditions which might favour a general scaling-down of armaments and a consequent lightening of taxation. In these circumstances a committee under Lord Birkenhead met to consider whether the fifty-two squadron scheme of air expansion could be modified or suspended in the interests of goodwill and economy. In November, 1925, the Birkenhead Committee came to the conclusion that the scheme ought not to be abandoned, but that its completion could safely be put back for some years. Accordingly a new Conservative administration, in office after a brief period of Labour rule, responded to the news that the scheme could not in any case be completed before 1930 by deciding that completion in 1936 would do. Four years later Mr. Ramsay MacDonald's second Labour Government, faced with an apparently still more urgent demand for economy, postponed completion until 1938. A third postponement resulted from the 'armament truce' observed in Britain while the Disarmament Conference was sitting at Geneva between 1932 and 1934.

Whatever their political merits, from the standpoint of those who ultimately bore the burden of air defence in the war with Germany these delays were highly inconvenient. In 1923 the Air Staff, notwithstanding their advocacy of air parity with France, had viewed the substitution of the fifty-two for the twenty-three squadron scheme with some misgivings, not because they thought the smaller scheme the better but because they feared the effect of disrupting plans already set in train. Having waived that objection, accepted the larger scheme and thereby agreed to direct their steps towards a more distant goal, they may have felt that they had earned the right to complete at least the first stage of their journey without interruption. In practice they were not allowed to do so. Some years later a spokesman of the Air Ministry expressed the view that the root-cause of the difficulty experienced after 1934 in matching German air expansion lay in the postponements begun in 1925. However that may be, the student may well wonder whether the Birkenhead Committee fully grasped how far the country really was from security, despite the apparent progress made since 1923. Certainly their recommendation caused much dislocation of plans already laid, and not easily recast to suit

requirements which changed twice more in the next few years. On the other hand it has been argued that on balance postponement did less harm than good, inasmuch as limitations of quantity tended to direct the minds of airmen to quality, thus focusing attention on researches which culminated in far-reaching technical improvements. But the argument is unconvincing. If the fifty-two squadron scheme had been completed in 1930, the state of the air defences would still have left no doubt that only unremitting attention to quality could make them strong.

As it was, the immediate effect of the decision of 1925 was that in the next three years only six squadrons were added to the home defence force. On the date laid down in 1923 for completion of the scheme, the strength of the force stood therefore at thirty-one squadrons instead of fifty-two. No new squadrons were formed in the financial year 1928-1929, but in 1929-1930 six squadrons were added, in 1930-1931 another two, and in 1931-1932 three more. Thus in the spring of 1932 the force was ten squadrons short of its full complement. Meanwhile nearly nine years had passed since the announcement that the whole force was to be formed as rapidly as possible.

One benefit which might be expected to have followed the diminished rate of progress was a better balance between air and ground components. But in fact the gap grew wider. The public had lost the taste for soldiering, the War Office had little money for any but the most urgent measures, and anti-aircraft experts, aware that since the Armistice the technical progress of aircraft had outstripped that of the defences, were in no position to attract recruits by lavish displays or promises of high achievement. Reluctance on the part of the authorities to endorse large measures of expansion until fresh researches had restored the balance would therefore have been understandable even if funds had been available to pay for them. Meanwhile the few who needed no inducement to volunteer were ill supported by their fellows, and the air defence formations sponsored by the army made only modest headway. By 1928, when three-fifths of the air expansion squadrons were in being, all the artillery and search-light units needed for the inner artillery zone enjoyed a shadowy existence, but were able to man less than half their establishment of guns and lights. Elsewhere the situation was still worse. In the outer artillery zone only one battery towards the twelve recommended by the Romer Committee had been formed; eleven of the twenty search-light companies needed for the aircraft fighting zone were in existence, but their average strength was about one half of their establishment and they had eight lights apiece instead of twenty-four. By concentrating all available troops and lights the authorities could have manned two sectors out of ten. The Observer Corps, appealing to a section of the public whose inconspicuous achievements deserve

high praise, had made some progress, but still numbered only four groups centred on Colchester, Maidstone, Horsham and Winchester. Another fourteen groups were needed to complete the scheme.

In the next four years a number of changes were made in the light of experience gained since 1923. At the beginning of 1929 certain responsibilities in regard to the Observer Corps were transferred from the War Office to the Air Ministry, mainly on the ground that the air force were the chief users of the information furnished by the Corps, and were better able to stimulate recruiting. A retired air force officer (Air Commodore E. A. D. Masterman) was appointed Commandant; and the Air Officer Commanding-in-Chief, Air Defence of Great Britain, became responsible for training and was authorised to call out the Corps if the need arose. The Corps remained a civilian body, raised and paid or reimbursed through the agency of the Chief Constables in the areas concerned; the members were sworn in as special constables and were required to signify their willingness to be called out if they were needed. As a result of close reasoning from practical trials the decision to exclude searchlights from the outer artillery zone was rescinded; and in due course the guns and lights of the Thames and Medway area—originally an outlying artillery zone like the other defended ports—were incorporated in the scheme. Both changes were steps towards the later ideal of a unified air defence scheme covering all threatened areas. But their immediate effect was to increase still further the disparity between the number of lights approved and the number that could be found and manned.

The outcome of nine years' work was, therefore, that when in 1932 a grave warning from the professional heads of the fighting services, coupled with a manifest decline in international relations, forced the Government to abandon the assumption that there would be no major war for a decade, four-fifths of the air expansion scheme had been completed, but the Territorial formations needed to man guns and searchlights had less than seven-tenths of their peace establishment and only about one-third of the numbers they would need in war. There were still only eleven searchlight companies towards the twenty needed in the aircraft fighting zone, the four artillery brigades assigned to the outer artillery zone continued to be represented by a single battery, and there were no searchlights in that zone, although their provision had been sanctioned two years earlier. Few opportunities had been found for realistic training by all arms together, communications were incomplete and the warning system was notoriously inadequate. Had war come soon, many parts of the air defence system would have been lacking and no part could have functioned with full efficiency. But as the outbreak of hostilities was in fact postponed for seven years, the deficiencies of 1932 are perhaps of less importance than the use made of the respite.

CHAPTER II
DISARMAMENT
AND REARMAMENT
(1930-1938)

(i)

AMONG reforms proposed by the Salisbury Committee in 1923 was an important change in relationship between the central administration and the professional heads of the three fighting services. The Chiefs of Staff, said the Committee, should not merely be advisers on questions of sea, land or air policy respectively, each answerable to his own Board or Council, but should have 'an individual and collective responsibility for advising on defence policy as a whole, the three constituting, as it were, a Super-Chief of a War Staff in Commission'.

The outcome was a new complex of sub-committees of the Committee of Imperial Defence, consisting in the first place of the Chiefs of Staff themselves, and secondly of a number of lesser bodies dealing with such aspects as planning and intelligence. In 1926 the Government defined the individual and collective responsibility of the Chiefs of Staff for tendering advice on matters of joint concern in a formal warrant given to each of them.

Thereafter reports and memoranda submitted by the Chiefs of Staff to the Committee of Imperial Defence, both in their joint capacity and separately, drew a picture of weakness which grew more alarming as the international outlook darkened. At the beginning of the 1930's the army was smaller than in 1914 and was not organised for war in Europe—facts whose significance for home defence we have already noted.¹ Instead of being able to mobilise six infantry divisions and one cavalry division in less than three weeks, as in 1914, the War Office were in a position to mobilise within that time only one infantry division and one cavalry brigade. At sea the navy had a margin of strength over any likely enemy, but professional opinion held that the limit of fifty cruisers imposed by the London Naval Treaty of 1930 was twenty less than the smallest number needed to

¹ See p. 5.

safeguard ocean trade. Moreover stocks of material for local naval defence had been pared so much in ten years of economy that a crisis overseas could not have been met without denuding the home country. The coast defences, almost wholly neglected since the war, were so much out of date that there was not a port in the United Kingdom, nor indeed throughout the Empire, whose guns were not outranged by those of a modern six-inch cruiser. The air defences, as we have seen, were still a long way from completion, and the role of aircraft in maritime defence had yet to be determined.

These facts were well known to the Government, but circumstances did not favour any radical reform. The country faced an economic and financial crisis which admittedly created a big reserve of labour, but which also made the measures needed to rearm the country appear untimely in the eyes of many statesmen of all parties. Moreover a large section of the public was undeniably opposed, on grounds which had little to do with finance or economy, to any move which smacked of war, and was not convinced that the best way to avoid war was to build up armaments.

There were also technical obstacles in the way of any large expansion of the defences, particularly in the air. Since the Armistice, progress in the art of air defence had been outstripped by the development of the bomber, so that even completion of the fifty-two squadron scheme and the complementary Romer Plan would not have made the country safe, especially as no probable enemy offered a target comparable with London. In 1918 General Ashmore had been able to put up fighters when approaching raiders crossed the coast, with some hope that they would intercept the enemy before he reached his target. But the speed of the bomber had doubled since that time and was likely to increase still further, so that nowadays the corresponding order must be given when the enemy was still some miles out to sea. Huge 'acoustic mirrors' made of concrete offered some hope of getting the necessary warning, but experiments at Hythe in Kent, where the building of a mirror two hundred feet in length was sanctioned, were disappointing. Many other measures were considered, including devices to detect the heat emitted by the engines of approaching aircraft, or the electrical effects created by their ignition-systems or by proximity to a magnetic field. All had grave defects. Unless the problem could be solved—and for some years no solution was in sight—the air defences would have no choice but to keep fighters on patrol whenever danger threatened. Such a course would quickly wear their squadrons to a standstill. Not knowing that the answer would be found within the next few years, Mr. Baldwin thus had reason on his side when he confessed in 1932 that 'the bomber would always get through'.

Meanwhile, if the danger of air attack were real and could not be

averted by naval power, the only action which seemed open to the Government was either to build a bomber force strong enough to deter aggression, or alternatively to strive for immunity by diplomatic means. The first course would be expensive and might entail the creation of an expeditionary force sufficiently numerous and well-equipped to hold or capture bases on the Continent. Moreover it might not achieve its object. The second promised to be cheaper, and might appeal more strongly to a public already heavily taxed and judged unlikely to support a major programme of rearmament. Furthermore, it had implications of special interest to a maritime country. By taking the lead in diplomatic action which removed the menace of the bomber, Great Britain would not only confer a benefit on humanity, but would also earn the reward of an honest broker if naval power again became the arbiter.

Accordingly, for reasons which may not have been solely idealistic although they certainly reflected a genuine preference for peaceful methods of adjustment, British statesmen worked hard during the next few years to secure a general scaling-down of armaments. At Geneva and elsewhere attempts were made to ban the bomber, or at least to bring about a drastic limitation of air power. As the Air Ministry were naturally reluctant to forgo a weapon in which the Air Staff had much faith, the views expressed by their spokesmen were not always easy to reconcile with those of other British delegates. But such divergences had little or no effect on the main issue. The banning of the bomber was defeated by the difficulty of devising any formula or course of action which would prevent an aggressor from dropping bombs from aircraft not defined as bombers. Similarly, abolition of military aircraft in general was dismissed on the ground that civil aircraft could be applied to warlike ends and could not be abolished or effectively controlled. After long discussion even limitation of size or numbers was rejected, no agreement on any major issue having been reached among the powers. Meanwhile little had been done to strengthen the national and Imperial defences, for British statesmen argued that any major measure of rearmament would be inappropriate while the negotiations were proceeding.

(ii)

The country's armaments, and not least the home defences, were thus in a poor state when the hope of a long peace began to fade. When the future of Singapore was discussed in 1925 the Foreign Secretary, Mr. Austen Chamberlain, had told the Committee of Imperial Defence that in his opinion any major clash in the Far East would be heralded by danger-signs in Europe. In the meantime Japanese ambitions in

China, if they threatened British interests in that country, would also threaten those of the United States. By presenting a united front the two English-speaking powers should be able, in his view, to ensure that any action taken by Japan was not offensive to them.

Five years later danger-signs in Europe were not lacking. At the general election held in Germany in the autumn of 1930 extremist parties of the Right and Left gained nearly a third of the votes cast. In the following spring the Chief of the Imperial General Staff, Sir George Milne, told the Committee of Imperial Defence that 'nothing was clearer' in the contemporary scene than the 'gradual emergence of a revisionist *bloc* of powers consisting of the ex-enemy states and Italy'. In June the committee nevertheless reaffirmed the assumption that there would be no major war involving the British Empire for ten years. A few months later Japan began military operations in Manchuria and early in 1932 she attacked Shanghai. Resolute action to safeguard British interests there was found impossible without incurring a risk of war which the country could not face; and the common front predicted by Austen Chamberlain was limited to vain attempts by both the League of Nations and the United States to adjust the Sino-Japanese dispute by mediation.

The principles which had governed British strategy for the last decade and more thus stood condemned by failure to avert a situation prejudicial to the country's commercial interests in Shanghai and elsewhere in China. Moreover the 'China incident' had wider implications. Within a month of the crisis at Shanghai the Chiefs of Staff, referring ominously to 'the writing on the wall', called urgently on the Government to cancel the 'ten-year rule' and start providing for 'purely defensive' commitments without awaiting the results of the Disarmament Conference assembling at Geneva. Among the shortcomings to which they drew attention was the poor state of the home defences, including the weakness of the coast defences and the incompleteness of the scheme of air defence.

The Government accepted the first recommendation, but were reluctant to apply the second as long as they retained the hope that international agreement might spare the country measures of rearmament which seemed to them financially and economically unacceptable. They nevertheless approved completion of the naval base at Singapore and its permanent defences by 1936, authorised certain naval and air measures designed to strengthen its position in the meantime, and appointed a committee under Mr. Baldwin to study the broad aspects of coast defence throughout the Empire. The chief effect on the home defences was the diversion of an air squadron to Singapore.

Soon afterwards events in Europe brought the danger nearer home. Early in 1933 the National Socialist Party led by Adolf Hitler came

to power in Germany. On his own showing, Hitler was no enemy to Britain or the British Empire. He condemned the policy which had led his forerunners to challenge British naval power by seeking colonies across the sea, and pointed to the rich cornlands of European Russia as a proper field for expansion.¹ The goal could be attained, however, only by breaking through the ring of French alliances in Eastern Europe. Hence the course he seemed to favour was likely to bring him into conflict with France. Moreover, as the leader of a party with a strongly patriotic programme, he was logically committed to revisionist measures bound to be unacceptable to the French. Finally, some aspects of his domestic policy offended many foreigners who might not otherwise have been unsympathetic to German aspirations.

When Germany rejected the promise held out at Locarno by leaving the League of Nations, observers in Britain saw some reason to fear a conflict in which their country might become embroiled. Regarded as recently as 1931 by the General Staff as the dominant power whose excessive armaments kept Europe in a state of tension, France began to assume once more the guise of a hard-pressed neighbour who might need support against aggression, and who indeed might claim it under the terms of the Locarno Treaty. The Chiefs of Staff reminded the Government that cancellation of the 'ten-year rule' had not removed the deficiencies to which the rule had given rise, and warned them that postponement of rearmament might be disastrous if the Disarmament Conference failed to achieve its purpose. Accordingly the Cabinet, recognising that failure at Geneva was now inevitable, appointed in November, 1933, a committee under their Secretary, Sir Maurice Hankey, to advise them how to meet 'the worst deficiencies' in national and Imperial defence.

(iii)

Meeting for the first time on 14th November, 1933, the Defence Requirements Committee—whose members included the three Chiefs of Staff, the Secretary to the Treasury and the Permanent Under-Secretary of State for Foreign Affairs—took as their point of departure a recent dictum of the Committee of Imperial Defence that for the moment the chief danger lay in the Far East. Nevertheless they soon reached the conclusion that the 'ultimate potential enemy' was Germany. There was no evidence that Germany contemplated an attack on Britain or the British Empire, but plenty to show that she intended to pursue her aims without deferring to her neighbours. To

¹ *Mein Kampf*, Eng. Edtn. (1939), p. 533.

what extent and in what circumstances Britain might consequently be called upon to honour her obligations under the Locarno Treaty was uncertain; but clearly the chances of an outcome which might put the country in jeopardy would increase as Germany rearmed. That she intended to rearm was plain. Accordingly the report submitted by the committee in February, 1934, laid much emphasis on the importance of putting the United Kingdom in a thoroughly defensible condition.

The General Staff believed that Germany might be ready for war by 1938 or 1939. Her navy seemed unlikely to become a serious threat within that time, but by concentrating on air power she might provide herself with a powerful offensive weapon. Aware that Germany had already begun to build an air force in defiance of the Treaty of Versailles, and perhaps influenced by Trenchard's evidence before the Salisbury Committee in 1923, the Defence Requirements Committee drew attention to the risk of air attack 'especially in the early stages of a war'. Like the 'bolt from the blue' which figured so much in discussions of defence plans before 1914, the newer conception of a 'knock-out blow' from the air at the very outset of a war owed more to speculation than to any evidence that the potential enemy contemplated such a move, but in course of time aroused much apprehension. Meanwhile the committee, although they urged completion of the fifty-two squadron scheme as a matter of 'first importance', themselves avoided any exaggerated reference to the danger. Recognising that the scheme (or more precisely the plan of air defence which it implied) would not protect the whole of the United Kingdom against attack from Germany, but mindful of their instructions to deal only with the 'worst deficiencies', they made no specific recommendation for a further increase in the home defence air force. They did, however, call attention to a probable demand for twenty-five additional squadrons for the defence of ports at home and abroad and for co-operation with the navy. They urged, too, that the public should be made acquainted with projected measures of passive air defence which had been studied in secret since 1925; suggested a moderate expenditure on coast defence and naval programmes, including local seaward defences against submarine attack; and recommended very strongly that a Field Force consisting of four infantry divisions, one cavalry division, two air defence brigades, one tank brigade and an air component drawn from the metropolitan air force should be made ready for despatch to the Continent within one month of the outbreak of hostilities. With such a force at its disposal the country would be able to co-operate with Continental powers in securing the Low Countries, where British bombers, fighters and observation posts could be deployed if they were needed there to ease the problem of defending London against air attack. The committee's

programme contemplated a capital expenditure of about seventy-one million pounds during the next five years; of that sum they proposed that roughly half should be devoted to the army, which had suffered most from recent economies.

The Government agreed that, for new reasons, the old principle of securing the Low Countries still held good; and in July a statement to that effect was made to the House of Commons by the Foreign Secretary. Examination of the Defence Requirements Committee's proposals by a ministerial committee under the Prime Minister led, however, to the conclusion that the balanced force proposed by the former committee was beyond the nation's means. At the same time the Government were aware of a keen desire in the country for reassurance about the risk of air attack. They decided to reduce by about a third the capital expenditure proposed by their advisers, cut the army's share by about a half, and rely largely on the deterrent effect of a larger air force than that suggested.

Meanwhile the Air Ministry had learned something of Germany's intentions. According to their information, the German Government had adopted a 'first-stage' plan designed to give by the beginning of October, 1935, a first-line strength of 576 aircraft, backed by adequate reserves and substantial provision for training. Thereafter the German air force would expand to 900 aircraft at the end of 1935, and would probably attain an ultimate strength of three or four divisions, each presumably about five hundred to six hundred aircraft strong. Further information digested in October and November indicated that the plan was being carried out, and that the second stage would give by the beginning of October, 1936, a first-line strength of 1,368 aircraft.¹

To what extent the expansion of the Luftwaffe in its early stages kept pace with these projects the evidence which has reached us since the defeat of Germany does not clearly show. We know, however, that by the end of 1934 the Germans had formed, on paper, twenty-two of the forty-eight squadrons supposedly comprised in the first stage of their plan. The squadrons held 146 aircraft towards an establishment of 246.² The German Air Ministry's total holding of military aircraft suitable for first-line units was 565, but many of these machines lacked engines or other necessary components.

To counter the first stage of the German plan and as much of Germany's subsequent intentions as was known in the summer of 1934, the British Government adopted in July of that year a new

¹ The first-line strength of German squadrons was reckoned as 12 aircraft, a figure later reduced to 9 by excluding immediate reserves supposed not to be strictly part of the first line. The 'second-stage' total without immediate reserves thus became 1,026.

² The German establishment seems to have included some immediate reserves, and was thus not strictly comparable with first-line strength as defined by the British Air Staff.

scheme of air expansion which replaced the fifty-two squadron scheme of 1923. Scheme A, as it was called, was designed to provide a metropolitan air force of forty-three bomber, twenty-eight fighter, four general-purpose (reconnaissance), four flying-boat and five Army Co-operation (tactical reconnaissance) squadrons by the end of 1938 or early in 1939. The numbers of first-line bombers and fighters contemplated in the respective schemes were thus as follows:

	<i>52-Squadron Scheme</i>	<i>Scheme A</i>
Bombers	394	500 ¹
Fighters	204	336
	<u>598</u>	<u>836</u>

In addition, 124 general-purpose, flying-boat and Army Co-operation machines included in Scheme A were reckoned as part of the metropolitan air force, whose total first-line strength would thus amount to 960 aircraft. The scheme provided also for 292 overseas aircraft in 27 squadrons. Hence the whole strength of the Royal Air Force would amount to 1,252 machines in 111 squadrons.

In principle, the great objection to Scheme A was that a threatened expansion of the British bomber and fighter force, unaccompanied by realistic preparations for war in Europe, would not necessarily persuade the Germans to forgo their ambitions. Indeed, it might induce them to hasten their preparations in the hope of striking while the ponderous mechanism of democracy was still gathering momentum. From a more immediate standpoint the chief weakness of the scheme was that it made inadequate provision for reserves. It allotted a small sum which would enable the air force to begin a war with something more than their bare first line, but deferred consideration of the bigger problem of keeping up the strength of the first line and the immediate reserve in a period of heavy fighting when losses were likely to exceed production. There was thus a grave risk that the potential enemy, by employing agents to discover how many machines the British aircraft industry was capable of producing and by calling arithmetic to his aid, might tumble to the fact that the Air Ministry's goods were nearly all in the shop window.

Contemporary criticism was, however, directed largely to the size of the proposed force, as measured by first-line strength. Towards the end of November, 1934, Mr. Winston Churchill attacked Scheme A in the House of Commons. He alleged that Germany already possessed an air force which was approaching equality with the British; that in twelve months' time the Luftwaffe would be at least as strong,

¹ Includes 24 torpedo-bombers.

and by the end of 1936 nearly half as strong again, as the Royal Air Force; and that by 1937 it would be almost twice the size of its competitor. Replying for the Government, Mr. Baldwin had no difficulty in showing that at any rate the first assertion was unfounded. He pointed out that, whereas the first-line strength of the Royal Air Force was 880 aircraft, of which 560 were at home, the Germans probably had from 600 to 1,000 military aircraft of all types. Whether they had yet formed any first-line units was uncertain. We have seen that five weeks later they had in fact formed a number of first-line units which were, however, very weak, and that they then had 565 machines of first-line type.¹ On the assumption that a number of trainers and other machines not of first-line type were entitled to rank as 'military aircraft', the figures quoted by Baldwin were well founded.

Turning to the future, Baldwin went on to say that in twelve months' time the Royal Air Force would have a margin 'in Europe alone' of 'nearly fifty per cent', but that with respect to the more distant future he could make no forecast and that he could not look 'more than two years ahead'. Perhaps because the speech to which he was replying had contained a specific reference to 1936, at least some of his hearers took him to mean that he could look two years ahead but no more. The debate continued on the assumption that he had predicted a safe margin of superiority in November, 1936. Unfortunately he himself contributed to the misunderstanding, first by appearing to acquiesce in it at the time, secondly by avowing six months later that he had made a false prediction. The record shows, however, that his forecast was not ill-founded insofar as he intended to refer only to the position on 1st October, 1935. Privately he complained afterwards that he had not been given full particulars of the second stage of the German plan. In fact, the particulars were circulated to the Committee of Imperial Defence two days after he made his speech. But Baldwin had been warned at least as early as July that the expansion predicted for the period ending on 1st October, 1935, was believed to be only the first stage of the German programme. Indeed, an appendix to a document which he himself signed on 16th July showed that, while the Royal Air Force would still have the advantage at the end of the first stage, subsequent expansion of the Luftwaffe would deprive them of it long before the end of the second stage was reached. Unhappily, in his attempt to meet Mr. Churchill's criticisms, he failed first to distinguish between the respective positions on 1st October, 1935, and at the end of that year, and secondly to rebut the presumption that he had predicted superiority in 1936.

¹ See p. 27.

Meanwhile a new factor contributed to the confusion. Returning from a visit to Berlin in the early spring of 1935, Sir John Simon and Mr. Anthony Eden (respectively Foreign Secretary and Minister for League of Nations Affairs) informed their colleagues that the German Chancellor had told them in course of conversation that the Luftwaffe was already as strong as the Royal Air Force. The claim was certainly not justified. It was flatly contradicted by secret information in which the Air Ministry had confidence, and also by German officials, who at first denied that the Führer could have made so inaccurate a statement. But the Government's faith in the Air Staff's sources had been shaken by Mr. Churchill's confident predictions and by the muddle arising from Baldwin's speech. They therefore sought a further explanation through diplomatic channels. Under pressure, General Milch of the German Air Ministry conceded that the Führer had made a statement of the kind imputed to him, adding that he had had in mind a figure of some 800 or 850 aircraft but had intended only an approximate comparison. On 22nd May Milch's superior, General Göring, made a similar avowal. He added that he hoped to achieve, perhaps by the end of 1935, a strength of 2,000 aircraft and consequent equality with France. The French air force was, however, known to be in the throes of a drastic reorganisation and seemed unlikely to reach within the next few months the strength assumed by Göring. For many reasons the British Air Staff came to the conclusion that, while Germany would doubtless muster 2,000 military machines and pilots by the end of the year, she would certainly not attain within that time a first-line strength of 2,000 aircraft as first-line strength was understood in London.

Amidst many uncertainties one fact seemed to stand out clearly: namely that the announcement of Scheme A in the previous year had not induced the potential enemy to draw in his horns. The Luftwaffe might be expanding at the rate predicted by the Air Staff; alternatively it might, as Mr. Churchill and some members of the Government feared, be expanding faster. Two lines of thought converged, however, to the conclusion that a first-line strength of roughly 1,500 aircraft would be reached in the spring of 1937. In the first place, parity with the French metropolitan and North African air force was an avowed and very credible German aim, and France was expected to reach about that number at that time. Secondly, circumstantial evidence relating to the German programme pointed to a figure of 1,512 aircraft as the target for the beginning of April in that year.

Despite the apprehensions expressed by Government spokesmen in the early part of 1935, the threat summed up in June by the Air Parity Sub-Committee of the Ministerial Committee on Defence Requirements thus appeared to the Sub-Committee scarcely different

from that foreseen in 1934.¹ The only real change was that the failure of Scheme A was now admitted. The Government had set out to frighten Germany, but so far seemed to have frightened no one but themselves and some of their compatriots.

Meanwhile they had marked their new appreciation of the threat by adopting an accelerated programme of air expansion called Scheme C. Intended for completion in the spring of 1937, the new scheme raised the numbers of bomber and fighter squadrons at home to 70 and 35 respectively, and increased the ratio of medium and heavy to light bombers.² In other respects it was scarcely an improvement on its predecessor. Provision for reserves was again inadequate—a fact betrayed by the financial implications of the scheme. Moreover the air programme was not backed by convincing preparations for land warfare on the Continent. Thus the Germans might regard it—indeed there is some evidence that they did regard it—partly as bluff and partly as a device to reassure the British public.

(iv)

We have seen that Scheme A failed to stop the Germans from rearming, and that Scheme C threatened to be equally ineffective in that respect. As a means of defence against an attempted 'knock-out blow', the new scheme had still greater drawbacks. Two-thirds of the home defence force which it envisaged would consist of bombers, the remaining third of fighters. This ratio reflected accurately enough the Air Staff's view that in the long run only offensive power could give the air superiority which made for safety. Against an aggressor who acted swiftly the bomber force would, however, be of little value if the fighter force and the rest of the air defences should prove too weak to repel a series of crushing blows at the outset of hostilities.

¹ See p. 27.

² The respective programmes under Schemes A and C were:

	<i>Scheme A</i>		<i>Scheme C</i>	
	<i>Squadrons</i>	<i>First Line</i>	<i>Squadrons</i>	<i>First Line</i>
METROPOLITAN AIR FORCE				
Heavy bombers	8	80	20	240
Medium bombers	8	96	18	216
Light bombers	25	300	30	360
Torpedo bombers	2	24	2	24
Fighters	28	336	35	420
Reconnaissance, etc.	13	124	18	252
	84	960	123	1,512
OVERSEAS	27	292	27	292
	111	1,252	150	1,804
FLEET AIR ARM	16½	213	16½	213

Moreover there was, to say the least, no certainty that the bomber force would be capable of effective action against the potential enemy. Two-sevenths of it was to be equipped with aircraft able to reach the Ruhr, but not Berlin, from British aerodromes; three-sevenths with light bombers unable to reach worth-while targets in Germany unless they flew from Continental bases. The remaining eighteen squadrons were to be equipped with aircraft of which no satisfactory type was yet available. The thirty-five fighter squadrons would have aircraft which ranked high by the standards of the day, but would be handicapped by the difficulty of spotting and tracking approaching forces in time to intercept them.¹

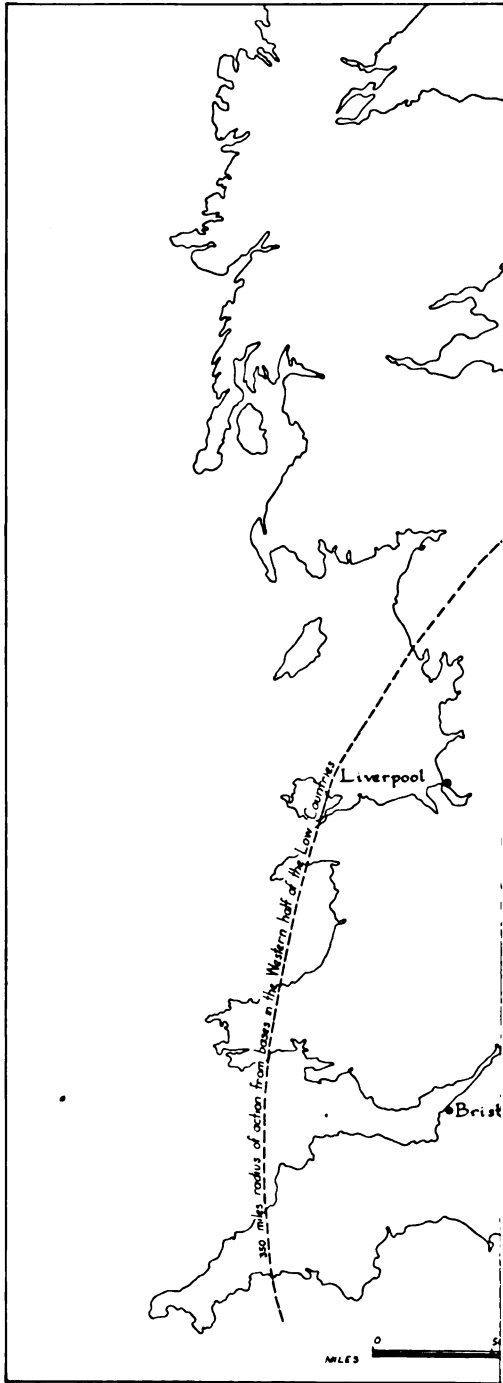
Production of the aircraft envisaged in the scheme—including a new type to supply the existing lack of medium bombers—was thought to be within the capacity of manufacturers on the assumption that they either enlarged their factories or fulfilled no civil or foreign orders. Apart from the admitted difficulty of completing the programme within the time allotted, a great weakness from the professional aspect was the dependence of so much of the force on Continental bases which, for one reason or another, our squadrons might not be able to occupy before the enemy delivered his first blow.

These problems did not escape the Air Staff. In their conception of air warfare as largely a slogging match between rival bomber forces, they had always recognised the great importance of purely defensive measures in the early stages of a contest, when the initiative would lie with an aggressor. Hence a saving consequence of the ill-fated expansion schemes of 1934 and 1935 was the attention devoted to the defensive system of which the Steel-Bartholomew and Romer plans were prototypes.

The aim of the Romer plan was to guard London, and give some

¹ The aircraft contemplated were:

BOMBERS	
<i>Type</i>	<i>Normal Range (miles)</i>
HEAVY BOMBERS	
Hendon	920 (1,500 lb. bomb-load)
	1,160 (1,000 lb. bomb-load)
Armstrong prototype	1,250 (1,500 lb. bomb-load)
(40 expected by 31.3.37)	(estimated)
MEDIUM BOMBERS	
Not selected	Probably 700-800 miles
	(750-1,000 lb. bomb-load)
LIGHT BOMBERS	
Hind	430 (500 lb. bomb-load)
FIGHTERS	
<i>Type</i>	<i>Maximum Speed (m.p.h.)</i>
Gauntlet	230
or Gloster prototype	255
(delivery expected to begin in 1936)	(estimated)



incidental protection to the Midlands, against attack from the south and south-east. Now that Germany was the potential enemy the likely direction of attack was from the east. Recognising that the defences must therefore be reorientated, the Air Staff examined various proposals and gave their verdict in favour of a continuous defence-zone stretching from the Tees round London to the Solent. A committee under Air Chief Marshal Sir Robert Brooke-Popham, since 1933 commanding Air Defence of Great Britain, was appointed to work out a new plan.

The Reorientation Committee reported early in 1935. They upheld the conception of a continuous defence-zone, preferably divided into two areas for the defence of northern and southern England respectively, and comprising an aircraft fighting zone, an outer artillery zone, and an inner artillery zone for the close defence of London. (See Map 3.) Local defences in the form of guns and searchlights should, in their opinion, be provided also for Manchester, Leeds, Sheffield and Birmingham, and ultimately should form part of the main system. Guns and searchlights at defended ports in front of the defence-zone or on its flanks, on the other hand, would remain outside the system, since Air Defence of Great Britain had as yet no responsibility for them. The Committee noted, however, that the intention of the War Office was to allot 88 guns and 174 searchlights for their defence. The principal measures contemplated in their report included fighters, searchlights, anti-aircraft guns, balloons, light automatics for use against low-flying aircraft, and such additional aids to safety as air raid precautions, camouflage, smoke-screens and control of wireless transmissions likely to be useful to the enemy for navigation. Ancillary measures would include predictors, height-finders, sound-locators, the Observer Corps and other means of detecting and tracking hostile movements, and finally a comprehensive system of communications.

The numbers of fighter squadrons, anti-aircraft guns and searchlights needed for the new plan, as compared with those previously contemplated, were as follows:

	<i>Modified Romer Plan¹</i>	<i>Reorientation Plan</i>
Fighter squadrons . . .	17	25 ²
Guns	218	456
Lights	624	2,160

¹ The Romer Plan as modified by the projected installation of searchlights in the outer artillery zone and by inclusion of the Thames and Medway defences.

² Under Scheme C a further ten would be available for deployment on the Continent. The intention was that four or five of them should support the Expeditionary Force if circumstances required it.

Apart from fighter squadrons, which were adequately provided for in the air expansion schemes, the new plan thus involved a big additional demand for guns and lights. It would also entail much work on aerodromes and communications and a considerable expansion of the Observer Corps, now to be reorganised in sixteen groups instead of the eighteen smaller groups envisaged earlier. At best it would give no more than a moderate degree of safety, for the problem of early warning was still unsolved.

In principle, completion of the Reorientation Plan at the same rate as Scheme A—soon to be succeeded by Scheme C—was much to be desired. The Committee recognised, however, that financial limitations were likely to preclude that course. They therefore proposed that the work should be done in three stages. Stage 1 would build a framework for the raising and training of the army units needed for the full scheme, and for the formation of the necessary Observer Groups; meanwhile it would provide 136 guns and 1,008 searchlights, including 104 guns for London and the Thames and Medway, and would enable the southern part of the aircraft fighting zone, from Huntingdon to the Solent, to be carried almost to completion. Stage 2 would add 168 guns and provide an attenuated aircraft fighting zone from Huntingdon northward to the Tees. Stage 3 would complete the full scheme, including local provision for Manchester, Leeds, Sheffield and Birmingham. In the light of the information furnished by Sir John Simon and Mr. Eden on their return from Berlin in the spring of 1935, the Home Defence Committee recommended that Stages 1 and 2 should be completed within the next five years and Stage 3 two years later, though they also made alternative proposals. The Air Staff, too, were much in favour of completion of the whole scheme by 1942.

These recommendations were not accepted. In the summer of 1935 the Government sanctioned completion by the spring of 1940 of that part of Stage 1 which related to the southern portion of the aircraft fighting zone and the provision of 136 guns and 1,008 searchlights, but not the further steps which envisaged completion of the full scheme two years later. Financial stringency, and especially difficulty in obtaining sanction for expenditure on weapons not immediately contemplated in measures already approved, continued for some years to place obstacles in the way of those whose eyes were directed to the future.

The decision of 1935 was distasteful to the Air Ministry, who would have welcomed a less niggardly provision. But if the Government's action seemed inconsistent with one aspect of their policy, it was quite consistent with another. Having decided not to spend much money on the army, they had good reason to suppose that the War Office would not be able by 1942 to raise, train and equip the Territorials

needed for the full scheme.¹ The irony was that one of the Government's motives for reducing the Defence Requirements Committee's allocation to the army had been that they wanted to spend more on air defence. As it was, the air defence plan would be seriously out of balance. Under Scheme A the home defence air force would be ready by 1939, under Scheme C by 1937; but the complementary fighter sectors, guns and searchlights would be a long way from completion even at the later date.

Meanwhile the Government's decisions to adopt Scheme C and a part of the Reorientation Plan, if somewhat contradictory, at least had the advantage of setting definite objectives. Perhaps for that reason they marked the beginning of an era of real progress.

Under Scheme C the home defence air force would rise to 70 bomber and 35 fighter squadrons. It would thus be too large to be commanded by one officer. The Air Staff had no doubt that ultimately bombers would become the country's main shield against air attack, for in their view only offensive action from a well-guarded base could give the air superiority which would bring security. Even so there was a good case for divorcing immediate control of the bomber force from that of fighters, guns and searchlights. If the country were heavily attacked, and if the bomber force and the defences proper were under one commander, he might face an invidious choice between immediate reprisals against the opposing air force and some other course of action, such as attacks on factories or naval bases. Admittedly he could turn to his superiors for guidance; but the argument that a bomber commander without purely defensive responsibilities would be better placed to make a realistic choice within the framework of his instructions still held good. Moreover, we shall see that by the time the problem of command arose, technical advances promised to confer a new status on purely defensive measures.

Accordingly, within the next twelve months the command called Air Defence of Great Britain disappeared, although the name continued to be used occasionally as a convenient term for the functions exercised by the commander of the air defences proper in his dual relation to the fighter force and to the air defence formations provided by the army. It was replaced by Bomber Command, concerned entirely with bombers of the metropolitan air force, and Fighter Command, concerned not only with fighters, but also with other elements of pure air defence, including operational control of guns and searchlights. Training—other than the operational training then

¹ The authorised establishment of the Territorial Army in 1935 was 165,000 and the enlisted strength about 130,000. The number needed for the Reorientation Plan was 43,500. Besides acting as the main reserve behind the Expeditionary Force, the Territorials were the principal source of manpower for coast defence.

done in squadrons—became the task of a new Training Command, which replaced the old Inland Area and was later divided into two commands concerned respectively with flying and technical instruction. In due course Coastal Command (replacing Coastal Area) and, later Maintenance, Balloon and Reserve Commands were added to the home commands.

The appointment of Air Chief Marshal Sir Hugh Dowding as the first Air Officer Commanding-in-Chief, Fighter Command, and the opening of his headquarters at Stanmore, in Middlesex, on 14th July, 1936, marked the transition from an experimental stage to one of active preparation for an emergency which might not be long delayed. Apart from the recently-formed 1st A.A. Division (Major-General R. H. D. Tompson), which was under his operational control but not yet in a position to fight, the new commander's resources when he took up his post comprised No. 11 (Fighter) Group (Air Vice-Marshal P. B. Joubert de la Ferté), with eight stations and eleven squadrons in south-east England; the Observer Corps (Air Commodore A. D. Warrington-Morris), with nine Observer Groups south of the Wash and two in Lincolnshire and Yorkshire; and (for administration only) No. 22 (Army Co-Operation) Group, whose task was to provide reconnaissance squadrons for the army. In addition a new Regular fighter squadron was about to form in Cambridgeshire, three Auxiliary squadrons were converting from bombers to fighters in Bomber Command, and five Regular squadrons in Egypt and Malta belonged in principle to the home defence force and in fact went under Fighter Command when they returned to England in September.

Meanwhile there had occurred the most important development yet recorded in the field of air defence. We have seen that, some years earlier, attempts to find a better means of detecting distant aircraft than was provided by sound-locators and acoustic mirrors had led to negative results. Early in 1935 Sir Robert Brooke-Popham's Re-orientation Committee recommended that the Anti-Aircraft Research Committee which had then examined the question should be revived, perhaps in a new form, 'to give further consideration to possible means of defence'. About two months earlier Mr. H. E. Wimperis, Director of Scientific Research at the Air Ministry, had made a rather similar suggestion. His proposal was that a committee headed by Mr. H. T. Tizard, Chairman of the Aeronautical Research Committee, should be set up to investigate, amongst other matters, the chances of damaging the mechanism or detonating the bombs of an approaching aircraft by means long known to be feasible in theory, and popularly associated with the conception of a 'death ray'. In the outcome both suggestions were adopted. The body proposed by Mr. Wimperis became known as the Committee for the Scientific Survey of Air

Defence, that proposed by the Reorientation Committee as the Air Defence Research Committee. Mr. Tizard was a member of the second and chairman of the first.

In January, 1935, Wimperis followed up his idea by consulting Mr. R. A. Watson-Watt of the National Physical Laboratory about the possibility of damaging approaching aircraft, or harming their occupants, by means of electro-magnetic radiations. Mr. Watson-Watt reported that such a method would not work. But he added that certain researches on which he was engaged suggested a novel means by which approaching aircraft, although they could not be directly destroyed or rendered harmless, might be detected and located. That radio waves were reflected by an ionized layer about sixty-five miles from the earth—the Heaviside layer or ionosphere—was well known. His researches were concerned with measuring the distance of the ionosphere from the surface of the earth by noting the interval between the emission of a radio pulse and the return of the corresponding echo.

At their first meeting on 28th January, the Committee for the Scientific Survey of Air Defence considered Watson-Watt's idea and suggested that he should pursue it. The Committee thereupon arranged that the Air Member for Research and Development should be asked to seek approval for expenditure on the project. Air Marshal Dowding, who then held that post and was later to command the air defences, responded by asking for evidence that an aircraft would emulate the ionosphere by reflecting radio waves in the form of an appreciable echo.

Accordingly, Watson-Watt and his associates gave a practical demonstration on 26th February. Ideally a pulse transmitter was required, but as none was available a source of continuous radiation was used in the shape of the beam from Daventry radio station. An improvised receiver was set up some six miles away at Weedon. A Heyford aircraft flew backwards and forwards at a height of 6,000 feet between Daventry and a point twenty miles along the lateral centre of the beam, but did not keep directly over the lateral centre as was intended. Thus conditions for the demonstration were by no means perfect. One run was disappointing. To the immense relief of the demonstrators, easily discernible echoes were received on the other three at ranges up to eight miles.

After his visit to Weedon, Dowding took steps whose consequences were perhaps as decisive for his country as any event recorded in British history. On his recommendation permission was obtained to spend more than the sum first proposed, and an experimental station was set up at Orfordness, on the Suffolk coast.

Immediate results were extremely promising. When the apparatus at Orfordness was demonstrated to the Secretary of the Committee

for the Scientific Survey of Air Defence in July, a Bristol aircraft which flew thence to Bircham Newton was easily detected at distances up to twenty-five miles. Observers accustomed to the apparatus could see echoes at distances up to thirty-five or forty miles and could assess range fairly accurately from five miles upward. Echoes were also given by aircraft not concerned in the demonstration, so that their occupants could not be suspected by the most sceptical of con-
niving at its success.

During the second half of 1935 progress was again good. In the course of the year work on acoustic mirrors was stopped, and sanction was obtained for the construction within the next six months of five detecting stations north and south of the Thames Estuary. They were intended as the first instalment of a chain of about twenty covering the coast from the Tyne to Southampton. As the stations would all stand on high ground near the sea, and be furnished with conspicuous masts about 250 feet tall, their existence could not be concealed; to balk enquiry they were, however, given the misleading name of Radio Direction Finding Stations. The abbreviation R.D.F. remained in use until the middle of the war, when the now familiar 'radar' was adopted. A property on the Suffolk coast, called Bawdsey Manor, was bought to serve as an experimental station and headquarters of the chain. At the beginning of August, 1936, Mr. Watson-Watt left the National Physical Laboratory to become full-time Superintendent of Bawdsey under the Air Ministry.

In practice, construction of the stations took longer than had been expected. Erection of the masts proved a slow job, and other setbacks were experienced. An ambitious programme of exercises arranged for the autumn of 1936 had to be postponed because the stations were not ready. A more modest trial held in the meantime showed that if accurate indications of range, height, bearing and approximate numerical strength were wanted—and all these were necessary if full value was to be had from the project—the organisation must be given time to find its feet. By the summer of 1937 the position was that, while the usefulness of the apparatus had been clearly demonstrated, only one station was in satisfactory working order. The Air Ministry foresaw that, if they awaited completion of the other four comprised in the first batch before continuing with the fifteen still to be erected, the chain would certainly not be ready before the spring of 1940. With the approval of the Treasury, they decided therefore to proceed at once with the whole system, now recast to cover the coast from a point north of St. Andrews to St. Catherine's Point. In the meantime completion of the first five stations would be hastened so that they, at least, would be ready by 1938. Orders for the necessary transmitters, receivers and goniometers were placed with the Metropolitan-Vickers Electrical Company Limited, A. C. Cossor Limited and the Radio

Transmission Equipment Company Limited, respectively. Meanwhile the Air Staff and Fighter Command—the latter now under Dowding—had shown their faith in the ultimate success of the venture by concerting a system of fighter control designed to use the information furnished by the stations. An important step was the appointment, towards the end of 1936, of Squadron Leader R. G. Hart, a signals officer attached to No. 11 Group, as Commandant of R.D.F. Training. The assumption made in the summer of 1937 was that the twenty 'chain home' (C.H.) stations, when complete, would be capable of detecting and locating at ranges up to forty miles all aircraft approaching the coast between Lowestoft and St. Catherine's Point at heights above 3,000 feet. North of Lowestoft a lower standard would suffice, except in the neighbourhood of a few ports where the full standard was required. Later the equipment was much improved and substantially longer ranges became common. A weakness of the C.H. stations was, however, their inability to spot low-flying aircraft.

But the C.H. stations did not exhaust the scope of the project. As early as the summer of 1935 the few who shared the secret of R.D.F. foresaw a number of other uses. Research and experiment soon showed that special applications might include short-range location for the benefit of anti-aircraft gunners, searchlight crews and fighter-pilots. Warships, too, might profit by long-range detection and location of surface craft, while short-range location would increase the chances of naval anti-aircraft gunners. Coast defence was yet another application. Accordingly, all three fighting services were soon associated with the venture. The Admiralty appointed a scientist, Dr. A. B. Wood, to keep the Naval Signal School at Portsmouth in touch with the experiments; and a visit to Bawdsey by Dr. E. T. Paris of the War Office Air Defence Establishment at Biggin Hill in February, 1936, was followed by the attachment of Dr. Paris and a small staff to cooperate with Mr. Watson-Watt and his associates. Within the next few years the development by Dr. Paris and his assistants of equipment suitable for coast defence pointed the way to a solution of the problem of tracking aircraft which flew too low to be spotted by the ordinary C.H. stations.

There were, however, many difficulties tending to oppose a simultaneous advance along a number of divergent lines. Although much was common ground, each field of application raised technical problems peculiar to itself; and all demands could not be met by making one kind of equipment. The supply of specialists, facilities for experiment, and manufacturing resources were all limited by complex factors, of which the need for secrecy—important as it was—was only one. Accordingly some uses took precedence over others. Inevitably, first place went to the C.H. stations, not merely because they

had been first thought of, but also for the much better reason that long-range detection and location of aircraft offered the best chance of meeting the massed air attacks with which war seemed likely to begin. If measures particularly applicable to night air defence progressed more slowly, the reason was not solely that the need for them seemed less urgent, but also that they threatened to take longer to perfect. Other applications ranked still lower. But here, too, the working policy adopted in the period of evolution, rough and ready though it may have been, was broadly justified by subsequent events.

By 1938 the administrative burden thrown on Mr. Watson-Watt, or in his absence on Dr. Paris, had become so heavy as to call for changes which culminated in the establishment of a special directorate of the Air Ministry to supervise the project. Watson-Watt moved to the Air Ministry as head of the new organisation and was replaced at Bawdsey by Mr. A. P. Rowe, who had recently been added to the staff as Deputy Superintendent. Soon afterwards an inter-service Committee was set up to deal, amongst other matters, with the allotment of priorities for research, development and production. Until that time these difficult questions were settled largely on the direct advice of the small band of experts who alone had sufficient knowledge to weigh the issues. We have seen that, broadly, their policy was to put long-range detection and location of aircraft first. Consequently, as we shall see in later chapters, the C.H. stations were ready when the moment came, but a number of devices needed to counter the night bomber reached maturity too late to achieve much when they were most needed. Inevitably, that outcome led to some repinings. But on the assumption that a choice had to be made, the course adopted was certainly the right one. Had the decision been reversed—had completion of the C.H. stations been deferred while other and more complex devices were developed—it is as certain as such hypotheses can ever be that the Battle of Britain and perhaps the whole war would have been lost. It may be argued that the need for a choice ought not to have arisen. To find enough resources, and especially enough trained researchers, to pursue all lines of development at once would, however, have been extremely difficult even if money and foresight had been unlimited. In any case, the progress made during the sixty-six months which divided Watson-Watt's discovery from the beginning of heavy air attacks on the United Kingdom remains a feat that reflects much credit not only on those directly engaged in the experiments, but also on others who saw their value and made sure that funds were provided for them. Among those others was Lord Swinton, whom the need for secrecy debarred from publicly receiving credit for his foresight at the time of his resignation from the post of Secretary of State for Air in 1938.

(v)

In the meantime much had happened to show that a discovery which promised to revolutionise the possibilities of air defence had come none too soon. In the autumn of 1935 tension between Great Britain and Italy, arising from Italian aggression against Abyssinia, caused such alarm that the Government felt bound to take steps for the protection of Alexandria and Malta. Troops, ships, air forces and equipment were despatched there in such numbers as seriously to threaten security at home. Most of the anti-aircraft ammunition intended for home defence was shipped abroad; with it went nearly all the material normally available for the local seaward protection of home ports. The ability of the home defences to cope with a sudden threat was thus reduced to a level which, if the facts had become known, would have appalled the public, and perhaps not least those members of it who were most critical of the Government's rearmament proposals. Germany, too, showed no sign that Scheme C had induced her to modify her aims. The 'revisionist bloc' predicted in 1931 was now in being, and was growing daily stronger and more belligerent.

At the beginning of 1936 the hope that peace might yet be saved was strong. On the other hand, the likelihood that the air force and the Field Force might have to be used in war, not merely as weapons of diplomacy, was clearly greater than in 1934. The Government remained reluctant to commit the country to a long war on the Continent; but where the air force was concerned they applied the lesson. In February they sanctioned a new scheme of air expansion, far superior to those they had adopted earlier. As compared with Scheme C, Scheme F strengthened the first line of the home defence force only by substituting medium for light bombers and by minor changes in other fields, but had the great merit of making good provision for reserves.¹ To provide the necessary aircraft, the Government decided to apply forthwith—instead of waiting until the outbreak of war, as they had at first intended—a scheme for the production of aircraft and aero-engines in 'shadow factories' organised by some of the leading manufacturers of motor-cars. The types selected were Fairey Battle single-engined and Bristol Blenheim twin-engined bombers, and the Bristol Mercury VIII air-cooled engine. They were chosen because they promised to be comparatively easy to produce, but in other respects the first was not a happy choice. Whatever its merits when first designed, by 1936 the Battle had only a doubtful place in the front rank of medium bombers. A subsequent impression that the

¹ See footnote on p. 42.

specification—for which the Air Staff, not the designer, were of course responsible—was not a good one proved well founded in 1940, when squadrons equipped with the Battle suffered heavy casualties in France. The Blenheim, on the other hand, made a useful contribution in the early stages of the war, both in its original form and as a stop-gap long-range fighter. In general, Scheme F was a sound one, infinitely preferable to its predecessor, since it aimed at real strength in 1939 rather than a hollow pretence of strength in 1937.

Moreover, a great change was coming over the design of military aircraft, so that far better fighters and bombers than any yet in service were on the way. The fighters of 1936 were the Bristol Bulldog, the Gloster Gauntlet, the Hawker Demon and the Hawker Hart. All were biplanes, as was the newer Gloster Gladiator. In four or five years all except the Gladiator were to seem nearly as outmoded as the pennyfarthing bicycle. But in 1934 the Air Ministry had drawn up two specifications—modified in 1935—which contemplated a far higher standard of performance. While these specifications were in preparation Mr. R. T. Mitchell and Mr. Sidney Camm, employed respectively by Supermarine Limited and Hawker Aircraft Limited, had designed monoplane fighters—later called the Spitfire and the Hurricane—which reflected experience gained in the international Schneider Trophy contests and which embodied just those features now seen to be most desirable. In the spring of 1935 an officer from the Air Ministry, Squadron Leader R. S. Sorley, inspected 'mock-up' versions of both aircraft. He was so much impressed that he urged his superiors not to wait for the prototypes to be completed and tested

¹ The programme (with the Scheme C programme for comparison) was:

	<i>Scheme C</i>		<i>Scheme F</i>	
	<i>Squadrons</i>	<i>First Line</i>	<i>Squadrons</i>	<i>First Line</i>
METROPOLITAN AIR FORCE				
Heavy bombers	20	240	20	240
Medium bombers	18	216	48	750
Light bombers	30	360	—	—
Torpedo bombers	2	24	2	32
Fighters	35	420	30	420
Reconnaissance, etc.	18	252	24	294
	123	1,512	124	1,736
OVERSEAS	27	292	37	468
	150	1,804	161	2,204
FLEET AIR ARM	16½	213	26*	312*
RESERVES	£1,200,000 to provide immediate reserve		£50,000,000 to bring total reserves up to 225 per cent. of first-line strength	
<i>Date for completion</i>	31.3.37		31.3.39	

* Rising by 1942 to 40 squadrons, 504 aircraft.

before taking steps which would enable production to be started without delay and delivery to squadrons to begin next year. For reasons which seemed good at the time, the suggestion was not adopted; accordingly, a few Hurricanes and Spitfires took part in the fly-past of new aircraft at the Hendon Display in 1936, but the machines did not appear in squadrons until some two years later, and then only in numbers too small to affect the diplomatic struggle that led to Munich. Squadron Leader Sorley was, however, successful in urging that the new fighters should carry eight guns apiece instead of four. The specification met by the four-engined Short Stirling bomber was drawn up in the spring of 1936 and was followed by another on which were based the Avro Manchester (followed by the Lancaster) and the Handley-Page Halifax. Production of the Manchester, Stirling and Halifax began in earnest during the winter of 1938-39, although the machines did not go into active service until the early part of 1941.

In order to match the contemplated reserve of aircraft with a sufficiency of pilots, the Air Ministry obtained sanction in the summer of 1936 for the formation of a new body called the Royal Air Force Volunteer Reserve. Training of reservists began in the spring of 1937. At that time the establishment of the Regular Air Force, filled largely by short-service entrants, stood at 55,000 officers and men. The Regular establishment was backed by a small but enthusiastic Auxiliary Air Force, corresponding to the Territorial Army. Created in 1924, the Auxiliary Force had since absorbed the Special Reserve, set up in the same year and akin to the Militia.

The years from 1935 to 1937 were also notable for much-increased demands on the static elements of air defence. At the same time technical developments called for changes in their deployment.

In 1935 the Reorientation Committee necessarily based their recommendations on the same broad principles as had guided their forerunners. Thus they took over the main features of the Steel-Bartholomew and Romer plans, including the outer artillery zone.¹ Soon afterwards the coming of radar promised to extend the aircraft fighting zone to the coast and even out to sea. Henceforth there would be neither room nor urgent need for an artillery zone in front of it, although locally-defended areas would still be necessary at certain ports. Accordingly, in 1936 the outer artillery zone was abolished and its guns were freed for use elsewhere. The saving thus effected, was, however, more than offset by other requirements which soon compelled the War Office to enlarge their programme. Moreover, as the threat of war with Germany took shape, the need was felt for a more effective means of defence against low-flying aircraft than was

¹ See Map 3.

provided by the light automatic weapons already contemplated.¹ Apart from something in the nature of a two-pounder, which would certainly be required in the long run, balloons might make a useful contribution.

In the First World War balloon-aprons had been used for the defence of London, but their value was debatable. After the Armistice the prevailing opinion was that only balloons capable of lifting a stout cable which would almost certainly destroy an aircraft that collided with it were worth having. By 1936 many years of experiment had convinced the Air Staff that there was no immediate prospect of perfecting a balloon capable of taking such a cable to the 15,000 feet or more at which high-level bombers would fly in a future war. On the other hand, low-altitude balloons capable of flying at 5,000 feet, and thus seriously hampering or even preventing low-level bombing, were quite feasible. Accordingly, in the summer of that year the Committee of Imperial Defence approved the suggestion that a barrage comprising 450 balloons should be installed for the defence of London. We shall see that, by the time the London barrage became an accomplished fact, demands for barrages had arisen at many other places.

Meanwhile the problem of defence against low-level bombing was only one aspect of a much wider question. A limitation of the Reorientation Plan and its predecessors—indeed, one inherent in all arrangements which fall short of an overwhelming air supremacy scarcely attainable during the early stages of any war—was that it aimed at inflicting casualties on the attacker and forcing him to fly high in order to escape destruction, but did not interpose an impregnable wall between him and his objectives. Important assets like arsenals, stores and bridges, unless they lay within the locally defended zones already contemplated, or were separately defended, would still be open to attack by the inevitable proportion of raiders which penetrated the aircraft fighting zone. To furnish all such places with local defences in the shape of heavy and light anti-aircraft guns, balloons and searchlights was quite out of the question, since it would disperse the available resources far too widely, thus leading to universal weakness rather than universal strength. The problem of striking a balance between undue dispersal and undue concentration was, however, clearly one which called for closer study than had been possible while war was only a remote hypothesis.

After the Reorientation Committee had themselves drawn attention to this weakness, the matter was studied by the Home Defence

¹ At the time of the Reorientation Committee's report the establishment of an anti-aircraft battery comprised eight 3-inch guns and twelve Lewis guns; that of a searchlight company, twenty-four lights and twenty-four Lewis guns. Stage I of the Reorientation Scheme would thus give 780 Lewis guns, apart from those at ports; the full scheme about four times that number.

Committee. The inescapable conclusion was that nothing would suffice but a detailed reconnaissance of objectives whose claims to local defence deserved consideration. Clearly the first step was to draw up a list of such places, which included many industrial plants in private hands. Analogous duties with respect to places needing protection against sabotage were already performed by the Home Defence Committee. To their list of such 'vulnerable points' they now added a list of 'vital points' requiring protection from the air. It included such diverse objectives as factories, commercial oil installations, telegraph, telephone, wireless telegraph and cable systems, lighting and power plants, docks, mills, bridges and places where large quantities of food or other materials were stored, or would be stored in time of war.

In the summer of 1936 two inspecting officers (Brigadier E. H. Kelly and Air Commodore I. M. Bonham-Carter, later joined by Air Commodore A. J. G. Bird) began a lengthy tour by visiting twenty-five 'vital points' out of some two hundred already listed. They made a number of useful suggestions regarding the layout and structure of industrial buildings, the chances of confusing an attacker by means of camouflage and smoke-screens, and the most suitable organisation for passive air defence. They also recommended that light anti-aircraft guns should be installed at three objectives and balloon barrages at two. Clearly these recommendations were only a foretaste of demands which would inevitably assume vast proportions as their tour progressed and the list of claimants lengthened. Moreover, large numbers of light anti-aircraft weapons would be needed at places outside the scope of the list, such as aerodromes and naval and army depots, and perhaps also aboard merchant vessels. Meanwhile a review of the anti-aircraft problem in the light of the abolition of the outer artillery zone had raised the estimated requirement for heavy anti-aircraft guns and searchlights (including those at ports) to 608 and 2,547 respectively, as compared with the 544 and 2,334 envisaged in the Reorientation Plan of 1935.¹

In June, 1936, the Committee of Imperial Defence approved the

¹ The following table shows the proposed distribution as between the air defence scheme proper and defended ports, and recapitulates the corresponding arrangements under earlier schemes which took ports into account:

	<i>Steel- Bartholomew Plan*</i>		<i>Reorientation Plan†</i>		<i>1936 Review†</i>	
	<i>Guns</i>	<i>Lights</i>	<i>Guns</i>	<i>Lights</i>	<i>Guns</i>	<i>Lights</i>
Air Defence Scheme .	192	504	456	2,160	392‡	2,160
Defended Ports .	72	168	88	174	216	387§
	<u>264</u>	<u>672</u>	<u>544</u>	<u>2,334</u>	<u>608</u>	<u>2,547</u>

* Includes Thames and Medway defences in defended ports.

† Includes Thames and Medway defences in air defence scheme.

‡ Includes 160 guns in mobile pool.

§ Includes 35 lights in reserve.

review in principle; but the chances of giving effect to it seemed remote. Notwithstanding the limitations imposed in the previous year by the Government's decision to approve only a truncated version of the Reorientation Plan, the War Office contemplated forming by the end of 1936 about three-quarters of the Territorial air defence units needed for the full scheme, equipping them gradually on a scale suitable for training. In the meantime the whole resources of the country amounted to about sixty usable anti-aircraft guns and a hundred and twenty searchlights. If the hopes of the General Staff were realised, the units would be equipped on a training scale by the spring of 1937, but would still be anything from sixty to eighty per cent. short of their war scale. Moreover, the gunners would have nothing but the 3-inch anti-aircraft gun, a standard weapon since the First World War but now due for replacement. The War Office wished to order enough new guns of larger calibre to meet the scale of defence laid down in the review, but could hold out no prospect of their being ready before the financial year 1938-1939. In the meantime something could be done by continuing to modify the older guns; but the number of modified guns available in 1937 would be comparatively small. In any case, their efficacy was doubtful, especially as the shell they fired was not of the most modern type. Unless a fresh solution was forthcoming, the air defence formations would thus be short of weapons for at least two years to come, and such guns as they did possess would be admittedly imperfect.

No answer had been found when, in the autumn of 1936, a confidential statement by the German Government confirmed the Air Staff's view that the second stage of the German air expansion programme was drawing near completion. At the beginning of October the Luftwaffe could therefore be credited with the 114 squadrons predicted in 1934; but as their first-line strength was now put at nine machines instead of twelve, the total could be reckoned as roughly 1,100 instead of 1,368.¹ There seemed good reason to suppose that the further estimate of 1,500 aircraft in the spring of 1937 would also prove correct. Regarding the more distant future, the Air Staff had hitherto made no detailed forecast, although in the summer of 1934 they had predicted in general terms an ultimate intention to form 'three or even four air divisions', each presumably comparable with that foreshadowed in the first stage of the German programme. They now warned the Government that, in view of Germany's more or less openly avowed intention of seeking parity with Russia, and also in view of recent signs that training and production were being hastened, a progressive increase 'up to a figure of not less than 4,000 first-line aircraft' must be expected.

¹ See p. 27, footnote 1.

At the time of this announcement the first-line strength of the British metropolitan air force stood at 696 aircraft. It was due to rise to 1,736 aircraft on the completion of Scheme F in the spring of 1939. Plainly, parity had been lost and would not be regained without a much more drastic effort than the country seemed prepared for. With a view to putting a better complexion on the matter the Government considered a number of new programmes, but none held the field for long, or promised to make much difference to a situation which would depend in the long run on the ability of the aircraft industry and the Air Ministry to turn out machines and train crews to man them. In other words, the governing factor was the extent to which it seemed wise to divert to warlike ends the resources of a nation whose well-being was bound up with flourishing markets and sound trade.

In the meantime the Government had appointed Sir Thomas Inskip as Minister for Co-ordination of Defence. Pending a decision on the larger question, Sir Thomas invited the Reorientation Committee, which had remained in being under Dowding and was responsible for the recent review of the air defence scheme, to draw up a new scheme for the 'ideal' air defence of the United Kingdom, irrespective of conditions of supply.

As all past schemes had been conditioned by the knowledge that only meagre funds would be forthcoming, the new programme was inevitably far more ambitious than its predecessors. The Committee recommended in February, 1937, that the defended zone should be extended northwards to a point beyond Newcastle and widened to cover the West Riding of Yorkshire and the Midlands. They also asked for more guns and searchlights at defended areas still outside the continuously defended zone, and for new defended areas covering the Clyde, the Forth and Bristol. The numbers of fighter squadrons, heavy anti-aircraft guns and searchlights contemplated, as compared with those previously envisaged, were:

	<i>Modified Reorientation Plan¹</i>	<i>New Plan</i>
Fighter squadrons	30	45
Guns	608	1,264
Lights	2,547	4,700

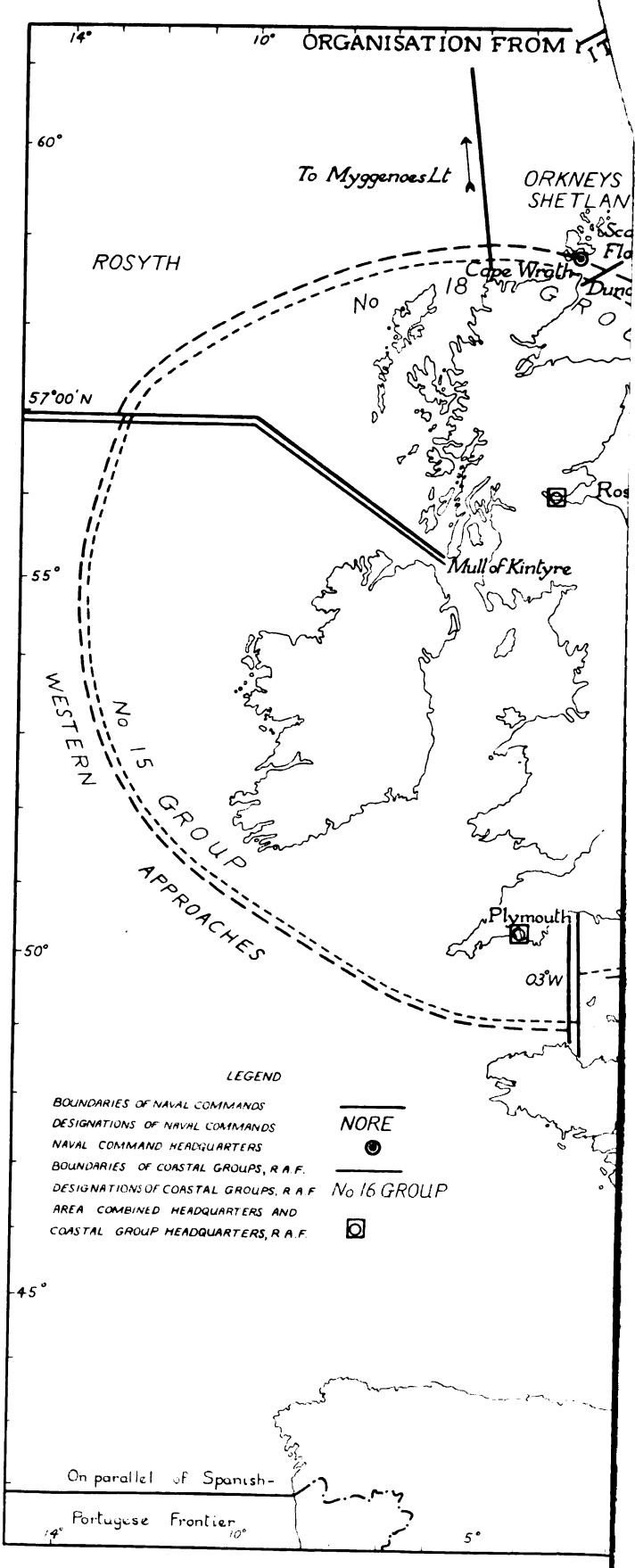
In addition, up to three hundred twin-barrelled pom-poms seemed likely to be needed for defence against low-flying aircraft, besides upwards of four hundred balloons for the London barrage and an indeterminate number elsewhere. To cover the new defended areas additional Observer Groups would be necessary.

¹ The Reorientation Plan as modified by Scheme F and the review of 1936.

Extension of the area covered by the Observer Corps was the cheapest and therefore the most readily accepted implication of the programme. The number of groups contemplated had already risen from sixteen to eighteen, new groups at Durham and Dunfermline having been sanctioned in 1936; and further additions to cover Bristol and the Clyde would present no major difficulty.¹ But the rest of the proposals raised tremendous problems. Even if no fighter squadrons were needed on the Continent, the number provided by Scheme F would fall fifteen short of the new estimate; and the War Office could hold out no hope of finding the proposed number of heavy anti-aircraft guns and searchlights earlier than 1941. Light anti-aircraft guns and balloons would make yet further and still unpredictable demands on manpower and material resources. Indeed, so far-reaching were the implications of the 'ideal' scheme that there was some doubt whether it ought to be accepted even with the reservations which that term embraced. It could be argued that a strengthened bomber force might be the better bargain. Supporters of that thesis could point to the long-considered view of the Air Staff that the bomber arm was the country's best protection and that purely defensive weapons should be kept to the essential minimum. But the real question was whether the 'ideal' scheme was not, as it was meant to be, that minimum.

In effect, the Committee of Imperial Defence gave their answer in the summer of 1937, when they approved the scheme in principle. Nine months later the German seizure of Austria underlined the threat to peace. Thereupon the Government made up their minds on the main issue by abandoning the rule that rearmament must not be allowed to interfere with normal trade. Soon afterwards they authorised the Air Ministry to order up to 12,000 aircraft for delivery by the spring of 1940, and, by accepting a new scheme of air expansion called Scheme L, committed themselves to an air force no longer designed to deter the potential enemy or match his strength, but to fight in face of odds.

¹ In the course of the year the number of groups authorised was raised to 35, including 13 to be established on a lower scale than the rest. Under the 1937 programme the only parts of the United Kingdom to be left entirely unobserved were Cornwall, western Wales, the Isle of Man, Northern Ireland and the Scottish Highlands. The programme was due for completion in 1941, but most of the area south and east of a line from Glasgow to Lyme Bay would be covered by 1939.



LEGEND

- BOUNDARIES OF NAVAL COMMANDS
- DESIGNATIONS OF NAVAL COMMANDS
- NAVAL COMMAND HEADQUARTERS
- BOUNDARIES OF COASTAL GROUPS, R.A.F.
- DESIGNATIONS OF COASTAL GROUPS, R.A.F.
- AREA COMBINED HEADQUARTERS AND COASTAL GROUP HEADQUARTERS, R.A.F.

NORE

No 16 GROUP

CHAPTER III

MARITIME DEFENCE

(1918-1939)

(i)

IN THE last two chapters we have seen that an unfinished scheme of air defence was the only home defence measure of positive importance undertaken during the period of retrenchment which followed the First World War; and that, when rearmament began in 1934, the government of the day rejected a balanced programme in order to make the air defences outwardly impressive. The fact remained that, while air attack was an unpleasant prospect, the British Isles could be effectively occupied only by seaborne troops. The way to military occupation might indeed be opened by air attack; but perhaps a greater danger was severance of the country's sea communications. Ultimately, as in the First World War, the submarine proved the biggest menace. But for some years the risk of underwater attack was under-estimated, partly because of the success achieved by the convoy system in the last year of the First World War, partly because too much reliance was placed on the device called asdic. Invented in 1917 and in some respects akin to radar, asdic was an apparatus emitting supersonic waves which travelled under water and were reflected by submerged objects such as submarines, whose presence was thus revealed to commanders of escort vessels or shore defences. In the outcome submarine commanders were able to reduce its effectiveness by skilful tactics.

For many years before and even after the First World War the defence of seaborne trade seems to have been generally regarded as a matter of interest only to naval experts. Thus it received little attention outside the Admiralty except on rare occasions when the whole fabric of national and Imperial defence was called in question. On the other hand the prospects of invasion, and measures calculated to avert the danger, were widely canvassed in governmental and official circles during the early part of the present century. Discussion revealed many differences on points of detail, but substantial agreement on broader issues. The fundamentals of the problem were found to have changed little since long-range guns were first installed in warships. In the sixteenth century when Spain was the adversary,

two centuries later in the Napoleonic Wars, and again when German naval expansion seemed to threaten invasion across the North Sea, British strategists agreed that the first line of defence must be the main fleet waiting at its war base, or cruising off the enemy's, to intercept his big ships if they put to sea. The advantages of a counter-offensive against his shore installations or fleets in harbour were admitted, but the circumstances which enabled Drake to 'sing the King of Spain's beard' in 1587 might not be repeated. On all three of the occasions cited, a subsidiary fleet was provided to engage the enemy's transports and any escort, short of the main fleet, which might sail with them. Again, on all three occasions a second line of defence was present in the shape of the coast defences, comprising on the one hand artillery on shore, on the other such local naval defences as the 'great Chayne for guarding of the Navye Royall' installed in 1588 at Upnor below Chatham, and the auxiliary patrols, anti-submarine booms and defensive minefields of modern times. The third line was the army, normally divided into forward elements stationed near the coast and a strategic reserve to be thrown in when the enemy had shown his hand. During the Napoleonic Wars and later the need for a third line of defence was sometimes questioned; but the arguments on the other side were strong. The case for the third line was well put by the Committee of Imperial Defence in 1908, when they pointed out that, even though naval supremacy could be assumed, the troops on shore must be sufficient in numbers and organisation not only to repel small raids, but to compel an enemy who contemplated invasion to come with so substantial a force as would make it impossible for him to evade our fleets.

In a broad sense, the defeat of Germany in 1918 did nothing to invalidate these principles. Conquest of the British Isles by airborne troops alone was perhaps conceivable as a distant prospect; but at least in the near future an invader would still need to bring the bulk of his men and gear by sea. The composition of his transport fleet would depend on the distance he had to come, and to some extent on the season chosen for the venture. In favourable conditions he might make the voyage with special landing-craft of shallow draught, either towed or self-propelled. These, however, would probably need to be followed by normal transports bringing the supplies required to consolidate the landing. An innovation particularly suitable for minor raids or diversionary attacks across the Narrow Waters might take the form of fast motor-boats, also of shallow draught, which would be difficult to intercept. On the other hand new weapons, including torpedo-bomber aircraft and improved warning devices, would doubtless be available to the defenders.

Accordingly there appeared good reason to hope that the well-tried system which had survived the technical advances of the

nineteenth century, if progressively modified to keep pace with new methods of attack, would suffice for many years to come. Developments in naval armament and armour since the beginning of the First World War would call for stronger fixed defences at important harbours liable to bombardment by armoured ships, new measures might be needed to deal with fast motor-boats, and aircraft—which had figured in coast-defence schemes for some years past—might be expected to occupy a more important place in future plans. Moreover, ports considered worth defending against attack from the sea would probably have to be defended against bombing also. But the old principle of three lines of defence seemed likely to hold good, if not for ever, then at least for many years.

Yet in the outcome the reshaping of the country's maritime defences made little progress before the middle of the 1930's. We have seen that in 1921 a suggestion that the air force should assume the chief responsibility for defence against invasion was soon dropped. Accordingly the burden continued to rest primarily on the navy, although there was no doubt that in war the other services would be expected to assist them. But whereas the army's task would clearly be to provide a home defence force, including guards for vulnerable points, and to equip and man the fixed defences and certain components of air defence, the contribution likely to be demanded of the air force had yet to be defined. Apart from the responsibility which it assumed in 1922 for air defence, the Air Ministry had the duty of providing squadrons needed for direct co-operation with the army, and for many years provided also those required by the Admiralty for service with the fleet. The Air Staff did not dispute the navy's claim to such assistance; but the means adopted for the purpose led to some dissatisfaction. While the issues thus called in question remained unsettled, it was perhaps inevitable that little practical attention should be paid to the important problem of the contribution that could be made to maritime defence by shore-based squadrons. Preoccupation with the air defence scheme may also have diverted attention from the matter.

But meanwhile a lack of shore-based squadrons for maritime defence did not prevent their theoretical potentialities from serving as a pretext for the neglect of other weapons. Soon after the Treaty of Washington had modified the relative naval strengths of the powers, the Admiralty drew up a new list of ports at home and abroad which ought, in their opinion, to be protected against a variety of dangers. Among the methods of attack to be guarded against were bombardment by capital ships and other warships; penetration or close approach by submarines, light surface craft, blockships and minelayers; air attack; assaults by landing-parties; and bombardment by cross-Channel guns. The list was not based

solely on the hypothesis of war with France, but envisaged the possibility of attack by any one of the four major naval powers. Besides upwards of forty places abroad it included some thirty in the United Kingdom and the Channel Islands, among them the principal naval bases at Portsmouth, Plymouth and Rosyth.

The views of the Admiralty were forthwith considered by a sub-committee of the Committee of Imperial Defence. Observing that more powerful weapons than the old 9·2-inch coast-defence gun would be needed at places liable to long-range bombardment by armoured ships 'unless or until this function can be relegated to aircraft or some other provision of a permanent nature can be made', the sub-committee recommended a variety of fixed defences, ranging from guns with a calibre of 12 or 15 inches and firing armour-piercing shells to a range of 40,000 yards, to light automatics capable of dealing with fast motor-boats. They also advocated local air defences, particularly against low-flying aircraft; infantry garrisons and mobile reserves to round up landing-parties; and measures of local naval defence, including offshore patrols by submarines and trawlers, mine-sweeping, booms, nets, detecting devices, smoke-screens, and an organisation for regulating traffic into defended ports, the whole supported by aircraft for reconnaissance and local counter-attack. Aircraft would be needed also as spotters for the fixed defences, but might be supplemented or in some cases replaced in that capacity by kite-balloons.

Outwardly at least, these recommendations embodied the agreed views of the experts nominated by their respective services, and could therefore be expected to command assent from all three of the ministries concerned. But in fact the memorandum which contained them had a stormy passage. Early in March, 1923, the Standing Defence Sub-Committee of the Committee of Imperial Defence dictated minor alterations which stressed the difficulty of laying down any general rule as to the need for long-range guns at places liable to bombardment by armoured ships. A few months later the Admiralty suggested two further amendments, one emphasising the limitations of the submarine as a defensive weapon, the other accepting a diminished standard of security at some ports liable to attack by cruisers. With the approval of the Standing Sub-Committee, these changes were incorporated in July. But the War Office, faced with a restricted budget, shrank from the prospect of heavy expenditure on the fixed defences, while the Air Staff were still not satisfied that the case for replacing guns by aircraft had been sympathetically considered. Accordingly, in December the newly-created Chiefs of Staff Committee asked the Committee of Imperial Defence to agree that the whole matter should be reopened in order that the respective staffs might consider what economies could be made by revising the

list of ports to be defended, and either altering the scales of defence at certain places or postponing their completion until a crisis became imminent. The Chiefs of Staff asked, too, that where home ports were concerned account should be taken of the help which might be given by such units of the home defence air force as happened to be stationed near them. Despite some obvious objections—for the home defence air force had responsibilities of its own, and neither aircraft which might be needed for other duties, nor paper schemes which promised security at the eleventh hour, were proper substitutes for the 'permanent works, established in quiet moments on sound principles' of Mahan's dictum—the Committee of Imperial Defence agreed in January, 1924, that further consideration should be given to these questions.

The effect was to postpone for many years an issue which might have been faced in 1922. In November, 1927, a fresh sub-committee, pointing out that 'air units will not normally be located specifically for the defence of ports' and that no special type of aircraft for maritime reconnaissance was in view, reported that fixed defences and measures of local naval defence and air defence on the lines suggested five years earlier were still required. In the same month they made detailed recommendations for the local defence of fifteen home ports on the hypothesis of war with France, and mentioned another twelve which either would or might be needed as naval harbours in time of war. Of the twenty-seven places listed, twenty-three seemed sufficiently important to justify the installation of 'adequate defences' in time of peace; for the other four only paper schemes were thought necessary until war broke out. As the outcome showed, with few exceptions adequate defences at the places proposed would be at least equally valuable if the potential enemy were not France but Germany.

In the circumstances envisaged, home ports seemed unlikely to be bombarded at long range by armoured ships. Accordingly no guns larger than 9.2-inch were recommended. The fixed defences proposed at the fifteen ports considered in the first instance, as compared with those existing, totalled:

	<i>Existing Totals</i>	<i>Proposed Totals</i>
12-inch guns	4	—
9.2-inch guns	55	35
6-inch guns	109	78
4.7-inch guns	41	13
4-inch guns	16	—
12-pounder guns	96	—
6-pounder guns	—	27
Lights	179	122

Thus the proposals involved a net decrease of no less than 168 guns, including 55 of 6-inch calibre or larger, and 57 lights. Nevertheless their financial implications were not such as to command ready support from authorities eager to save money. The initial cost of re-siting and modifying the guns was estimated at more than a million and a quarter pounds, and local naval defences would absorb the best part of another million. Against these figures could be set such sums as might accrue from the sale of abandoned sites and surplus armament. During the next twenty-seven months consideration of the needs of the remaining ports on the list brought the number of schemes to twenty-six and the estimated cost to rather more than two-and-a-half million pounds, these figures including about a million for local naval defences.¹

These schemes were only part of a more comprehensive series covering the Empire as a whole. In the aggregate the financial implications were formidable, especially as some ports abroad were liable to heavier attacks than those at home and therefore needed more far-reaching systems of defence. A notable example was Singapore, where the programme approved in 1928 included three 15-inch, four 9·2-inch and four 6-inch guns. Other obstacles were the assumption that there would be no major war for ten years, and the perennial controversy about the respective merits of aircraft and big guns. For all these reasons little was done within the next few years to implement the schemes. When the Shanghai incident of 1932 revealed the bankruptcy of a Far Eastern strategy not backed by secure bases, the Ministerial Committee appointed to examine the whole problem of coast defence were thus forced to acknowledge that 'the whole of the coast defences of the Empire at home and abroad are obsolete and out-ranged by the guns of a modern cruiser armed with 6-inch ordnance'. The plight of the home ports was substantially no better two years later, when the Defence Requirements Committee, naming Germany as the potential enemy, observed that the coast defences at home were 'completely out of date' and would have to be revised as Germany developed her sea-power.

¹ The places considered were:

1927: Berhaven; Portsmouth and Southampton; Plymouth; Harwich; the Thames; the Medway; the Forth; Milford Haven; the Mersey; the Humber; the Clyde; the Tyne; the Tees and Hartlepool; Lough Swilly; Queenstown. (Schemes 1-15.)

1929: Portland; Dover; Belfast; Swansea; Barry; Cardiff; Avonmouth and Newport. (Schemes 16-22.)

1930: Falmouth; Newhaven; Barrow-in-Furness; Scapa Flow.

The needs of the Tay and Aberdeen were also considered, but no defences were recommended. (Schemes 23-26 and Scheme 27.)

(ii)

When the Joint Oversea and Home Defence Sub-Committee of the Committee of Imperial Defence remarked in 1927 that air units would not 'normally be located specifically for the defence of ports', they were thinking mainly of attack from the air. But the observation was equally true of defence against attack by sea. Despite the claims advanced for aircraft as weapons of maritime defence, the air force was in no position to make a major contribution to that branch of strategy, except insofar as it provided a few squadrons for service with the navy.¹ Theoretically, the bomber force was equally capable of attacking objectives on sea or land; in practice, it was not adequately trained or organised for war at sea, and in any case was likely to be fully occupied with the offensive aspect of air defence and in providing such bomber-support as might be needed by the army. Moreover the air force lacked means of maritime reconnaissance from shore bases, and thus the power of locating hostile naval forces as an essential preliminary to their engagement by shore-based bombers. In 1934 the only shore-based flying units at the disposal of the command called Coastal Area—whose main task was the administration and training of Fleet Air Arm units—were four squadrons equipped with flying-boats. These might be used for maritime reconnaissance. But as radiolocation had not yet been invented, they were likely to be needed also for giving warning of impending air raids.

Expansion Scheme A, adopted in that year, proposed the addition of four general-purpose (later called general-reconnaissance) squadrons to the home-based air force; but the precise role of the new squadrons had yet to be determined. Under Expansion Scheme C, which followed in 1935, as also under Scheme F of 1936, the number rose to seven. With six flying-boat squadrons instead of four, the new Coastal Command which replaced Coastal Area in the latter year would thus have thirteen shore-based squadrons of its own. Two shore-based torpedo-bomber squadrons were also included in its establishment, but at that time were intended to go under Bomber Command in time of war. For the time being Coastal Command retained its predecessor's responsibilities towards the Fleet Air Arm, whose strength was fixed under the respective expansion schemes at 16½, 16½ and 26 squadrons, rising to 40 squadrons by 1942.

¹ When rearmament began in 1934 the Fleet Air Arm, as it was then called, comprised six fleet reconnaissance, fighter and torpedo-bomber squadrons in the carriers *Courageous* and *Glorious*, one torpedo-bomber squadron disembarked at Gosport, and four flights divided equally between the capital-ships and cruisers of the Home Fleet and cruisers based on overseas stations.

But much ground had yet to be covered before the organisation and functions of the new command were settled. An early scheme envisaged devolution to three groups responsible respectively for flying-boats, general-reconnaissance squadrons and training, besides the equivalent of a fourth group concerned with the Fleet Air Arm. A serious objection to such a purely functional arrangement was that, if either the flying-boats or the general-reconnaissance squadrons, or both, were used for maritime defence, the authorities in charge of them would need to be in close touch, and preferably in physical proximity, with the home commands of the navy at Plymouth, Portsmouth, Chatham and Rosyth.

For some time, however, the Air Ministry were unwilling to agree that maritime defence should necessarily have first call on the coastal squadrons. The strategic argument for their case was that, while in certain circumstances maritime defence might be the right task for the squadrons, in others they might be needed to swell the effort of the bomber force. Another reason for the Air Staff's attitude was that, as long as the status of the Fleet Air Arm remained a controversial issue, they were wary of concessions which might pave the way to annexation of the new command by another service.

As the threat of war with Germany took shape, the Air Staff's case became less tenable. Attempted invasion seemed unlikely, but attacks on seaborne trade were almost certain. That trade-defence would call for shore-based aircraft in substantial numbers, no matter how other phases of the air war might develop, could scarcely be denied. Somewhat paradoxically, the difficulty became less troublesome in the summer of 1937 when the Government, on the advice of the Minister for Co-ordination of Defence, decided to transfer the Fleet Air Arm, lock, stock and barrel, to the Admiralty. Apparently satisfied that their loss of what had long been a bone of contention would at least ensure their continued control of the coastal shore-based squadrons, the Air Staff had henceforward less reason to stand on principle, and grew more amenable to arguments founded on necessity. Thereafter understanding between Coastal Command and the navy became so close that when, in 1941, the course of the war required that the Admiralty should take operational control of the command, the change did little more than recognise an existing situation which had grown up with the active concurrence of both partners.

At the beginning of December, 1937, the Air Ministry agreed at last that the primary role of Coastal Command in war should be 'trade-protection, reconnaissance and co-operation with the Royal Navy'. Progress thereafter was reasonably rapid. Study of the problems likely to arise in a war with Germany, especially in the light of an exercise held that summer, showed that practical needs could best be met by organising the command on a geographical basis and

locating its group headquarters at places where naval, air and possibly also army commanders could control their respective forces from joint operations rooms with the help of integrated staffs. Apart from the Home Fleet and its ancillary forces, the naval organisation for maritime defence in home waters would consist of four commands. These were the Western Approaches Command (headquarters Plymouth); the Portsmouth Command (headquarters Portsmouth); the Nore Command (headquarters Chatham); and the Coast of Scotland or Rosyth Command (headquarters Rosyth).¹ The obvious locations for the headquarters of the three coastal groups at present contemplated were Plymouth, Chatham and Rosyth. The headquarters of the army Commanders-in-Chief—in time of war responsible to the Commander-in-Chief, Home Forces—could not conveniently be moved to the coast, but ultimately it was found sufficient that they should be represented by liaison officers. The name Area Combined Headquarters was coined for the joint centres ultimately set up.

The new system was tried out in a combined coast-defence and trade-protection exercise held in the summer of 1938. Temporary combined headquarters at Rosyth were shared by the local naval Commander-in-Chief and the Air Officer Commanding No. 18 Group—a future coastal group whose formation was anticipated for the purpose. Similarly at Chatham the Commander-in-Chief, The Nore, shared temporary combined headquarters with the Air Officer Commanding No. 16 Group—a coastal group already formed but based normally at Lee-on-Solent. Fortress Combined Headquarters (later called Combined Defence Headquarters) were established at the Forth, the Tyne, Harwich and the Thames and Medway to control the local defences at those places. For the purpose of the exercise, Headquarters, Coastal Command (in fact located also at Lee-on-Solent) were deemed to be 'near London', and Air Marshal Sir Frederick Bowhill, the Air Officer Commanding-in-Chief, issued orders to his groups from the Admiralty War Room in Whitehall. Naval and air forces which took part on the defending side included two cruisers and four destroyers (representing nine capital ships, fifteen six-inch cruisers and eight destroyer flotillas) under the ultimate control of the Deputy Chief of Naval Staff; eight general-reconnaissance squadrons (this category now including flying-boats) and two torpedo-bomber squadrons under Coastal Command; four fighter squadrons controlled by No. 11 (Fighter) Group at Uxbridge; and six coast-artillery co-operation aircraft for artillery reconnaissance. The attacking force comprised the bulk of the Home Fleet and the Fleet Air Arm. The exercise confirmed the usefulness of the integrated system, and Area Combined Headquarters were accordingly

¹ See Map 4. The map shows also the Orkney and Shetland Sub-Command (under a Flag Officer responsible to the Commander-in-Chief, Home Fleet).

established at Mount Batten (Plymouth), Chatham and Donibristle (Rosyth). Nos. 16 and 18 Group moved to Chatham and Donibristle respectively in November; in the following summer No. 15 Group, formed later than the others, took up its position at Mount Batten. Headquarters, Coastal Command, moved in August, 1939, from Lee-on-Solent to Northwood in Middlesex. As 'chief adviser to the Admiralty and Air Ministry on all home air operations involving naval co-operation', the Commander-in-Chief occupied a position of exceptional responsibility towards his own service and towards the navy.

Meanwhile detailed plans were taking shape. In devising them the Naval and Air Staffs had to reckon with two alternatives, namely war with Japan and Germany at the same time, or war with Germany alone. Here only the second need be considered. In the Admiralty's opinion Germany, with her small surface fleet, was unlikely to attempt invasion (though the risk of small raids could never be entirely excluded), but extremely likely to attack the seaborne trade on which the British Isles depended for a great part of their sustenance. Apart from the risk of air attack and mining, attacks on seaborne trade might be made by submarines or surface raiders, or by both, and might or might not be restricted by considerations of humanity and international law. The Naval Staff believed that submarines were the lesser danger, for a system of convoys escorted by aircraft and by ships equipped with asdic was expected to go far to make them ineffective. If unrestricted attacks by submarines began, such a system would be at once put into force. Ships bound for the United Kingdom would be formed into groups at distant ports, and on entering the danger area would be met by escorts. Outgoing traffic would leave in convoy, but the convoys would break up south of Ireland. In addition, local convoys would be run between United Kingdom ports. In 1937 the forces needed for convoy escort were estimated at seven special anti-aircraft vessels, 107 escort vessels of various kinds and 165 shore-based aircraft. Before the introduction of the convoy system, or if it proved unnecessary, the aircraft would co-operate with ships in a general offensive against submarines.

The Admiralty's biggest fear, however, was lest surface raiders, which might be either warships or converted merchantmen, should break out of the Narrow Waters. Having once gained the Atlantic, they could be rounded up only by an extravagant dispersal of naval effort, and meanwhile might do an immense amount of damage. Accordingly the Naval and Air Staffs were much exercised by the problem of preventing such excursions. The main features of the system they devised were a minefield and a system of naval patrols covering the southern exit from the North Sea through the Straits of Dover, coupled with measures designed to block the wider exit to the

north. For the second and more difficult task they relied mainly on air reconnaissance, supplemented by submarine patrols to cover an area which existing general-reconnaissance aircraft could not reach.

The number of shore-based aircraft needed to maintain daylight patrols over the North Sea between Scotland and Norway was estimated at 84, and another twelve were required for co-operation with the naval Northern Patrol designed to control the passage of contraband through the waters between Iceland and the Faeroes. The total number of shore-based aircraft needed for maritime defence was thus 261. The nominal establishment of Coastal Command on the eve of the war (including torpedo-bomber squadrons) was only three short of that figure, although in practice the average number available for active use during the first fortnight of hostilities was about 170. And a substantial deficiency in escort vessels could be expected in the early stages of the war if the convoy system was put into effect at once.

An easily foreseeable weakness of the scheme was the short range of the Anson aircraft with which most of the general-reconnaissance squadrons were equipped. In many ways an admirable machine, the Anson was limited to an effective radius of about 250 miles, and could carry only a small bomb-load. The more modern aircraft intended to replace it were not yet ready. In the summer of 1938 the Air Ministry found a substitute with about twice the effective range and five times the bomb-load of the Anson in the American Lockheed B.14, known in the United Kingdom as the Hudson. Re-equipment of the general-reconnaissance squadrons with the Hudson began in 1939, but by September only one of them had its new aircraft. Hence some time was likely to elapse before the submarines temporarily included in the system of North Sea reconnaissance could be replaced by aircraft. In the flying-boat squadrons, too, the modern Sunderland was only just beginning to replace the older London and Stranraer; while the shore-based torpedo-bomber squadrons had nothing but the Vildebeeste IV, an obsolescent aircraft with a cruising-speed of only eighty knots.

In due course experience revealed other weaknesses in the maritime defences; but most of them will be more conveniently discussed in later chapters. One important shortcoming was, however, evident well before the outbreak of war and calls accordingly for mention here. This was the absence of adequate protection for merchant shipping against air attack. By diverting a proportion of traffic from the East Coast to the West, where German bombers were less likely to penetrate, the Admiralty hoped to reduce the danger. But complete diversion was impossible. Even if all ocean traffic were taken to the West Coast, local coastwise traffic to the East Coast ports, including

London, would still be necessary to avoid an intolerable strain on the railways. Anti-aircraft fire from escort vessels, although a method much favoured by the Admiralty, could never give complete protection; while aircraft of Coastal Command assigned to convoy-escort would be busy searching for submarines ahead of the ships they were guarding and could not be expected to deal with bombers too. If convoy was not in force, machines engaged in a general offensive against submarines would be in a still less favourable position to guard individual vessels from air attack. Arming of all merchant ships with short-range anti-aircraft weapons was an ideal which could not be realised until many more such weapons had been produced, and even then would not protect them against high-level bombing. An inter-service committee appointed to consider a rather different aspect of bombing at sea thus pointed to a very real danger when they warned the Government early in 1939 that the problem of defending merchant shipping was still unsolved.

The Committee of Imperial Defence responded by suggesting more drastic diversion of traffic to West Coast ports; but about a month before the outbreak of war they went further by sanctioning the formation of four long-range fighter squadrons for the express purpose of escorting shipping in particularly dangerous areas between Southampton and the Forth. On grounds of expediency rather than of principle, the Air Ministry proposed to allot them, not to Coastal Command as the air formation normally concerned with shipping, but to Fighter Command as that concerned with fighters. The innovation was unlikely to appeal to Fighter Command, whose organisation and methods of control were largely designed for the very purpose of avoiding the standing patrols which shipping escort would entail. The 'trade-protection squadrons', as they were called, were not expected to be ready before 1940. In practice the seriousness of the threat to shipping forced the Air Ministry to form them in October, 1939. They were equipped with Blenheims.

A radical weakness of the trade-protection squadrons was that they were inadequate in numbers and equipment for the task in view. When war began, experience soon showed that by far the most acceptable safeguard for ships in coastal waters was that given by single-engined fighters, whose employment for such a purpose had not at first been seriously contemplated. Originally Fighter Command's province ended some five miles from the coast, for beyond that distance pilots could not count on hearing orders from the stations which normally controlled their movements. In 1939 and 1940 the gradual replacement of existing radio equipment by new sets of longer range extended the distance to about forty miles. We shall see in later chapters that, as the war went on, the fighter force found itself charged with an unlooked-for and by no means welcome

responsibility towards shipping within that limit, often in defiance of its cherished principle that standing patrols were to be avoided.

(iii)

Meanwhile the naming of Germany as the 'ultimate potential enemy' had aroused the long-dormant problem of the coast defences. Observing in 1934 that, with few exceptions, 'the gun defences of the Empire have not been modernised for nearly thirty years', the Defence Requirements Committee put the sum required to make the fixed defences of home ports reasonably efficient at approximately four million pounds—more than twice the estimates of 1927–1930. In view of Germany's small surface strength they did not suggest that the whole amount should be spent at once, but recommended a modest annual expenditure of a hundred thousand pounds for the next five years. In their opinion the first essential was to make the existing armament fit for war and to complete the close defence of the main naval ports and the Thames. More drastic changes, designed to furnish North Sea ports with effective counter-bombardment weapons, could follow later. On the other hand they attached great importance to the early provision of local naval defences, particularly against submarines. Their view was that 'as regards our home ports, it would be folly, in view of a probable development of the German navy, to leave places of such immense importance without any seaward defences whatever and completely open to submarine attack'. To meet this need at fifteen of the most important places at home and abroad they proposed an annual expenditure of £125,000 for the next five years.

In the outcome, financial limitations mutilated these proposals, and led in 1940 to improvisations undertaken in conditions far removed from the studious atmosphere conducive to prudent investment in weapons designed to serve a long-term purpose. On the advice of the Ministerial Committee which examined the Defence Requirement Committee's report, the allotment to the fixed defences was cut down by three-quarters. Consequently the efforts of the authorities concerned with coast defence were largely devoted, during the remaining years of peace, to the preparation of local naval defence schemes and the provision—within the means available—of equipment needed to give effect to them. Little could be done for the fixed defences except to put them into a position to fight with their existing armament, and if necessary with old-fashioned ammunition.

When the Defence Requirements Committee made their report in 1934, preparation of a new series of schemes, superseding those of 1927–1930, had recently begun. The process continued up to and

after the outbreak of war. In August, 1939, the ports at which defences were considered necessary numbered twenty-eight, as compared with the twenty-six of 1927-1930; but a number in Eire were no longer included in the list, the right to fortify and use them having been renounced. At nineteen of the twenty-eight, installation of the defences in time of peace was planned at least in theory; at the other nine—of which four might not have to be defended—installation after the outbreak of war was deemed sufficient.¹ The unlikelihood that local seaward defences could in fact be perfected in peacetime was acknowledged; it was recognised that practical considerations would probably prevent the finishing touches from being given at most places until war was declared. Before discussing the outcome, we must turn to the progress made meanwhile in other branches of home defence.

¹ The ports listed in August, 1939, were:

Category A (defences to be installed in time of peace)

- (a) *Covered by Schemes prepared 1933-1938.* The Forth; the Tyne (interim scheme); the Tees and Hartlepool; the Humber (interim scheme); Harwich (interim scheme); the Thames and Medway; Dover; Portland; Plymouth; the Clyde; Belfast (interim scheme).
- (b) *Covered by Schemes in preparation or under revision.* Scapa Flow; Invergordon; Portsmouth and Southampton; Swansea; Milford Haven; the Mersey; Falmouth; Cardiff and Barry.

Category C (defences to be installed after outbreak of war)

- (c) *Covered by Scheme prepared in 1936.* Newhaven.
- (d) *No modern Schemes prepared.* Blyth; Sunderland; Yarmouth; Avonmouth*; Newport*; Barrow-in-Furness; Lerwick*; Dundee*.

There were no Category B ports.

* Removal from list under consideration.

CHAPTER IV

THE EVE OF THE WAR

(1938-1939)

(i)

WE LEFT the air defences at the point where the Government, abandoning the principle of 'business as usual,' authorised the Air Ministry to order virtually all the aircraft they could get. On the assumption that financial considerations could be disregarded, the maximum output of the aircraft industry, working on double shifts, was estimated in the spring of 1938 at 4,000 machines by April, 1939, and 8,000 in the following twelve months. More could not be expected from factories long starved of orders, and even in 1938 employing little more than a quarter of the hands employed at the height of the First World War, when aircraft could be built with about one-tenth of the effort now required.

Scheme L of 1938 was designed to provide 73 bomber and 38 fighter squadrons by the spring of 1940. The full programme was:

	<i>Squadrons</i>	<i>First Line</i>
METROPOLITAN AIR FORCE		
Heavy bombers	47	752
Medium bombers	26	600
Fighters	38	608
Reconnaissance, etc.	30	413
	141	2,373
OVERSEAS	39	490
	180	2,863

Reserves would be provided for fighter and general-reconnaissance (including flying-boat) squadrons on a scale designed to cover sixteen weeks' wastage in time of war, and for other squadrons on a scale designed to cover nine weeks' wastage. The establishments of bomber, fighter and general-reconnaissance (other than flying-boat) squadrons were made substantially larger than those contemplated in Scheme F, so that (for example) the addition of only eight squadrons to the fighter force increased its nominal first-line strength by nearly one-half. While the fighter force would undoubtedly gain in

staying-power if these additions were made good, its squadrons would not normally go into action with more than twelve aircraft at a time.

The strength and weakness of the new scheme can be summed up very briefly. On the one hand, it promised to make good use of a limited industrial capacity, though a possible criticism is that too much emphasis was laid on bombers, which took a relatively long time to produce and which would be less valuable at the outset of a war than the fighters needed to secure the base. On the other hand, it would give in two years' time only about three-quarters of the fighter squadrons needed for the 'ideal' programme, and only about the same bomber strength as Germany was expected to achieve within the next few months.

These shortcomings were the more disturbing since other components of the air defence scheme threatened to fall far short of requirements. In 1936 the War Office had warned the Government of the long time that must elapse before their new 4.5-inch and 3.7-inch anti-aircraft guns were ready. In 1938 the guns were beginning to arrive, but shortages of skilled labour and materials gave little hope that output could be accelerated. The reconditioned 3-inch guns, with their rather old-fashioned ammunition, were scarcely fit to cope with modern aircraft, and even they were none too plentiful. That Scheme L 'fell below the level of safety' which they thought necessary was, indeed, quite clear to the Air Staff; nor could the Government deny that attempts to achieve parity with the German air force had failed.

In retrospect an increase in the fighter force at the expense of the heavy bomber squadrons may seem an obvious solution. But in the early part of 1938 that course would not have appealed to the Air Staff. Their faith in bombing had survived the replacement, as the hypothetical aggressor, of France—whose aircraft factories, conveniently clustered near Paris, might have made good targets—by the less accessible enemy beyond the Rhine. Admittedly German heavy industry was concentrated in the Ruhr, which even medium bombers could reach from forward bases. But would such attacks on the Ruhr as the British bomber force could make within the next few years be an effective answer to a knock-out blow on London? And would such attacks be possible at all if the base was not more securely guarded than it promised to be under the existing programme?

The shortcomings of British air power were much in the minds of statesmen while Scheme L was current, and in the spring of 1938 some of them were freely ventilated in Press and Parliament. At the same time, measures of maritime defence were a long way from completion, and British participation in a land campaign to secure the integrity of the Low Countries was still uncertain.

To the German Government, who had incurred no penalty two

years before by remilitarising the Rhineland in defiance of the Treaty of Versailles, conditions may have seemed ripe for a display of power. In the spring of 1938 their troops marched into Austria; thereafter they advanced a claim to parts of Czechoslovakia whose population was predominantly German, but whose loss would strike at the root of the strategic plan by which France and her Eastern European Allies hoped to check the eastward expansion of the potential enemy. In the autumn the German attitude became so threatening that the British Government ordered an emergency deployment of a great part of the home defences.

The deployment was not a full-dress rehearsal for mobilisation. Neither a state of hostilities nor the 'precautionary period' for which the various departments of State had drawn up plans was deemed to have begun. In some respects conditions were less favourable for rapid moves of units than they might have been if emergency measures had been applied more widely. Nevertheless the experience provided a convincing demonstration of unreadiness for war. In Fighter Command twenty-nine fighter squadrons were reckoned mobilisable, but only five of them had modern aircraft. Even those five were incapable of fighting at high altitudes, for their guns had not yet been modified to work above 15,000 feet. There were also five squadrons of Gladiators, old-fashioned in appearance and no match for modern fighters, but capable of engaging bombers. The rest of the fighter squadrons had obsolete or obsolescent aircraft.¹ There were no stored reserves of fighter aircraft; immediate reserves with squadrons and in workshops amounted to about two-fifths of first-line strength. The radar chain gave partial cover only between the Wash and Dungeness, communications were incomplete, and the whole command was dependent on radio equipment much inferior to that which replaced it in 1939 and 1940. The London balloon-barrage was only about one-third ready—142 balloons were deployed towards an establishment of 450—and its deployment raised many problems, not all of which had been foreseen. The state of the anti-aircraft and searchlight formations was still worse. Nearly 50,000 Territorials joined the air defence and coast defence formations when summoned, but only about one-third of the anti-aircraft guns and lights proposed by the Reorientation Committee in 1937 were available. Some of them were not in working order or were accompanied by unsuitable ammunition or equipment. The majority of the guns were of the obsolescent 3-inch pattern, some fifty 3·7-inch and no 4·5-inch pieces being ready. Arrangements for billeting and the issue of stores left much to be desired. Measures of Civil Defence were hampered,

¹ The 29 squadrons were equipped as follows: Hurricane 5, Gladiator 5, Fury 3, Gauntlet 9, Demon 7.

according to the Air Raid Precautions Department of the Home Office, by undue regard for secrecy.

Arrangements for maritime defence were also far from satisfactory. Whereas the navy mobilised, the air force did not; and of the twelve squadrons of Coastal Command considered fit for active service, eight had to move over an average distance of 270 miles without the benefit of war establishments. Only the help of naval and army reservists, and of officers' wives who were hastily pressed into service and had to be taught by officers with too much to do already, made it possible to maintain communications for the brief period of the crisis. Again, a lack of spares would soon have kept some squadrons on the ground if the emergency had been prolonged. Destroyers and escort vessels were scarce, trawlers needed for minesweeping could not have been made ready for action in less than three weeks, the coast defences at several naval ports were manifestly inadequate and much of the berthing space at Rosyth was silted up, as were the naval harbours at Dover and Harwich. Despite the lesson of the Shanghai incident, stocks of oil fuel at home and abroad were still unprotected; and lack of storage space compelled the navy to disperse its reserves of ammunition largely in ships and trains. On the other side of the account, German naval strength was low but the much-feared Luftwaffe had a thousand serviceable bombers.¹

The crisis was ended by negotiations culminating in the Munich agreement, whereby France and Great Britain purchased a respite at the cost of some thirty Czech divisions. Notwithstanding the reassuring words with which the Prime Minister returned from Munich, preparations for war were afterwards conducted with new energy. In the sphere of maritime defence, steps were taken to ensure concurrent mobilisation of the navy and the air force; the system of operational control through Area Combined Headquarters was elaborated; and

¹ The following table shows establishments and strengths of Luftwaffe units on 26th September, 1938, and the numbers of serviceable aircraft and operational crews at their disposal:

	Aircraft			Operational Crews		
	Estab- lishment	Strength	Service- able	Total	Fully Trained	Partly Trained
Bombers	1,220	1,128	1,040	1,171	744	427
Dive-bombers . . .	235	226	220	251	118	133
Ground-attack . . .	195	195	182	192	185	7
Fighters	985	773	738	883	705	178
Long-range reconnaissance . . .	228	222	206	212	145	61
Tactical reconnaissance . . .	303	291	270	311	184	127
Coastal	180	164	149	138	74	64
	<u>3,346</u>	<u>2,999</u>	<u>2,805</u>	<u>3,158</u>	<u>2,155</u>	<u>997</u>
Transport	362	308	299	357	289	67
	<u>3,708</u>	<u>3,307</u>	<u>3,104</u>	<u>3,515</u>	<u>2,444</u>	<u>1,064</u>

the finishing touches were put to plans for trade-defence and maritime reconnaissance. If physical resources dictated the extent to which shortages of vessels, aircraft and equipment could be made good, at least the crisis ensured that the deficiencies which it revealed would not be overlooked. By the beginning of September, 1939, the strength of Coastal Command had risen to nineteen squadrons (including three torpedo-bomber squadrons), of which sixteen were fit for active service. Apart from the limited range of the Anson, a weakness of the general-reconnaissance squadrons was their lack of an effective means of sinking any submarines they might detect. Meanwhile the Admiralty had done their best to ensure that in 1939 shortages of escort vessels, minesweepers and the like—though in the outcome serious enough—would be less glaring than in 1938.

Among shortcomings not revealed by the crisis, one of the most notable was in the provision made for taking and interpreting air photographs as a source of information about the enemy's dispositions and intentions. In general, air photography was regarded as a normal function of bomber and general-reconnaissance squadrons; and the difficulty which such squadrons would have in photographing hostile territory in time of war was underestimated. Ultimately the problem was solved by equipping a special Photographic Reconnaissance Unit (formerly the Photographic Development Unit) with fast, high-flying aircraft of fighter type. The ancestor of the unit was a small and highly secret flight set up for a special purpose in the early part of 1939, when its flying personnel comprised two pilots. Again, by the summer of 1939 both Bomber Command and the Air Ministry had staffs for the interpretation of air photographs—a task performed until the spring of 1938 exclusively by the army. But they proved incapable of getting the best out of the relatively small-scale photographs taken from great altitudes by high-performance aircraft. A commercial firm, the Aircraft Operating Company Limited, was able to fill the gap, and after the outbreak of war the solution was found in a forced marriage between service and civilian experts. Thus a window was opened on German preparations for invasion—and much else besides—in time for the events of 1940.

Where the air defences were concerned the lesson of the crisis was unmistakable, especially at a time when a 'knock-out blow' seemed likely to be attempted at the beginning of a war, and perhaps before war was declared. Whether the Air Staff were right or wrong in thinking that the bomber force could make a useful contribution to defence in the first few years of war, it would have no chance of doing so if the defences proper were too weak to avert defeat before a counter-blow could be delivered.

Accordingly in the autumn of 1938 Sir Kingsley Wood, who in May had succeeded Lord Swinton as Secretary of State for Air,

announced, with the approval and on the advice of the Minister for Co-ordination of Defence, that henceforth priority would go to fighters. Additional aircraft were needed both to strengthen the first line and to provide against losses to be expected at the outset. The new policy was reflected in Scheme M, which followed (but did not supersede) Scheme L in November. The scheme aimed at a metropolitan air force of fifty fighter and eighty-five bomber squadrons, the ratio of fighters to bombers thus rising from roughly 1 : 2 to 1 : 1·7. At the same time the hitting-power of the bomber force would be increased by equipment throughout with heavy bombers.¹ But Scheme M was intended for completion in 1942, when faster fighters and bigger bombers than those now coming into service could be expected. Meanwhile the aim was to build a fighter force which would be ready for action by the spring of 1939, and twelve months later would be backed by strong reserves. Its main strength would lie in the Spitfire and the Hurricane, whose good performance and eight-gun armament promised excellent results against the virtually unarmoured and lightly-armed German bombers then in view. Much was expected, too, of the Defiant, a new two-seater single-engined monoplane which ultimately proved disappointing.

But equipment of the entire fighter force with Hurricanes and Spitfires was not feasible, for it would have absorbed the whole output of those aircraft and have left no margin for reserves. As a make-shift measure the Air Ministry decided, therefore, to adapt a number of Blenheim bombers as fighters and equip at least three and possibly ten squadrons with them. The Blenheim was chosen not so much on merits as because it was one of the two types produced in the shadow factories, and was therefore available in substantial numbers. Yet it was by no means a bad choice, especially as it provided experience which proved invaluable when more advanced twin-engined aircraft came into service as night-fighters. Fighter Command was also strengthened during the last year of peace by transfer and re-equipment of a number of Auxiliary squadrons formerly in Bomber Command—a process begun on a much smaller scale some years before.

¹ The new programme (with Scheme L for comparison) was:

	<i>Scheme L</i>		<i>Scheme M</i>	
	<i>Squadrons</i>	<i>First Line</i>	<i>Squadrons</i>	<i>First Line</i>
METROPOLITAN AIR FORCE				
Heavy bombers	47	752	85	1,360
Medium bombers	26	600	—	—
Fighters	38	608	50	800
Reconnaissance, etc. . . .	30	413	28	389
	141	2,373	163	2,549
OVERSEAS	39	490	49	636
	180	2,863	212	3,185

In the outcome the Auxiliary fighter squadrons, recruited mainly in large towns and cities, proved strikingly successful.

Two further reforms were the creation of an organisation for the salvage and repair of damaged aircraft, and the establishment of Group Pools (later called Operational Training Units) whose task was to relieve first-line squadrons of part of the burden of preparing qualified but untried pilots for active service, and to provide a reservoir from which casualties could be replaced. Six repair depots were set up in various parts of the United Kingdom, so that aircraft requiring major overhaul or reconstruction no longer had to be returned to the manufacturer. The first Group Pool in Fighter Command began to function in the spring of 1939.

The new sense of urgency created by the Munich crisis was felt throughout the country and not least in the aircraft factories. Output of Hurricanes and Spitfires rose sharply towards the end of 1938 and in the early part of 1939, when it exceeded the predicted figure by about a quarter. By the summer of 1939 a reserve of two hundred modern fighters had been assembled—a number insufficient to dispel anxiety, but one which held out some hope that before long the gap between resources and probable wastage might be bridged. By that time about the same number of Volunteer Reserve pilots had completed their flying training, although they still had to go through the Group Pool or its equivalent before they would be fit for active service. In the sphere of passive defence, too, good progress was made, especially after the appointment of Sir John Anderson as Lord Privy Seal and, in effect, full-time Minister for Civil Defence. Before the crisis half a million citizens had volunteered as air-raid wardens and the like; in the next few months the number doubled. About thirty-five million respirators distributed to civilians in September, 1938, were left in their hands and checked by a series of house-to-house visits, since to call them in would have meant depriving the public of them for six months while they were being overhauled and disinfected. Again, by the spring of 1939, 570 heavy anti-aircraft guns and nearly 2,000 searchlights were ready for deployment within two days—a considerable improvement over the numbers available six months before. On the other hand, the communications needed for the safe working of the air defence system in time of war were by no means complete, only about two-thirds of the planned radar stations and Observer Groups were ready, and shortages of trained operators and satisfactory equipment would still have hampered deployment of the London balloon-barrage if war had come in the spring or early summer.

Meanwhile new factors had carried demands on the air defences beyond even the 'ideal' plan of 1937. In the spring of 1939 the Admiralty informed the Home Defence Committee of their intention

to use both Scapa Flow and Rosyth as bases for the Home Fleet when war broke out. According to the accepted view, the fleet was capable of defending itself against air attack, whether in harbour or at sea; but the tankers, store-ships and other facilities on which its efficiency depended were not so fortunate. Hence the experts estimated that twenty-four heavy anti-aircraft guns would be needed for the defence of Scapa in place of the eight previously allotted to it as a 'naval port of secondary importance'; and a plan was made to station two home-defence fighter squadrons at Wick, on the mainland about fifteen miles distant. Pending the planned extension of the radar chain to the Orkneys, a temporary C.H. station was moved there from Ravenscar in Yorkshire. A fighter squadron and twenty-four guns were allotted to Belfast. These changes, with others which included plans for a mobile reserve of heavy guns and a reduction in the number of searchlights, brought the approved programme to that shown in the second column below.

	<i>'Ideal' Plan</i>	<i>1939 Plan</i>
Fighter squadrons	45	53 ¹
Heavy guns	1,264	2,232
Light guns (barrels) . . . . .	...	2,000 ²
Searchlights	4,700	4,128
Balloons . . . . .	...	1,450

Of the balloons, 450 were for London and the remaining thousand for provincial barrages. Of the heavy guns, 168 were allotted to a mobile pool, the same number to a strategic reserve and 128 to aerodromes, leaving 1,768 to be divided between London, the leading industrial centres and the chief ports. The number allotted to London and the Thames and Medway defended area on its eastern outskirts was 480, or rather more than a quarter of that figure. Elsewhere the most heavily defended areas were to be Birmingham; the Mersey; the Forth; the Tyne, Tees and Sunderland; Portsmouth and Southampton; the Humber and Grimsby; and Glasgow with its outskirts. Nearly a third of the light guns were allotted to mobile and new requirements reserves, the rest divided in various proportions between factories and other civil objectives, naval, army and air force establishments (aerodromes claiming a big share) and railway junctions. Allotments of light guns were largely academic, since nothing like the number of pieces involved seemed likely to be available for several years.

To the allotment of the fighter squadrons we must now turn.

¹ Excludes the 4 trade-protection squadrons approved in August, 1939.

² Includes 140 allotted to a War and Maintenance Reserve, leaving a net figure of 1,860 for Air Defence of Great Britain.

(ii)

The problem of the hypothetical Expeditionary Force and its concomitants impinged at several points on those of home defence. On the one hand a strong force in France or the Low Countries might, and probably would, contribute substantially to the safety of the United Kingdom; on the other, units sent there would be drawn, at least in the first instance, from those otherwise available at home. For the army the issue was comparatively simple, since invasion was held to be unlikely. Hence presumably a large number of well-equipped divisions would not be needed at home in any case. For the air force the problem was more complex. Successive Air Expansion Schemes provided Army Co-operation squadrons for tactical reconnaissance, and did not exclude the despatch of other squadrons across the Channel for purposes which might include support to troops. The fact remained that any fighter or bomber squadrons assigned to the support of an army on the Continent would diminish the number available at home for pure defence or for 'strategic' bombing.

Until the spring of 1939 the Government were reluctant to commit the country to a land war in Europe, and accordingly refused to sanction unrestricted staff talks with Continental powers. In April, 1938, they agreed, however, to 'low level' conversations between British and French officers, primarily for the purpose of exchanging information about air matters. In deference to French wishes, they conceded that naval topics and the possibility of sending an Expeditionary Force to France should not be excluded, on condition that the talks did not take place at a higher level than that of the service attachés. The outcome was a tentative plan for the despatch of two infantry divisions and an Advanced Air Striking Force of either ten or twenty bomber squadrons. The role of the bombers would be a 'strategic' offensive against Germany, rather than direct support for the still hypothetical two divisions.

Soon afterwards the virtual loss of some thirty Czech divisions in consequence of the Munich Agreement left France unwilling to bear the brunt of a war on land unless assured that a substantial British army would cross the Channel as soon as hostilities began. Should France collapse, or fall out for lack of such support, a British strategy based on access to the Channel ports and French aerodromes would have to be discarded. During the next few months the case for 'full-dress' staff talks thus became extremely strong. It was further strengthened in March, 1939, when German troops crossed the frontier of the diminished Czechoslovakia under cover of a demonstration by the German air force over Prague.

Accordingly a new series of talks, conducted on the British side by

the Joint Planning Sub-Committee of the Chiefs of Staff Committee, and later by the Permanent Military Advisers (Designate) to the projected Franco-British Supreme War Council, began in London on 29th March. In due course the delegates agreed that four British divisions, instead of the two first proposed, should go to France as soon as war began, and that if Germany invaded the Low Countries 'collaboration with the French Army and Air Force in the land battle' should become 'the primary commitment of the British Bomber Command during any critical phase of the invasion'. The Advanced Air Striking Force would now consist of a First Echelon of ten medium-bomber squadrons (equipped with Battles) and a Second Echelon comprising the same number of Blenheim squadrons. Later the plan for a Second Echelon was cancelled in favour of operations by the Blenheims from bases in the United Kingdom. Apart from the Advanced Air Striking Force—originally conceived as an outpost of Bomber Command rather than an army support weapon—the Expeditionary Force would be accompanied by an Air Component comprising eight Army Co-operation (reconnaissance) squadrons and four squadrons of fighters. Originally the last were to have been Blenheim squadrons; but largely in consequence of a memorandum by Air Chief Marshal Dowding, which stressed the need for speed and climbing-power in a battlefield fighter, the Air Staff ultimately decided to send Hurricanes instead. As they would necessarily be drawn from his command, the author of the memorandum was thus faced, as the result of his own candour, with the loss of four of his best squadrons. Worse still, he would lose the aircraft likely to be needed to keep them up to strength at a time when heavy casualties might well be suffered.

Hence the employment envisaged for the fifty-seven fighter squadrons contemplated in the final peacetime plan was:

<i>Task</i>	<i>Squadrons</i>
Air Defence (main scheme)	46
Air Component	4
Defence of Scapa Flow	2
Defence of Northern Ireland	1
Trade protection	4

The number of squadrons allotted to the air defence scheme proper—for Scapa and Belfast were outposts—thus corresponded very closely with that recommended in the 'ideal' plan of 1937. Moreover, it was precisely that at which the Air Staff had arrived in 1938 by a calculation based on the probable striking power of the German air force and the theoretical chances of successful interception. There was accordingly a strong case for regarding it in 1939 as the essential minimum. On the other hand, the allowance of four

squadrons for the Expeditionary Force was far from generous. Both the French authorities and the British General Staff pressed for more fighters, the latter suggesting that at any rate the number should be increased within the first six months of war. On the ground that the country was still short of the standard required for protection against a 'knock-out blow', the Air Staff refused to commit themselves to more than the four squadrons, but promised that all of them (instead of only one, as had been contemplated earlier) should cross the Channel with the first contingent of the Expeditionary Force, and that the possibility of sending others should be reviewed if no heavy air attacks were made on the United Kingdom early in the war.

(iii)

The seizure of Bohemia and Moravia in March, 1939, showed clearly that the German Chancellor had no intention of abiding by the agreement made at Munich, and that his claim to be concerned solely with areas inhabited by German-speaking peoples could not be relied on. The British Government responded by joining the French in guarantees to Poland; taking measures to bring the twelve divisions of the Territorial Army up to strength and then double them; introducing conscription; and setting up a Ministry of Supply to find the weapons needed by a rapidly expanding army.¹

Thereafter the home defences passed gradually from their peacetime state to one of readiness for war. Under a system of 'couverture' adopted in the early summer, anti-aircraft formations of the Territorial Army were called out in four contingents for one month at a time; guns were moved to prepared positions in a belt twenty-five miles deep extending from Newcastle to Plymouth. At the same time the radar chain was brought into operation. The public air-raid warning system was made ready for instant action, and the Postmaster-General placed essential telephone lines at the disposal of the air defences. Air Chief Marshal Dowding was given power to intercept unauthorised flights over the United Kingdom, and throughout the summer a continuous watch was kept by skeleton crews in the essential operations rooms of Fighter Command and its ancillary formations. In June, German aircraft began to make flights over the North Sea and the English Channel, but did not infringe British territorial limits and were not molested. The opportunity was taken to make important technical modifications to the radar system and order the 'chain home low-flying' (C.H.L.) equipment needed to detect and track low-flying aircraft.

¹ On paper there were thirteen Territorial divisions; in practice the number never exceeded twelve, or twenty-four when doubled.

In consequence the final transition to a state of hostilities was accomplished with fewer pains than the emergency deployment of 1938, and found the air defences in much better shape. Fighter Command mobilised thirty-nine fighter squadrons, as compared with the twenty-nine considered mobilisable eleven months before. Sixteen were equipped with Hurricanes, ten with Spitfires, seven with Blenheims, four with Gladiators and only two with the obsolescent Hind and Gauntlet. Reserves amounted to some 300 aircraft. After deduction of four squadrons for the Air Component, Fighter Command thus had thirty-five squadrons towards the forty-six approved for the main scheme of home defence, but none for Scapa Flow or Northern Ireland, and none as yet for trade-protection.¹ Anti-Aircraft Command, recently reorganised in seven divisions under Lieutenant-General Sir Frederick Pile, Bt. (but like the rest of the air defences under the operational control of Air Chief Marshal Dowding), mustered about one third of the heavy, one-eighth of the light anti-aircraft guns and rather less than three-quarters of the searchlights to which it was entitled. Balloon Command (Air Vice-Marshal O. T. Boyd) deployed 444 balloons in London, and 180 elsewhere, on the first day of the war, or altogether about three-sevenths of its establishment.² The Observer Corps (Air Commodore A. D. Warrington-Morris) was virtually complete over the greater part of England and parts of Scotland, while the radar chain had all twenty of its C.H. stations in action, though their equipment was still imperfect. No C.H.L. stations were yet ready.

As war became more probable, corresponding precautions were taken in other branches of home defence. In the course of the summer a number of naval reservists were called out by individual notice. In August a series of exercises was held to test naval and air plans for the detection of surface raiders and the laying of the mine barrage at the southern exit from the North Sea. Before the exercises the Reserve Fleet was held fully manned and was inspected by H.M. the King in Weymouth Bay. As they were drawing to a close, news that Germany and Russia were about to conclude a pact of non-aggression brought the threat appreciably nearer. Thereupon arrangements were made

¹ See p. 72.

² The figures, as compared with the approved scales, were:

	<i>Approved Scale</i>	<i>Deployed by out- break of war</i>
Fighter squadrons	46*	35
Heavy guns	2,232	695†
Light guns (barrels)	1,860‡	253
Searchlights	4,128	2,700
Balloons	1,450	624

* Main Scheme only.

† Of which 425 were modern (4.5-inch and 3.7-inch) pieces.

‡ Excludes War and Maintenance Reserve.

to call out further reservists as they were needed, shipowners were warned of the dangers their vessels might run in foreign ports, and preliminary steps were taken to requisition shipping needed to carry the Expeditionary Force and the Air Striking Force to France. At the same time the Lord Privy Seal was authorised to put the Civil Defences on a war footing when he thought fit.

The signing of the Russo-German pact in Moscow on 23rd August was the signal for further measures, accompanied by a solemn warning to the German Government that Great Britain intended to stand by her pledge to Poland. Air reconnaissance over the North Sea began on the morning of the 24th; by the end of the month all ships of the Home Fleet and naval home commands—including nine capital ships, four aircraft carriers and seventeen cruisers—had moved or were moving to the war stations shown in Appendix I, and the sixteen active squadrons of Coastal Command were at the bases shown in Appendix II. Anti-submarine booms were laid before the outbreak of war at Scapa Flow, Rosyth and Portsmouth, and arrangements were made to add the rest of the local naval defences in two days at the first two places and in nine days at the third. Elsewhere some risk of attack would have to be accepted while the schemes drawn up since 1933 were put in hand. The fixed defences were far from strong, for the 6-pounders considered best for defence against fast light surface craft were not yet ready; moreover most 9·2-inch and 6-inch batteries had nothing but an old type of ammunition whose replacement with a better kind had only just begun. But the deficiencies of the coast defences will be best considered in a latter chapter, where they can be studied in the light of events not yet foreseen.

A chart at Appendix III shows the broad structure of the organisation for home defence at the beginning of the war.

CHAPTER V

THE OPENING PHASE

(September, 1939–May, 1940)

(i)

DURING the first week of war the ten Battle squadrons of the Advanced Air Striking Force and the four Hurricane squadrons allotted to the Air Component crossed the Channel without interference from the enemy. They were followed by the eight reconnaissance squadrons of the Air Component, the first of which reached France about the middle of September. By the fourth week in October the Dover mine barrage at the southern exit from the North Sea had been completed. Meanwhile the four divisions of the Expeditionary Force had taken up the positions assigned to them.

The departure of the Expeditionary Force left the United Kingdom guarded on land by weak forces under Western, Southern, Eastern, Northern and Scottish Commands, the whole responsible to General Sir Walter Kirke, Commander-in-Chief, Home Forces.¹ At the outset of the war invasion was not expected, and the main task envisaged for General Kirke and his subordinates was to prepare drafts for despatch abroad while absorbing the flow of recruits created by conscription. As we have seen in the last chapter, the air defences were considerably below their planned strength, but British naval forces in home waters far outmatched the small surface power of the German navy.

In the spring of 1939 the Air Staff had put the size of the German long-range bomber force at 1,650 aircraft and the possible weight of attack during the first two weeks of war at 700 tons a day. The true position was not quite so alarming. On the outbreak of war the Germans had 1,180 long-range bombers, of which 1,008 were serviceable, besides about 400 short-range dive-bombers and ground-attack aircraft. Their total first-line strength, including transport machines, amounted to some 4,000 aircraft.² Unlike our own, their fighter force of roughly 1,200 aircraft was intended more for tactical support of an army in the field than for home defence. For the latter purpose they

¹ Aldershot Command, also under C.-in-C. Home Forces, was responsible for providing drafts and reserve formations.

² See footnote 1 on page 78.

relied mainly on a plentiful supply of guns. Reserves, which were estimated in London at five times the true figure, amounted to fewer than a thousand machines fit for the first line, while production, at roughly seven hundred aircraft a month, was almost the same as the British for a first line twice as great as ours. The training organisation commanded some 3,000 aircraft, of which about 500 were of first-line type. On the other side of the account, the British and French metropolitan air forces mustered between them about 3,400 first-line aircraft and nominally about 3,800 aircraft in reserve.² On the whole, the Allied organisation was far less suited than the German to support a land campaign, while both the first line and reserves included many machines whose performance was not up to modern standards. Figures apart, events soon showed that effectively the Luftwaffe was substantially stronger than the British and French air forces put together.

Shortly before the war the British Air Staff had come to the conclusion that the enemy was unlikely to begin by bombing individual factories or arsenals. More probably he would seek to destroy the nation's will to fight by attacking densely populated areas or vital links

¹ The precise figures were:

	<i>Strength</i>	<i>Serviceable Aircraft</i>
Long-range bombers	1,180	1,008
Dive-bombers	366	318
Ground Attack Aircraft	40	37
Fighters (all categories)	1,179	1,053
Long-range reconnaissance (excluding Coastal) aircraft	262	235
Short-range reconnaissance aircraft	342	294
Coastal aircraft	240	214
	3,609	3,159
Transport aircraft	552	540
	<u>4,161</u>	<u>3,699</u>

² According to a statement made to the War Cabinet by the Secretary of State for Air, the figures on 26th September were:

	<i>British</i>		<i>French</i>	
	<i>First Line</i>	<i>Reserves</i>	<i>First Line</i>	<i>Reserves</i>
EUROPEAN THEATRE				
Bombers (all categories)	536	1,450	463	...
Fighters (all categories)	608	320	634	...
Long-range reconnaissance (exclud- ing Coastal) aircraft	—	—	444	...
Short-range reconnaissance aircraft	96	105		
Coastal aircraft	216	125	194	...
Fleet Air Arm	204	200		
	<u>1,660</u>	<u>2,200</u>	<u>1,735</u>	<u>1,600</u>
OVERSEAS All types	415		595	
	<u>2,075</u>		<u>2,330</u>	

in the system of supply and distribution. London seemed a likely target, since it was at the same time a great port, an important residential centre and a focus of commerce, industry and government. Other promising objectives included the industrial districts of Lancashire and the Midlands, and the chief ports outside London, from the Forth to the Mersey and Belfast.

In Poland, however, the Germans opened their attack by striking at the opposing air force and its bases. Other campaigns might begin in the same way. The Royal Air Force, protected as it was by an unrivalled early-warning system and a well-planned system of dispersal, could reasonably hope to escape destruction on the ground, but might be gravely injured by damage to the factories on which it counted for supplies.

Accordingly reports from Poland soon led the Air Staff to modify their estimate of the enemy's most likely course of action. A fortnight after the declaration of war, Air Chief Marshal Dowding was directed to review the deployment of the air defences on the assumption that 'the aircraft industry is to be regarded as a very probable first objective for enemy air attacks against this country', and to pay special attention to Sheffield, Coventry, Derby and Bristol, where there were factories of great importance to the air force. As attacks on London could not be ruled out, these orders looked like a clear instruction to the Commander-in-Chief to apply himself to the defence of London, the industrial Midlands and Bristol, even at the expense of other tasks. In reality much else had to be considered. As we shall see in later chapters, many additional demands were afterwards made on the air defences, and were often urged with much force and authority. At no time during his tenure of office was Dowding able to get from the Air Staff a clear statement of their relative importance; and admittedly such an assessment would have been extraordinarily hard to make.

In the outcome the German assault was postponed for the best part of a year, and was then directed to ends which differed considerably from those foreseen in 1939. At the beginning of September nearly half the Luftwaffe, with the better part of the German army, was on the Polish front. There is no evidence that the German High Command had sanctioned even provisional plans to use the other half against this country. As no invasion of the United Kingdom was in view, an attack on London would not have been consistent with an outlook which sought to justify the bombing of Warsaw on the ground that it paved the way for military occupation of the city. Moreover the German Government did not favour measures calculated to destroy the hope of a peaceful settlement with Great Britain when Poland was defeated. Thus the 'knock-out blow', round which so much British planning had revolved, was not attempted. Some weeks

after the outbreak of war the Intelligence Division of the Operations Staff at the German Air Ministry did, indeed, urge that British ports should be vigorously attacked; but they made no mention of inland cities. Ultimately even their plea for a strictly limited programme of strategic bombing was rejected.

(ii)

On the other hand, attacks on shipping by German naval and air forces began at once.

Until 1939 the Air Ministry in Berlin, like its counterpart in London, had done little to provide a striking force expressly trained for maritime war. In the spring and summer of that year its attention was drawn to the possibility of using bombers against British warships in harbour or at sea. The outcome was a small anti-shipping force commanded by General Hans Ferdinand Geisler, a former pilot of the naval air service who had joined the Luftwaffe in 1933.

After the outbreak of war Geisler's task was widened to include attacks on merchant ships and naval auxiliaries. Occasionally harmless fishing-vessels were attacked, perhaps because they were mistaken for minesweepers. As a trawler screen was posted off the East Coast while the C.H.L. stations were lacking, they may alternatively have been suspected of reporting German movements. Less understandably, attacks were sometimes made on lightships, which admittedly helped Allied shipping but were also useful to the Germans. On 9th September Geisler's force, which included some of the newest bombers and best crews in the Luftwaffe, numbered 85 aircraft, of which 71 were fit for active service.¹

German naval dispositions for war on merchant shipping were put in hand some days before the outbreak of hostilities. Between 19th and 29th August seventeen ocean-going submarines out of a force of twenty-six left Kiel for the Atlantic, while fourteen short-range submarines out of thirty made their way to the North Sea and the English Channel. By the end of the month thirty-nine German submarines of all classes were at sea. As soon as the Allied ultimatum gave the signal they struck at the supply lines which linked Britain with the outside world. Their commanders had orders to observe the international convention which forbade the sinking of merchant

¹ It comprised:

Unit	Equipment	Strength	Serviceable Aircraft
<i>Kampfgeschwader 26</i>	Heinkel 111	65	58
<i>I/Kampfgeschwader 30</i>	Junkers 88	20	13

The Junkers 88 was the newest German bomber, and *I/KG. 30* was the first unit equipped with it.

vessels without regard for the safety of passengers and crews, but did not always obey them. On 3rd September, for example, the submarine *U.30* sank the passenger liner *Athenia* off north-west Ireland at the cost of 112 lives. In the whole of September 41 ships, aggregating 153,879 gross tons, were sunk by German submarines.

The Allied answer was to introduce the system of convoy planned before the war. But escort vessels were scarce, while Coastal Command, preoccupied with its programme of North Sea reconnaissance, had few aircraft to spare for convoy escort. Consequently some groups of ships were forced to sail unescorted. Moreover, aircraft had little chance of spotting submarines unless they surprised them on the surface. Even then the quarry had only to dive in order to become virtually safe from an attacker who carried no depth-charges and whose bombs were few and small. Nevertheless seven submarines were sunk by various means in the first two months of war. As winter drew on, the U-boat offensive dwindled, not so much because of sinkings as because the weather grew less favourable and because an ambitious programme of minelaying absorbed much of the German effort.

But if the winter brought a temporary alleviation of one problem of maritime defence, it promised no relief from others. The fear that German surface raiders would try to gain the High Seas proved better founded than faith in the system designed to stop them. Leaving Wilhelmshaven on 21st August, the pocket-battleship *Admiral Graf Spee* slipped into the Atlantic a few days later, while our general-reconnaissance squadrons were grounded for a final inspection before beginning their North Sea patrols. On the 24th her sister ship, the *Deutschland*, left the same port. Helped by thick weather, and making the best use of darkness, she too escaped detection. In September replacement of Ansons by Hudsons enabled the air reconnaissance patrols to be carried almost the whole way to the Norwegian coast; but in general the patrols were ineffective. A radar set with which aircraft could detect surface vessels in darkness or thick weather was under development but not yet in use; meanwhile patrols were discontinued at night, and in the daytime were often defeated by cloud, fog or heavy rain. On 8th October a Hudson of No. 224 Squadron from Leuchars spotted a German naval force—the battle-cruiser *Gneisenau*, the cruiser *Köln* and an escort of destroyers—near the coast of Norway; but the *Deutschland*, returning to the Baltic in November, was missed once more. In the same month the battle-cruisers *Scharnhorst* and *Gneisenau* cruised for some days in the Atlantic, also without detection as they came and went. Meanwhile the escape of the pocket-battleships, coupled with the demands of the U-boat campaign, the conveyance of the Expeditionary Force to France and other tasks, had caused a wide dispersal of Allied naval forces.

Moreover, British warships and their bases soon proved more vulnerable than had been expected. To make up for the shortage of escort vessels and shore-based aircraft for convoy escort, towards the middle of September the aircraft-carriers *Ark Royal*, *Courageous* and *Hermes* were ordered to cruise in the Western Approaches so as to provide a measure of protection for shipping there. On the 14th the *Ark Royal* narrowly escaped sinking by the submarine *U.36*; on the 17th the submarine *U.29*, encountering the *Courageous* at an unhappy moment when she was flying-on her aircraft and was inadequately protected, sank her. A month later the submarine *U.47* exposed the inefficacy of the local naval defences at Scapa Flow by entering the Flow through a channel that had been left inadequately guarded; on the morning of the 14th she sank the battleship *Royal Oak*, lying at anchor about a mile from the shore.

Two days after the sinking of the *Royal Oak* nine aircraft of *Kampfgeschwader 30* attacked warships in the Firth of Forth, doing slight damage to two cruisers and a destroyer. It happened that on this occasion the system of early warning worked unsatisfactorily; and while the silence of the public air-raid sirens could be justified on the ground that no attack on the mainland was expected or in fact took place, the failure of the local Gun Operations Room to receive notice of the enemy's approach until some of the guns had opened fire was not so easily explained away. A moment after the warning had been tardily received, the enemy appeared over the Forth Bridge. All guns not already firing were then called to action. The gunners at one site were engaged in gun-drill when they saw a German aircraft near them, and had hastily to exchange their dummy ammunition for live. The Spitfires of Nos. 602 (City of Glasgow) and 603 (City of Edinburgh) Squadrons of the Royal Auxiliary Air Force joined the guns in shooting down two bombers—the first destroyed over or near the United Kingdom since the beginning of the war.¹

Next morning aircraft of the same German unit raided Scapa Flow. In the absence at sea of the Home Fleet they attacked and damaged the depot-ship and former battleship *Iron Duke*, which was subsequently beached. One bomber was hit by anti-aircraft fire and crashed on the island of Hoy.

On the whole the destruction of three aircraft in the two raids was a satisfactory achievement, but the performance of the early-warning system was less so. Where the guns were concerned, the verdict of General Pile was that evidently neither the standard of training nor the equipment of his command was yet up to the standards of modern war.

¹ As a result of the action No. 603 (City of Edinburgh) Squadron (Squadron Leader E. E. Stevens) was officially credited with the destruction of the first aircraft destroyed by Fighter Command. At the time four German aircraft were believed to have been destroyed.

The exploits of *U.47* and *Kampfgeschwader 30* showed that Scapa Flow was not yet a secure base for the Home Fleet. Before it could be so regarded, the local naval defences must be extended and improved, and stronger air defences must be provided. These tasks could scarcely be completed before the early spring. Meanwhile the Fleet must move elsewhere, though Scapa would still be put to occasional use. To provide some measure of fighter defence while the Fighter Command squadrons promised for 1940 were awaited, the Admiralty arranged to send two naval squadrons to a neighbouring aerodrome.

Rosyth was a possible alternative, but was a little too far south to be altogether satisfactory, and its approaches were vulnerable to mining. For the next five months the Fleet was therefore compelled to make use of remote anchorages on the West Coast of Scotland.

Within two months of the outbreak of war the Government were thus confronted with a situation rather different from that for which their plans provided. Allied naval resources were widely dispersed; the Home Fleet was without its best strategic base and on the wrong side of Cape Wrath; and the system of North Sea reconnaissance had been found wanting. Attempts to bomb German warships at sea had failed in recent weeks and might succeed no better in the future. In short, control of the North Sea had been lost, at least for the time being. Thus invasion could no longer be ruled out on the old ground that a hostile expedition would be infallibly detected by air reconnaissance and would be 'bombed and shelled to destruction' before arrival, though it might still be thought unlikely for other reasons. Moreover the German Chancellor, meeting with no response from the British Government to his offer of peace terms after the defeat of Poland, might be expected to grow more belligerent.

In the light of these considerations the War Cabinet decided in October that the risk of a landing by German forces which might slip past the navy and Coastal Command during the longer nights of winter was not to be ignored. They asked the Chiefs of Staff to reconsider the danger and take steps to meet it.

After studying the matter at some length, the Chiefs of Staff came to the conclusion that small raids were possible, and invasion proper conceivable, but that neither threat was serious enough to justify them in keeping back field formations intended for use elsewhere. To meet the Government's wishes they proposed that 'a suitable proportion' of such troops as would normally be at home should be disposed within easy reach of the East Coast, and that plans should be made for their rapid concentration if the need arose. Special air and naval reconnaissance to give warning of the assembly and passage of a large seaborne expedition could, they implied, be deferred until the danger became imminent. They also recommended a number of measures

designed to strengthen the defences of ports and aerodromes, but added that most of them were already in hand. Their mention of an 'adequate air striking force in a state of readiness' suggests that the practical difficulty of co-ordinating reconnaissance with offensive action, and the frequent inability of bomber crews to find or hit their targets, were even yet not fully grasped; though admittedly the Chiefs of Staff went on to point out that communications, and co-operation between different branches of the defences, must be improved.

Thereafter until the spring of 1940 the country's landward defences against invasion or minor raids were governed by a new scheme called the 'Julius Caesar' plan. Its basis was the dual assumption that the landing of seaborne troops in any number presupposed the early capture of a port, and that parachutists or other airborne forces would play a vital part in any attempt that the enemy might make. Further assumptions were that a seaborne force of one division could be carried in twenty transports of 4,000 to 5,000 tons, which could make the crossing in 20 hours and would be escorted by 25 to 30 modern destroyers.¹ German resources for an airborne operation were estimated at 1,000 transport aircraft, 4,000 trained parachutists and 6,000 trained air-landing troops.² Any attempt at a major landing would probably be supported by a heavy air offensive against the Home Fleet, the Royal Air Force and 'other objectives in this country'.

General Kirke believed that if the airborne force were defeated the battle would be won. Deprived of its support, the seaborne force would, he thought, find landing so hazardous that the assault would fail. Accordingly his plan laid emphasis on the prompt annihilation or capture of parachutists and other airborne troops as they descended or were assembling on the ground. Bodies who nevertheless succeeded in establishing themselves on British soil would be either surrounded by a cordon, or broken up by armoured troops or horsed cavalry. As an additional precaution against capture of a port from the landward side, Scottish, Northern and Eastern Commands were ordered to allot infantry for the local protection of ports and their fixed defences in their respective areas. Should the enemy land, Home Forces would have the direct support of two bomber squadrons, besides an Army Co-operation squadron and three communication aircraft. In the meantime a small bomber force had stood by since the outbreak of war to attack German naval targets as opportunity arose; and in an emergency all home-based bombers would in theory be available to engage a hostile expedition before departure or on passage. There

¹ In fact, some 50 to 60 transports of that tonnage would have been required, and the crossing could scarcely have been accomplished in less than 36 hours. The German navy had about 20 destroyers.

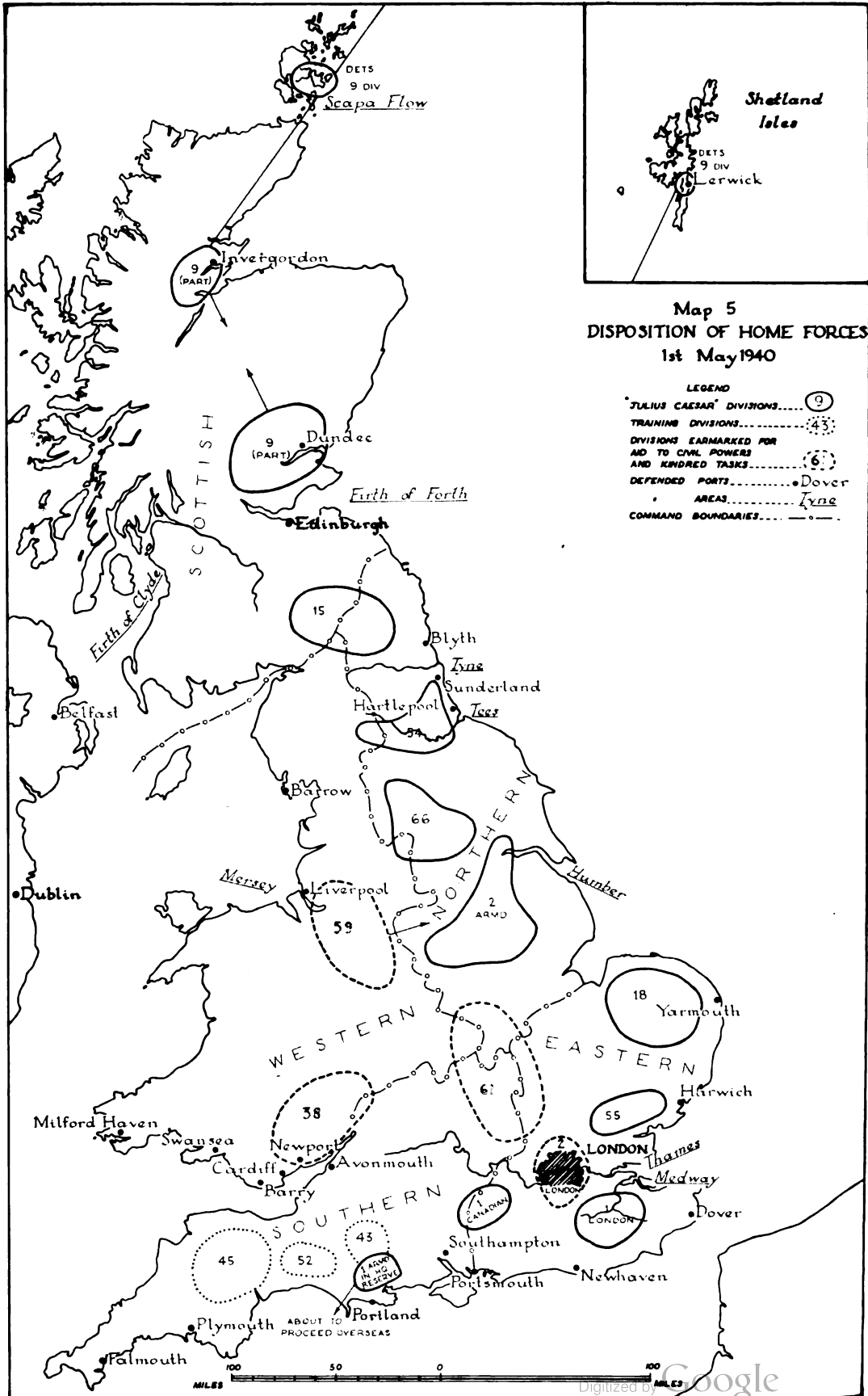
² These estimates were approximately correct.



Plate 1. Air attack on British Warships in the Firth of Forth, 16th October, 1939.



Plate 2. Preparing to fire a 3.7-inch Mark II Anti-Aircraft Gun
(Static Mounting).



Map 5
DISPOSITION OF HOME FORCES
1st May 1940

- LEGEND
- JULIUS CAESAR DIVISIONS..... (9)
 - TRAINING DIVISIONS..... (43)
 - DIVISIONS EARMARKED FOR AID TO CIVIL POWERS AND KINDRED TASKS..... (6)
 - DEFENDED PORTS..... Dover
 - AREAS..... Tyne
 - COMMAND BOUNDARIES.....

would also be a few torpedo-bombers under Coastal Command. In practice, attempts to bomb the German fleet in harbour or at sea were almost uniformly unsuccessful, and were suspended in December while protective armour was fitted round the fuel-tanks of the aircraft used. Meanwhile the Admiralty had decided that precautionary air patrols over the southern part of the North Sea were advisable, even though the imminent danger postulated by the Chiefs of Staff was not in view. Begun on 29th October, the patrols were continued through the winter for the additional purpose of investigating movements of German minelayers and other suspicious craft.

Before the war invasion had seemed so slight a risk that in 1937 entries bearing on the withdrawal of civilians from threatened areas had been deleted from the Government War Book, despite a reminder from an experienced source that a similar decision before the First World War had led to unpreparedness. Once again the matter had to be reconsidered now that war had come. The decision reached was that civilians not in immediate danger should be encouraged to stay where they were; those more vulnerably placed would be withdrawn by routes designed to interfere as little as possible with military traffic.

General Kirke put the troops needed for 'Julius Caesar' at not less than one division each in Northern and Scottish Commands, two in Eastern Command and three in reserve, or a minimum of seven altogether. The forces at his disposal in November, apart from those performing static tasks, comprised nine infantry divisions and elements of three more, one cavalry division, one armoured division and an armoured brigade, with 25 cruiser and 267 light tanks. In general these formations were inadequately trained and equipped for mobile warfare. Furthermore the best of them could expect to be ordered abroad as soon as they were ready for despatch.

At the beginning of May, 1940, by which time the 1st Cavalry Division had left for the Middle East and the 1st Armoured Division was nearly ready to go to France, nine weak or inexperienced divisions, including the 2nd Armoured Division, were available to carry out the plan. Among them were the 1st Canadian Division, which had arrived in January. Other formations under General Kirke included three training divisions and four divisions earmarked for special tasks. Map 5 shows how these forces were disposed.

(iii)

Meanwhile a new danger had arisen. From the start of the war German submarines and surface craft, defying the convention which prohibited undeclared minefields dangerous to peaceful shipping,

began to lay mines in British coastal waters. Within the first week the Admiralty suspected that some at least were of the magnetic type, designed to rest on the bed of the sea until the magnetic field of an approaching ship made them active. The Royal Navy had used magnetic mines in 1918, and the possibility that other powers might use them in the future had been considered on numerous occasions since that time. Nevertheless no effective steps to guard against the danger had been taken, chiefly because a lack of funds prevented the Admiralty from providing for all contingencies. On the outbreak of war the whole of the minesweeping fleet immediately available was equipped to deal solely with contact mines, and plans for its expansion were based on the assumption that magnetic mines would not be used. Moreover the risk that surface craft might be employed to lay mines in our coastal waters had not been seriously considered. In September and October 59,027 tons of shipping were sunk by mines off the East Coast, in the Thames Estuary and elsewhere.

A fully effective answer to the threat demanded detailed knowledge of the German weapon. Nevertheless a good deal could be done without such knowledge. Service and civilian experts were put to work on the problem of sweeping magnetic mines; plans for a magnetic sweep and for the construction of a 'mine destructor ship', which had been projected some months before the war but shelved for lack of funds, were revived in a new form; and steps were taken to make shipping less vulnerable by altering or suppressing the magnetic field with which every metal ship is endowed in the builder's yard. Apart from their practical value, which was somewhat overrated, 'wiping' and 'degaussing', as the alternative methods of treating ships were called, had an important moral effect on Masters and crews of merchant vessels, some of whom are said to have attributed to these mysteries the power of warding off torpedoes. As for sweeping, the method first tried employed ships with huge magnets in the bows; it proved uneconomical and hazardous. That eventually adopted consisted of a double sweep by two ships, each towing a pair of buoyant cables so arranged as to explode the mines at a safe distance. The problem of making a suitable cable was successfully tackled by two British cable companies after some authorities had pronounced it insoluble.

In November seaplanes began to supplement the efforts of the German navy by dropping magnetic mines attached to parachutes. The first expedition for the purpose was made on the night of the 18th by aircraft of *Küstenfliegerstaffel* (Coastal Reconnaissance Squadron) 3/906, but was abandoned because of unsuitable weather. On the night of the 20th the same squadron laid mines off Harwich and at two points in the mouth of the Thames, supposedly in the King's Channel and the Black Deep. The seaplanes dropped their mines

from heights of the order of 3,000 feet, but were not engaged by guns or fighters, although some searchlights were in action. The squadron again dropped mines on the next night, and on the 22nd were joined by seaplanes from another coastal reconnaissance squadron, *Küstenfliegerstaffel 3/106*.

On the third night watchers on shore near Southend saw an object fall into tidal water. At the time its nature could only be guessed; but it was in fact one of the mines dropped by *Küstenfliegerstaffel 3/106*. The Admiralty were informed, and within a few hours a party headed by Lieutenant-Commander J. G. D. Ouvry of H.M.S. *Vernon* left to look into the matter. In the small hours of 23rd November the receding tide revealed the mine and steps were taken to secure it. The next low tide revealed a second mine and enabled Ouvry and his helpers to undertake the delicate task of stripping the first of its detonator and other essential fittings with special non-magnetic tools which had been hastily made locally. The mine and fittings were then landed and taken to the Naval Mine Department for further dissection.

The knowledge thus gained was a major contribution to the devising of effective counter-measures. From the German viewpoint the opening contribution of *Küstenfliegerstaffel 3/106* was doubly disastrous, for it not only presented the adversary with the mine itself but also revealed the presence and purpose of the seaplanes to the defences. Nevertheless the interception and destruction of aircraft engaged in minelaying remained until the end of the war extremely difficult, for the machines were not bound to cross hostile coasts and could often escape detection by remaining only just above the surface of the sea.

Offensive counter-measures to minelaying by German seaplanes included patrols over their bases by Blenheim fighters and Whitley bombers (replaced in the early part of 1940 by Hampden bombers). On the night of 19th March Whitleys and Hampdens aimed some fifteen tons of bombs at a seaplane base at Hornum, on the island of Sylt, as a reprisal for one of Geisler's raids on Scapa Flow, but the Luftwaffe unit stationed there reported little damage. Aircraft in the shape of Wellington bombers fitted with magnetic loops energised by generators which they carried with them, and manned by Coastal Command crews, also contributed to sweeping, making their first successful sortie on the night of 8th January, 1940, and continuing to take a valuable share of the work while more strictly naval measures were getting under way.

In the outcome the harrying of minelayers on, under and above the water, preventive treatment of friendly shipping and, above all, the keeping open of swept channels, all contributed to victory over the magnetic mine. In the first six months of the war the navy swept

74 such mines; in the next three they swept 213. The Germans then turned to the acoustic mine, also a weapon studied by the Admiralty during the First World War. Once again the problem of devising counter-measures was eased by the recovery of mines dropped by German aircraft near the shore. Minesweepers were fitted with road-drills whose ear-splitting din exploded the mines at a comparatively safe distance, and other ships with loudspeakers or pneumatic hammers. In view of the obvious preference shown by the Germans for non-contact mines, possible variants of both weapons were explored, with the result that the Admiralty were ready with counter-measures or able to devise them quickly when the need arose in later years.

(iv)

Meanwhile the absence of heavy air attacks on the United Kingdom gave the air defences a valuable breathing space. During the first four months of war the number of heavy anti-aircraft guns available for home defence increased by about a fifth and the number of light anti-aircraft barrels doubled. The supply of searchlights kept pace with new demands, but the total available remained at the end of 1939 about 1,400 short of the approved scale. On the other hand, Balloon Command suffered a setback. Losses due mainly to sudden changes in the weather far exceeded expectations; and as current production was not large enough to make them good, the squadrons were forced to conserve their stocks by keeping about two-thirds of their balloons deflated. The return of the *Deutschland* to Germany in November, and the scuttling of the *Graf Spee* in the River Plate in December after she had been cornered and damaged by British cruisers, eased the home defence position somewhat, since it freed important naval forces—amounting in October to four British and French battleships, five aircraft carriers and fourteen cruisers—which had hunted or lain in wait for the two ships. In the circumstances there may have seemed little reason throughout the late winter and early spring to question the adequacy of the 'Julius Caesar' plan to ward off invasion or lesser expeditions.

On the other hand, the threat of an all-out air attack still hung over the United Kingdom, and Air Chief Marshal Dowding was far from satisfied that his resources were strong enough to meet it. Although aware of the Air Staff's proposal to send four fighter squadrons to France with the Air Component, he had continued until the outbreak of war to hope that they would not leave the country until all fifty-three of the squadrons contemplated in the final peacetime plan of air defence were in existence. In the outcome he not only lost the four squadrons, but was ordered to put six more on a mobile footing

against the day when further demands from the Expeditionary Force could no longer be resisted. Apart from the immediate effect on his resources, he foresaw that casualties suffered across the Channel when fighting began would have to be made good from reserves or new production which might be urgently needed for home defence. Moreover, he had personal grounds for his uneasiness. Shortly before the war he had been asked to broadcast a reassuring message to the nation, and had done so under the mistaken impression that all the fighter squadrons mobilised would remain at his disposal for some time to come.

On 16th September, after interviews with the Secretary of State for Air and the Deputy Chief of the Air Staff had failed to satisfy him, he therefore made a formal protest, in which he likened the despatch of the four squadrons to the opening of a tap through which the whole output of Hurricanes would ultimately be drained away. During the next few weeks he repeatedly urged the Air Ministry to resist further demands from France and concentrate on building up his strength to withstand the 'knock-out blow' which he thought was bound to come. His view was that the needs of Fighter Command deserved absolute priority over other claims, for he argued that defeat at home would make the strengthening of other commands a useless sacrifice. If the country were knocked out by air attack, nothing Bomber Command or the forces in France could do would be likely to retrieve its fortunes.

The Air Ministry did not accept these arguments. Although they had been obliged in the previous year to put fighters before bombers, they still believed that the best contribution they could make to victory was a powerful bomber force. At the same time they felt bound to support the Franco-British armies to the best of their ability. Nevertheless they agreed that demands from France must not be allowed to cause 'an unwarrantable drain on the available resources'. They consented, therefore, to allay the worst of Dowding's fears by laying down the principle that supplies of Hurricanes should be divided between Fighter Command and the squadrons across the Channel in the ratio of three to one; and they sanctioned measures designed to strengthen the fighter force a little and make its immediate future slightly less dependent on that aircraft. Six half-squadrons of Blenheims would be formed immediately, and would become full squadrons as soon as possible; at the same time Gladiator squadrons would be substituted for two of the six Hurricane squadrons earmarked for despatch abroad. Only when the output of Hurricanes had improved were these two squadrons re-equipped with the more modern aircraft.

But requests from France, and the manifest likelihood that before long more would have to be done for an expanding Expeditionary

Force, soon forced the Air Staff to go further. Foreseeing that much pressure would be put upon them to send more fighters across the Channel if German armies attacked France or the Low Countries, they decided in October to form ten more squadrons by the middle of November, besides the six already promised and another two to fill the gap caused by the departure to France of the first two of the six squadrons earmarked.

In practice, formation of all eighteen of the new squadrons proved impossible before the middle of December. By the 18th two of them had been added to Dowding's first-line strength and the rest were working up. But a number were temporarily equipped with obsolescent aircraft which would have to be replaced before the squadrons could be reckoned fit for active service.

Thus by the end of 1939 Dowding, having lost six squadrons and gained eighteen since the beginning of the war, had 51 of the 53 which were Fighter Command's target. About a third of his force was not yet fully trained, but might perhaps be ready by the time the enemy attacked. With the six in France, the fighter force as a whole stood at 57 squadrons.

Unfortunately it did not follow that attainment of the target would give Dowding all he needed, for his responsibilities were growing. So far Geisler's attacks on merchant shipping had done no damage comparable with that inflicted by magnetic mines, but his force was a constant threat to local convoys, mine-sweepers and naval flotillas in coastal waters. In general, the convoy-routes passed close inshore; but even so the normal practice of despatching fighters to deal with approaching bombers when they were detected by the radar chain was not enough to protect the ships that used them. When the defeat of Poland brought the fear that British rejection of German overtures might be the signal for heavier attacks on shipping, Dowding strengthened his forces near the East Coast, but pointed out that interception of bombers several miles from the shore could not be guaranteed. The convoys needed fighters which would stay near them as long as they were in danger.

The Air Ministry responded by forming the four trade-protection squadrons projected just before the war. Obviously four squadrons of Blenheims would not be enough to give strong and continuous escort to all East Coast convoys; but the Air Staff hoped that even one or two long-range fighters with each convoy would perform a useful function by serving as rallying-points for Dowding's short-range high-performance aircraft. Dowding did not welcome the addition, fearing that the new task would conflict with his command's essential duty of guarding London and the aircraft industry. On the other hand the Blenheims would be invaluable to Air Marshal Bowhill of Coastal Command; for the Admiralty, having somewhat modified

their view that warships could look after themselves, were pressing for air cover by shore-based aircraft in waters within reach of Geisler's bombers. Assailed on two fronts, the Air Ministry conceded that the squadrons should move to Coastal Command, at least for the time being. In the outcome they remained in Coastal Command throughout the war, except for a brief period in 1940 when Dowding used two of them to strengthen weak parts of his line on the South Coast and in Scotland.

Unfortunately for Dowding's hopes, the burden of guarding coastal convoys did not move with the trade-protection squadrons. Bowhill used the squadrons chiefly for reconnaissance and for covering naval movements. In any case he lacked the short-range high-performance fighters which alone could provide the real answer. Hence the change did little to lighten the task of Dowding and his staff, whose only remedy was to find some way of discounting the shortcomings of the short-range fighter as a means of continuous protection for slowly-moving targets.

The solution adopted was to ring the changes on three methods, according to the degree of danger and the importance of the convoy. The least burdensome method (called 'fighter cover') required merely that Air Officers commanding or their deputies in the operations rooms of the command should note the position of convoys from time to time and should be specially prompt in sending fighters to deal with hostile aircraft shown by radar to be approaching them. Apart from the risk that the enemy might escape notice by flying very low, a great weakness of fighter cover was that the best method which could be devised for tracking convoys did not accurately disclose their positions at every moment. The ships and their escort could not themselves provide the information without betraying it to the enemy, and hence were bound to silence until attack seemed imminent. Consequently convoys guarded only by fighter cover were sometimes attacked when groups did not suspect that they were threatened, so that fighters sent only when a call for help was made arrived too late. On the other hand, the method was cheap, and entailed no departure from the normal practice whereby a small number of fighters was held constantly at readiness in every sector.

A second method, called 'fighter protection', was more exacting but avoided some of the penalties of standing escort. In each sector concerned, fighters other than those normally at readiness were detailed to protect a given convoy while it passed along the stretch of coast for which the sector was responsible. They did not accompany the convoy, but took up a position assigned by the group commander or controller, who might even allow them to remain at their base if he had no reason to suppose that the ships would be attacked. In

favourable conditions they were thus able to keep watch with little expenditure of fuel and without adopting a patrol-line dictated by the movement of the convoy; but again ships' crews, unless attacked, did not enjoy the moral advantage of seeing their protectors near them. Regulations designed to lessen the risk that ships might be surprised by German bombers virtually prohibited fighters from going within about three-quarters of a mile of merchant vessels, or six miles of a warship, unless they were in contact with the enemy.

Finally there was 'fighter escort'. Where this method was employed the ban was lifted and the fighters assigned to a given convoy stayed with it until relieved. Fighter escort was the method generally preferred by seamen, but was inherently extravagant and not much liked by fighter pilots. Always at a disadvantage over water unless at a good height, the pilot of a single-engined landplane was trebly handicapped when tied to a slowly-moving mass of ships whose surface escort bristled with suspicion of any object which looked as if it might drop bombs. If he remained low enough and close enough to the ships to put his identity beyond doubt, he might be caught at a tactical disadvantage and would probably be unable to reach the shore in an emergency. If he interpreted his instructions more liberally and improved his tactical position by gaining height and going further from the convoy, he ran the risk of being fired upon by his own side when he returned. In time the better education of ships' gunners in aircraft recognition, and a better understanding between the services, did much to improve his chances, but they did not lessen the essential wastefulness of standing escort by high-performance fighters.

Hence there could be no question of giving escort wherever help for shipping was requested. Standing escort for all shipping in vulnerable areas throughout the daylight hours would have saddled the fighter force with so intolerable a burden as to render it unfit for a major battle. On the other hand coastal convoys, naval flotillas and important traffic across the Channel could not always be left with no better defence than that provided by the interception system and by such anti-aircraft armament as the ships might carry. Thus Dowding was forced to compromise, adjusting his support to needs and risks. At first the choice was often difficult, for the naval liaison officers attached to his headquarters were not qualified to assess competing claims; moreover requests for air support were sometimes made direct to his subordinate formations. Later he was able to improve matters by adding a senior naval officer to his staff and by exacting a promise that all requests should be addressed to Stanmore. Meanwhile the number and urgency of the requests were such that his jealously-hoarded squadrons were obliged to fly about a thousand sorties for the direct defence of shipping in each of the last three

months of 1939, and in each of the first two months of 1940 more than twice that number.¹

For this reason, and also on other grounds, the outlook at the beginning of the New Year seemed to Dowding far from promising. No big attacks had yet been made on the United Kingdom; but the blow might fall at any moment. Already the threat to shipping had forced him to extend his left flank by basing squadrons north of the Tay, and he saw no prospect of withdrawing them. Moreover his calculations did not exclude the risk that in the spring the Low Countries or even France might be overrun by German troops. In either case the Luftwaffe would be able to strike over a wider area. Meanwhile there was some evidence that its leaders meant to do so from existing bases by using aircraft of longer range than their normal long-range bombers. A prisoner taken in January alleged that his superiors intended to set up a unit capable of reaching the Western Approaches, apparently from German bases. He gave its name correctly as *Kampfgeschwader 40*, although the aircraft he assigned to it proved troublesome and were not used until much later. In the same month the German Air Ministry raised the status of Geisler's command for the second time since the outbreak of war, and reports that his resources were to be increased reached London and were passed to Stanmore. They proved well founded, though in the outcome the augmented force was used for the Scandinavian campaign which came in April.

A consequent request from Dowding that the Air Staff should review the needs of air defence found them already engaged in such a study. They noted that since the beginning of the war the defences claimed to have shot down thirty German aircraft—an estimate more or less confirmed by various sources at the time and now known to have been substantially correct.² The number which had come within their reach was estimated at not less than 100 and not more than 300. Thus at least a tenth and perhaps nearly a third of the attackers had been destroyed while in search of ships and harbours. Superficially it seemed fair to assume that attacks on inland targets would bring a higher rate of loss.

As combat losses exceeding ten per cent. of the attacking force were widely held to approach the prohibitive if long continued, thus far the argument tended to show that the defences needed no improvement. But much else had to be considered. Whether the enemy increased his range or not, the flanks of the defensive system lacked

¹ A sortie is one flight by one aircraft; a patrol one flight by any number of aircraft. Thus a patrol by two aircraft counts as two sorties.

² During the period in question the Luftwaffe lost 46 aircraft in operations against the United Kingdom and shipping in adjacent waters. Of these losses, a minimum of 27 and a maximum of 32 were attributed by the Germans to the defences, the rest to other causes such as accidents.

depth, and local defences there and elsewhere were generally weak for want of guns. Success against small forces which hardly crossed the coast might therefore be a misleading index of ability to cope with larger forces bent on penetration. The country's war potential was growing; factories and stores were springing up in remote parts of the kingdom, so that places yesterday obscure were to-day important, and to-morrow might perhaps be easily assailable. At the lowest estimate there seemed to be a good case for the formation of a new fighter group in the south-west, which had been projected before the war. That another would soon be needed to bridge the gap between the northern flank and the outpost at Scapa Flow was highly probable. Moreover the Air Staff, taking a gloomier view than events were afterwards to justify, calculated that by the autumn of 1940 the enemy would have well over two thousand bombers, and six months later about a thousand more. It followed that sooner or later the fighter force would have to be increased, and there was much to be said for planning its expansion in such a way as to keep pace with the formation of any new groups which might be in view. For the new groups would be of little value if Dowding was so short of fighters that he could not count on furnishing them with squadrons.

Accordingly in March Air Commodore D. F. Stevenson, Director of Home Operations, recommended that seven new fighter squadrons should be formed at once and another twenty within the next twelve months.

However good these arguments, the conclusion was not one which the Air Staff as a whole could be expected to accept without reluctance. When putting forward the original scheme of air defence in 1922, and again before the Salisbury Committee in 1923, their predecessors had stressed the importance of bombing. The fighter force, they urged, was a subsidiary weapon, likely to be invaluable during the awkward period while the bomber offensive was getting under way, but always to be kept as small as possible. At any rate in theory, they had never departed from that doctrine. Even after the advent of radar had revolutionised the possibilities of pure defence, they had continued to regard a powerful striking force, erected on the modest framework of the peacetime Bomber Command, as their main weapon. Accordingly the outbreak of war should have been the signal for a great expansion of the bomber force and all its services. But in fact the manifold claims of war had precluded any such expansion, so that instead of being larger than in 1939 the bomber force was three squadrons smaller, and well behind the peacetime programmes. If Stevenson's recommendations were accepted its expansion would be still further delayed.

Moreover there was no certainty that the aircraft industry would be able to maintain a fighter force of the size proposed. At the end of

the third week in February the Aircraft Storage Units held only sixteen Spitfires and Hurricanes immediately ready for active service; in the whole of that month the output of single-engined aircraft was 143. Two months later the outlook was so unpromising that Air Marshal Courtney, the member of the Air Council responsible for supply and maintenance, found it necessary to propose a fortnight's halt in re-equipment with new aircraft in order that his department might have some chance of building up a small reserve.

Irrespective of any theories about the relative importance of the bomber and the fighter, probably the only course the Air Ministry could reasonably have taken, short of somehow engineering a spectacular increase in production, was a compromise. At any rate that was the course they took. They approved substantial additions to Fighter Command's ground organisation, but deferred the formation of new fighter squadrons until they could see what dislocation of supplies was likely to result.

There the matter stood in early May, when reports that the Germans—who had already struck at Norway—were about to launch their main offensive in the west became increasingly circumstantial and persistent. If the Expeditionary Force were heavily involved in France or Belgium, demands for more fighters in that theatre would certainly be made and could scarcely be resisted. To meet them without grave prejudice to home defence would be impossible unless Fighter Command had a margin over present needs. On the 8th the Air Ministry bowed to the inevitable. They sanctioned the immediate formation of three of the seven squadrons proposed by Stevenson in March, and arranged to discuss the other four at a meeting two days later.

Thus the opening of the battle for Western Europe on 10th May found the Air Ministry on the eve of a modest expansion of the fighter force, while ahead of them loomed formidable problems of production and supply. The meeting planned for that date was postponed for six days while the Air Staff grappled with issues more urgent but scarcely more important.

CHAPTER VI

NORWAY TO DUNKIRK

(April–May, 1940)

(i)

BY THE SPRING of 1940 some elements of home defence were not far short of pre-war programmes, others far below them. The fighter force, as we have seen, had reached a strength of fifty-seven squadrons; but six of the fifty-seven were in France and only fifty-one at home. As Air Chief Marshal Dowding had renounced the trade-protection squadrons but was nevertheless committed to the defence of coastal shipping, his minimum requirement for all needs except the protection of Belfast, which as yet was not in danger, could scarcely be put at less than the fifty-two squadrons allotted to the main scheme, trade protection and the defence of Scapa Flow by the plan drawn up in 1939.¹ We have also seen that any further demand for fighters in France could be met only at the expense of Dowding's force until such time as an increase in production—whose achievement threatened dislocation of the Air Staff's programme of re-equipment and expansion—permitted the formation of more squadrons. Other components of the air defence complex were still further below admitted needs. Anti-Aircraft Command was short of guns and searchlights, and much of its ancillary equipment was old-fashioned. Balloons were scarce. The system of early warning and control was well-knit at the centre, but called for consolidation and extension on its flanks. Devices to counter night attack—notably airborne radar and radar sets for guns and searchlights—were still in the experimental stage. Despite these weaknesses, the air defences could perhaps be reckoned capable of dealing with such daylight attacks as the enemy was likely to deliver from his present bases. But their ability to cope with night attacks was much more doubtful. Moreover, there was always the risk that hitherto neutral or friendly countries, falling into German hands, might give the enemy bases nearer to the United Kingdom. In any case some awkward problems were certain to arise if a land campaign in Europe coincided with even modest air attacks at home.

To what extent the defences could be reckoned adequate against other forms of direct assault depended on the soundness of assumptions soon to be severely tested. For many years the attitude of

¹ See p. 72.

British governments to invasion had been coloured by the belief that British naval power would confront an aggressor with almost insuperable problems. More recently the coming of new weapons had shaken that belief but not destroyed it. At bottom the 'Julius Caesar' plan was founded on two hopes. The first was that, despite doubts expressed when the matter was mooted in October, naval and air power, backed by the coast defences, would virtually preclude a landing by seaborne troops alone; the second, that the admittedly weak divisions left at home would suffice to mop up airborne landings. Recent experience, so far as it was relevant, did nothing to confirm the one, while the other rested on no experience at all. Up to the present the maritime defences had not gained control of the North Sea, and even the return of the Home Fleet to Scapa Flow in March left many problems still obscure. The coast defences lacked much that they might need, especially for dealing with fast light surface craft. With few exceptions the booms installed under local naval defence schemes were intended only to keep out submarines, and the short-range armament at most ports was not of the most modern type. Generally the fixed defences fell short of the approved scales.¹ In any case the scales did not reflect the new conception of the invasion risk adopted since the war began. Perhaps the fairest verdict is that, while the measures taken since the autumn were possibly the best that could have been devised at a time when much else had to be considered, such confidence as was reposed in them owed less to their intrinsic merits than to the unlikelihood that they would be put to the test without good warning.

Until April these shortcomings aroused few apprehensions—perhaps fewer than they should have done. But if the authorities seem

¹ The state of the fixed defences in May, 1940, can be summarised as follows:

GUNS

At the nineteen ports assigned to Category A before the war, the numbers present, as compared with the approved scales, were:

	<i>Approved</i>	<i>Present</i>
MEDIUM RANGE		
9·2-inch	43	22
7·2-inch	—	3
6-inch	105	97
4·7-inch	1	9
SHORT RANGE		
Latest Type		
6-pounder	27	2
Older Types		
12-pounder	23	48
3-pounder	—	2

At most of the Category C ports the scales had not been fixed when war broke out. In May the five ports considered most important shared ten 6-inch guns.

SEARCHLIGHTS

In general, searchlights were provided on a scale of one for each two-gun battery. At large estuaries, such as the Thames and Humber, their power was insufficient to allow the 9·2-inch and 6-inch guns to fire after nightfall to their full range, if at all.

in retrospect to have been unduly hopeful, at the time they had strong support from the argument that invasion was unlikely without their getting wind that such an undertaking was in view. Additional precautions could then be taken, and the whole weight of the bomber force—whose effective striking power was still overrated—could be brought to bear against the expedition while it was assembling. On the other hand, one of the Government's duties was to provide against the unexpected. Their attitude must be judged in the light of both considerations. As for the general public, the chances of invasion would seem to have figured little in their calculations. In the early part of 1940 most citizens would probably have found it difficult to imagine that hostile troops could land on British soil. Many educated Englishmen, seduced by romantic interpretations of naval history and by the claims of poets from Shakespeare to Thomas Campbell, forgot that wind, tide and geography could be enemies as well as allies of Great Britain. Even in face of experience, there was a tendency to take control of the North Sea for granted as long as the country possessed a relatively strong surface fleet. Before long dire events gave a sharp jolt to that assumption.

(ii)

From the British standpoint the events which culminated in the fall of Norway began on 4th April, when aircraft of Bomber Command reported 'two enemy capital ships of the *Gneisenau* class' at Wilhelms-haven, the principal German North Sea base. Two days later photographic reconnaissance confirmed the presence there of the battle cruisers *Scharnhorst* and *Gneisenau*, with other warships. That night a stationary warship was seen in the Jade roads, and a bomber crew reported seeing a large ship twenty miles north of Heligoland, moving north.

Attempts by Bomber and Coastal Commands to follow up these finds next day were only partially successful. Even so enough was seen to make it certain by the afternoon that several German warships were at sea. In fact they comprised the two battle-cruisers, the cruiser *Hipper*, and fourteen destroyers, all on their way to land troops in Norway. At the time their identity and destinations were not known. For some time past, reports from confidential sources had testified that the enemy was accumulating troops and shipping in the Baltic, possibly for despatch to Scandinavia; but whether the warships now at sea would in fact go to Norway, or alternatively turn into the Skagerrak, make for the Atlantic, or return to North Sea bases was not established. Meanwhile their presence was a potential threat to the United Kingdom and to Allied interests generally.

Accordingly, measures were taken to intercept them. On the evening of the 7th Admiral Sir Charles Forbes, Commander-in-Chief, Home Fleet, left Scapa Flow with the capital ships *Rodney*, *Repulse* and *Valiant*, accompanied by two cruisers and ten destroyers. The Second Cruiser Squadron, numbering two cruisers and four destroyers, sailed from Rosyth to support him. The *Renown* and fourteen destroyers being already at sea on a mining expedition designed to check the flow of Swedish iron-ore to German ports, his force comprised the greater part of the available strength of the Home Fleet. Other British naval forces already at sea included a cruiser under orders to join the *Renown*, and nine destroyers covering or escorting convoys.

With the object of coming up with the German ships if they made for the Atlantic, Admiral Forbes set a course which left the central part of the North Sea uncovered. The First Cruiser Squadron was at Rosyth embarking troops held ready to exploit any opportunity of landing unopposed in Norway which might arise from the mining expedition; after the Commander-in-Chief had sailed, these ships were ordered by the Admiralty to disembark their troops and join him at sea. The cruiser *Aurora* and six destroyers similarly occupied in the Clyde were to move to Scapa Flow when they, too, had put their troops ashore.

Early on the 8th an encounter between the *Hipper* and one of the destroyers covering the mining operation left no doubt that she at any rate was bound well north of the Skagerrak. For the rest of the day the search for the German ships was the main task of the maritime defences. While the Home Fleet sought them in a waste of waters, shore-based aircraft covered a great part of the North Sea and the Norwegian coast, though in general their patrols were too far north to reveal other German forces which sailed unobserved to ports in southern Norway.

Next morning the German expeditions reached their destinations and Norway awoke to find herself invaded. At the same time German troops crossed the Danish frontier; and within the next few hours the principal Danish aerodromes fell to parachutists and airborne infantry. By the evening Denmark was virtually a conquered country.

In Norway, resistance by the Norwegian Army and counter-attacks by Allied forces postponed defeat, but the enemy's progress in the early stages was almost equally spectacular. Helped by an accurate if lucky long-term weather forecast, and profiting by British failure to grasp the situation at the outset, the German High Command reaped the reward of a bold and well co-ordinated plan. The success of their naval forces in eluding interception on the outward voyage, followed by a daring and imaginative use of first-line

and transport aircraft, enabled them to forestall and outwit their adversaries, despite a marked inferiority in naval surface power and a sparing employment of troops. The small Norwegian air force was annihilated before it had time to take the air. Parachutists and airborne infantry then seized the principal aerodromes near Oslo and Stavanger, which were forthwith put to use as bases for the next stage of the offensive. Pending the capture of the aerodrome at Vaernes, near Trondheim, on the second day of the campaign, German transport aircraft landed on an improvised strip outside the town. Possession of these bases was of great help to the Germans in repelling counter-attacks by Allied troops whose lack of similar facilities was a tremendous handicap. On the Allied side a shortage of anti-aircraft weapons was also keenly felt. Two British forces which tried to re-take Trondheim by a converging movement were sorely hampered by the much-envied efficiency of German arrangements for co-operation between troops and aircraft, and by their own lack of air support. At Narvik, ultimately captured by the Allies only as the prelude to withdrawal from the Norwegian theatre, British air bases were improvised before the end of the campaign; meanwhile air superiority rested with the Germans. Finally, theoretical inferiority at sea did not prevent the enemy from sending the *Scharnhorst*, the *Gneisenau* and the *Hipper* once more into the North Sea in early June, when the two battle-cruisers sank the aircraft-carrier *Glorious* as she returned from Narvik.

These events have been recounted much more fully in other volumes of this series. They are recapitulated here because their bearing on certain problems of home defence was clearly, and was seen at the time to be, of great importance. The Scandinavian campaign cost Germany one eight-inch cruiser, two light cruisers, ten destroyers and eight submarines, against one aircraft-carrier, two cruisers, a sloop, nine destroyers and six submarines lost by her opponents. In addition, many German ships were damaged. On the one hand these losses, relatively much heavier than our own, diminished her capacity to give naval cover to a seaborne attack on the United Kingdom; on the other, she captured naval and air bases of great value for her offensive against trade, while the latter were also of some value for attacks on Britain. Outwardly, too, she gained an important moral victory, for her ability to carry troops to Norway in the teeth of the Royal Navy and the Royal Air Force could not fail to impress potential victims elsewhere, and came as a great shock to the British public.

But the moral effects were not all one-sided. Worse setbacks were needed before the British public and its leaders awoke to all the dangers to which German *Blitzkrieg* methods exposed a country whose defences were not designed to meet such blows, and in any

case were incomplete. But some at least of the lessons of Norway did not go unheeded, even though their full import was not apparent until later. One immediate result was a widespread feeling that all was not well with British strategy. Not all those who criticised the handling of the campaign in Norway were at one in their diagnosis; but, justly or unjustly, allegations of inadequate co-ordination at the highest level found wide support. After a stormy debate in the House of Commons, Mr. Chamberlain resigned his leadership to take office in a Coalition Government under Mr. Winston Churchill, hitherto First Lord of the Admiralty.

(iii)

Before Mr. Chamberlain had actually resigned, the Germans launched their main blow in the west. Early on 10th May their bomber force struck at aerodromes, rail centres and other targets over a wide area in France and Belgium, while parachutists and airborne infantry seized vital objectives near the Belgian frontier and in Holland as the prelude to a powerful assault by troops well supported by air and armour. In the Low Countries objectives which had been expected to hold out for days or weeks succumbed in a few hours to methods of attack which their defences were not designed to meet. Airborne forces overwhelmed the Netherlands in eighteen hours; in Belgium a fort built to withstand a long siege fell early on the second day, its captors suffering only five casualties. Within a few days the French line gave way before the German onslaught. Pressing westward, the enemy soon reached the Channel, cutting the bulk of the British Expeditionary Force, with other Allied forces, from its bases and from the French armies south of the German penetration.

Within a few hours of the opening of the German offensive, reports from Holland, coming hard on the heels of events in Norway, set in motion a drastic reassessment of the chances of direct assault at home. Now at last the British public, long accustomed to assign invasion to a class of undesirable events which happened only in foreign countries, began at last to wonder whether their island home was in truth as impregnable as most of them had hitherto supposed. The sudden appearance of well-armed parachutists in the English countryside, in the neighbourhood of great ports or even in the streets of London, seemed no longer a vague menace which did not seriously threaten our security, but a present danger. In a message widely circulated on 10th May, the Air Ministry urged all concerned to take prompt steps for the capture of any who might be seen descending, possibly in the guise of airmen seeking only to surrender.

But this particular danger, though it impressed the popular imagination more strongly than any other, was only one of many which seemed to have sprung up over night. On the same day a new body, called the Home Defence Executive, was set up to supervise a drastic overhaul of measures of defence. Besides the Commander-in-Chief, Home Forces, who took the chair, the members included representatives of the Admiralty, the Air Ministry, the Ministry of Home Security and the chief home commands of the Royal Air Force.

The province of the Home Defence Executive extended to almost every aspect of home defence; but not the easiest or the least important of their tasks was that of preparing the commercial and domestic fabric of the nation for the shock of invasion by sea or air, and so avoiding the dislocation which was said to be causing such havoc in Continental countries. Elaborate arrangements for Civil Defence, including the appointment of twelve Regional Commissioners with wide powers to co-ordinate local schemes with military needs, and if necessary to act on their own responsibility should communication with the central government become difficult, had been made before the war; but as long as invasion seemed unlikely the emphasis had rested on the dangers arising from air attack. A great number of counter-invasion schemes had now to be hastily improvised by civil departments and local authorities, passed as satisfactory, and knitted into a coherent whole. At the same time naval, army and air plans—with which the civil plans must not conflict—had all to be scrutinised from a standpoint almost inconceivable a few weeks earlier. Surrounding and obscuring the whole process was the cloud of rumour, exaggeration and false witness stirred up by the swift advance of the German armies from the Ardennes to the Somme. Lying reports were said—with some exaggeration—to be so potent an ally of the German cause that steps to counter potential ‘fifth column activities’ were not the least of the Executive’s preoccupations.

Meanwhile the Chiefs of Staff were trying to define the threat. To do so was not easy at a time when anything seemed possible, and almost any energetic action meritorious. In fact, the German High Command had sanctioned no plans to cross the Channel; but lack of evidence that immediate mischief was intended seemed less reassuring than in the past. Even so, the experts felt justified in assuming that invasion proper was not imminent. The enemy was still heavily engaged in France, and would need some weeks to collect the necessary shipping. As for air attack, its dangers would be increased by the fall of Holland, but the offensive might not take the form so long expected. Instead of ordering a ‘knock-out blow’, the enemy might aim at air superiority over a stretch of coast where raiding forces were to land, or where full-scale invasion was contemplated in the future. The practical difference was that, while a ‘knock-out’ blow

might be attempted at a number of places—and might still be made—the neighbourhood where seaborne landings could be best supported by air power was limited by factors of geography and range. In particular, the dive-bombers which figured so largely in reports from France were restricted to an effective radius of about a hundred miles.

On this basis the most vulnerable area was the stretch of coast from Sussex to the Wash. Attacks by parachutists and airborne infantry would be most menacing if aimed at the fighter stations defending London; at the same time seaborne troops, conveyed in fast self-propelled boats of shallow draught, might come on a scale which fell short of invasion proper, yet do such harm as would make subsequent defence extremely difficult. Already installed in Holland (which capitulated on 15th May) and threatening to overrun the whole of Belgium, the enemy had no long sea-route to cover; and such boats could, the experts thought, be quickly assembled in Dutch or Belgian estuaries without being spotted by air reconnaissance. Hence no warning of their arrival could be relied upon. Looking further ahead, the authorities admitted that if, for example, a hundred small German transports carrying troops and tanks were to sail boldly up the Thames, some at least would reach their destinations, and that the process might be repeated at all the small ports between Portsmouth and the Humber. Five 9·2-inch, six 6-inch, four 12-pounder and two 3-pounder guns defenced the estuaries of the Thames and Medway, but on a dark night those at the mouth of the Thames were likely to be very ineffective. The Humber had eleven guns, including four 12-pounders, but again their probable effectiveness at night was fairly small.¹

Accordingly, measures to reinforce the seaward defences along the most vulnerable stretch of coast were among the first to receive attention. Light naval forces were ordered to positions which would give the best chance of intercepting a seaborne expedition from Dutch or Belgian harbours. Since the beginning of the war a series

¹ The guns present, as compared with the approved scales, were:

	<i>Thames and Medway</i>		<i>Humber</i>	
	<i>Approved Scale</i>	<i>Present</i>	<i>Approved Scale</i>	<i>Present</i>
9·2-inch	5	5	3	2
6-inch	11	6	4	3
4·7-inch	—	—	—	2
6-pounder	9	—	4	—
12-pounder	—	4	—	4
3-pounder	—	2	—	—

The 9·2-inch guns commanding the Thames estuary could not fire by night, as they had no fighting lights; the 6-inch guns, which could fire in daylight to 12,000 yards, were restricted at night to a practical range of 4,000 yards, as their lights were not effective beyond that distance. At the Humber the effectiveness of the medium-range guns was also limited after nightfall by the range of their searchlights. The relatively narrow entrance to the Medway was protected by day and night.



Plate 3. Beach Defences on the Coast of Kent : a Concealed Machine-Gun Point at Dymchurch.



Plate 4. Coast Defence Gunners preparing to fire a Practice Round from a 9·2-inch Gun.

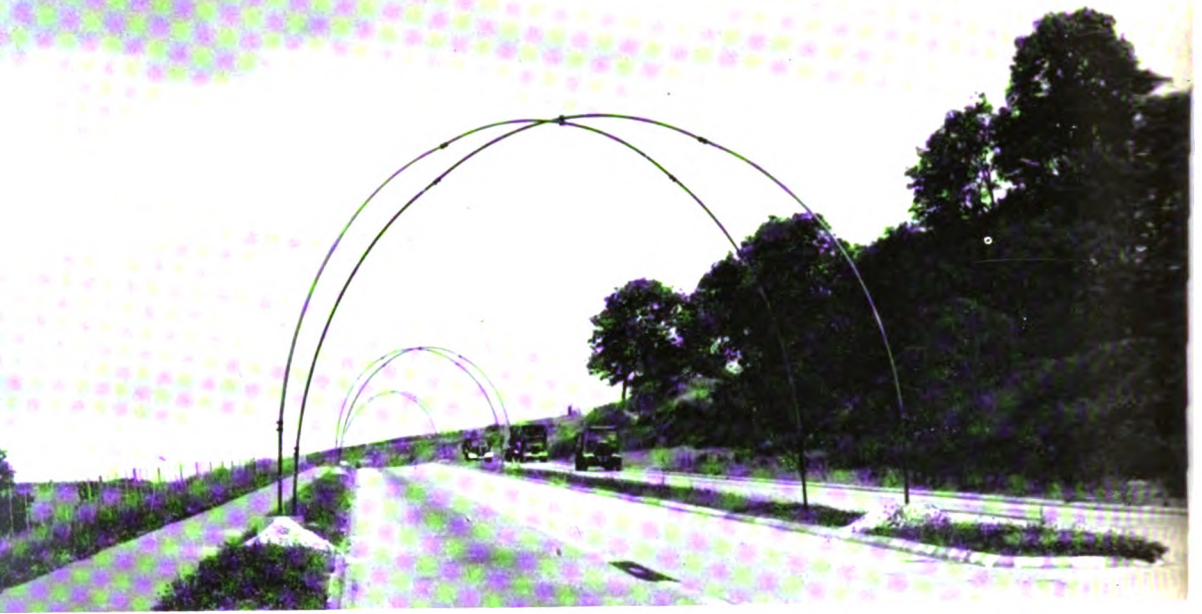
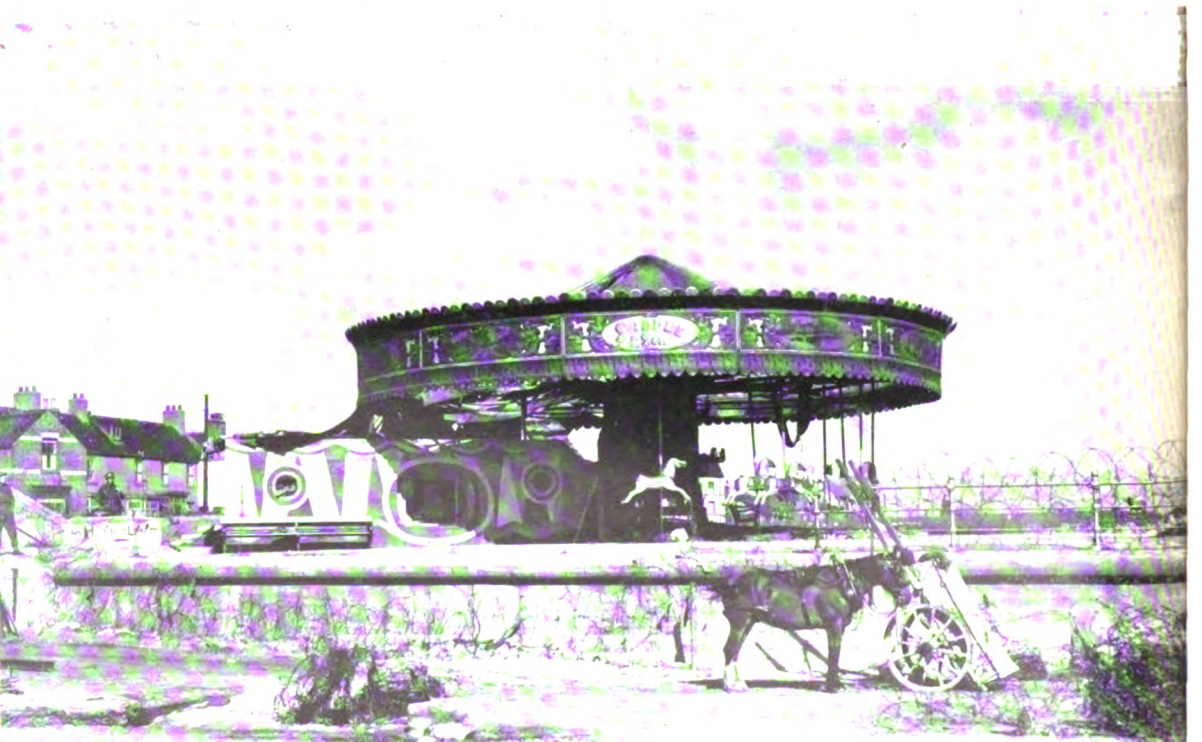


Plate 5. Obstructions to prevent the landing of Gliders or Troop-Carrying Aircraft on a Bypass Road in Surrey.

Plate 6. A Camouflaged Strong Point in Northern Command.



of declared minefields along the East Coast, primarily for the protection of coastal traffic against minelayers, had been begun but not completed; arrangements were now made to strengthen the southern portion and extend it seawards so as to hamper attempts to sweep a passage for an invading force. To fill some of the worst gaps in the fixed defences, the Admiralty agreed to find 150 6-inch guns from a pool intended for the arming of merchant vessels; later additions, including some smaller pieces, brought the number ultimately drawn from naval sources to 653. Under the general supervision of the Admiralty, local naval authorities from Aberdeen to Swanage drew up schemes for denying ports to the enemy by various means, including blockships, mines and demolition charges. In general, the intention was not to wreck ports on the mere chance that they might be captured, but to ensure that at worst the enemy should not find their supplies and facilities intact. A flag officer was appointed to inspect all ports concerned, and another to visit all likely landing-places. Naval brigades were formed to give additional protection to dockyards and other naval establishments threatened with sabotage or capture. At the end of May the Admiralty assumed control of the Coastguard Service, a civil organisation hitherto administered in peacetime by the Board of Trade and in war by the Ministry of Shipping. To simplify co-operation between navy and army, a senior naval officer joined the staff of the Commander-in-Chief, Home Forces, and was given authority to deal directly with his colleagues at the Admiralty.

Measures of a more general character included the internment of aliens of enemy origin and the detention of many members of organisations whose loyalty could not be relied on. Preparations were made to render useless to an invader not only ports but also railways, telephone and radio communication systems and public utilities, and to deny him bulk stores of food, petrol and other commodities. To hamper the landing of troop-carrying aircraft and gliders, open spaces and stretches of arterial road near the South and East Coasts were obstructed; at the same time roads leading to ports and aerodromes were blocked and bridges were prepared for demolition. Policemen were armed against parachutists. Place-names were removed from signposts, shopfronts, tradesmen's vans and the like throughout the country. Restrictions were placed on the sale and possession of maps, plans and guide-books, and retailers near the coast were asked to move their stocks of such material inland. After discussion between the Ministry of Home Security and the ecclesiastical authorities, orders were given that church bells should be rung only as a warning that parachutists or airborne infantry were descending.

(iv)

Meanwhile many members of the public had given earnest of their determination not to succumb lightly to the fate which had overtaken Holland. Since the start of the war the formation of local defence forces recruited from those debarred by age or circumstances from volunteering for general service with the armed forces had been proposed from many quarters. On 10th May and the succeeding days the news from Holland gave a tremendous impetus to the movement, while at the same time it created a climate in which many of the orthodox objections to such schemes lost much of their force.

On 11th May the possibility of forming some kind of local defence organisation was discussed at a meeting held at the War Office under the chairmanship of Mr. Oliver Stanley, Secretary of State for War in Mr. Chamberlain's outgoing Government. Those present included the Vice-Chief of the Imperial General Staff, the Adjutant-General, the Commander-in-Chief, Home Forces, and a representative of the Home Office. General Kirke, who had been considering the matter for some time, made a number of suggestions, and ultimately he and General Sir Robert Gordon-Finlayson, the Adjutant-General, drafted a message to the public, which they intended that General Kirke should broadcast on the evening of the next day. At a further meeting on 12th May the authorities agreed that any man between the ages of sixteen and sixty-five who had fired a rifle or a shotgun and was 'capable of free movement' should be eligible unless there were special grounds for his rejection. Those accepted would be embodied in an organisation to be known as the Local Defence Volunteers, and would be unpaid. Later the force was known as the Home Guard.

In the outcome ministerial responsibility for the scheme fell on Mr. Anthony Eden, who succeeded Mr. Stanley while the discussions were in progress. His colleagues agreed that, in order to give special weight to the broadcast appeal for volunteers, he should deliver it himself.

Mr. Eden drafted his broadcast on the evening of 13th May from the notes already prepared by Kirke and Gordon-Finlayson.¹ He delivered it on the evening of the 14th, immediately after the French had suffered a severe reverse across the Channel. After referring to the German use of parachutists, and to the many offers of help which had been made by private citizens, he asked volunteers to enrol at their local police-stations. Some of his hearers left to offer their services before he had finished speaking, and in a few hours police-stations all over the country were thronged with callers.

¹ Graves, Charles, *The Home Guard of Britain* (1943).

By 20th May about a quarter of a million local defence volunteers had been enrolled, and by the end of the month the number had reached about three hundred thousand. On 30th May Major-General Sir John Brown of the War Office accepted the immense task of organising the force with the help of Territorial Associations throughout the country, and of supervising its training in consultation with the Director of Military Training. Operational control was vested in the Commander-in-Chief, Home Forces. Rifles of military pattern were available for about one-third of the volunteers; the rest had shotguns, sporting rifles or improvised weapons such as golf clubs, sticks and bludgeons. Even those with rifles would scarcely be a match for parachutists armed with sub-machine guns and grenades; but at worst the volunteers might usefully supplement the work of the scanty home defence divisions by giving the alarm.

(v)

Meanwhile, on 11th May, the War Cabinet had honoured a long-standing promise to the French by ordering the immediate despatch to France of the 1st Armoured Division. The division had long been earmarked for that destination, but its preparations were not yet complete. With it went the better part of the country's armoured strength. Later the 52nd Division and parts of the 1st Canadian Division also crossed the Channel. On the assumption that invasion was not yet imminent, these moves could not be censured, but they left Home Forces very weak. From the outset divisions destined for the Expeditionary Force had enjoyed a substantial degree of priority, so that those which remained at home were neither as well equipped, nor generally as well manned, as those in France.

On the other hand, where air forces and weapons of air defence were concerned, the home front had the advantage. In view of the scale of air attack which might be delivered from German or other Continental bases, diversion of the major part of the air defences from their prior task of defending the United Kingdom had formed no part of pre-war plans. In early May the fighter squadrons at home outnumbered those in France by roughly eight to one, and Anti-Aircraft Command, though far below its approved scales, had a generous share of the available anti-aircraft weapons. Across the Channel six fighter squadrons had not only to meet all the claims of the Expeditionary Force, but also shared with a small number of heavy and light guns and balloons the task of protecting rear areas, including their own bases and those of other air force units. Numerically the troops in France were better off for bombers, with ten medium squadrons in the Advanced Air Striking Force, and the

promise of direct support from another six at home. But even though the original plan of using these squadrons for 'strategic' bombing had been relegated to the background, they were not at the sole disposal of the Expeditionary Force, since they also had a duty to the French. The rest of the effective bomber force comprised eighteen heavy squadrons at home bases. These the Air Staff wished to keep for 'strategic' bombing, though they too might be called upon to support the Franco-British armies in certain circumstances. The Army Co-operation squadrons in France—now raised from eight to nine—comprised the major part of those available, some fifty aircraft remaining in Great Britain. Coastal Command now mustered some nineteen squadrons, all at home.

As soon as the Germans opened their offensive against France and the Low Countries, the Air Ministry despatched to France the remaining four of the six fighter squadrons which had been put on a mobile footing early in the war.¹ Their departure left Air Chief Marshal Dowding with 43 squadrons fit for first-line duties, including two about to go to Norway, and with four as yet unready for active operations. Thus he was already nine short of the fifty-two squadrons which represented his minimum requirement. From the start, however, events across the Channel showed so ominous a tendency that further demands on his resources were inevitable. The medium bombers could not live against German fighters and anti-aircraft weapons unless escorted, and the army called urgently for fighters to counter the bombers and dive-bombers which harassed artillery positions, tanks and infantry. Sorties by home-based fighters along the Belgian coast and over Holland were not a sufficient answer. On the fourth day of the battle the Air Ministry responded to appeals from British army and air commanders on the spot by sending 32 more Hurricanes, drawn from several of Dowding's squadrons.

Next day the French suffered a severe reverse on the left bank of the Meuse above Namur. They were thus confronted with a situation which could scarcely be retrieved except by a powerful counter-attack, for which they would need far stronger air support than their own air force, depleted by recent losses, could provide. In these circumstances M. Reynaud, the French Premier, asked that ten more British fighter squadrons should be sent to France. After discussing the matter the British Government came to the conclusion that in any case no counter-attack would be possible for several days. Accordingly they did not at once return a favourable reply, but asked the Chief of the Air Staff to make such preparations as would ensure that the squadrons could start without delay if they did decide to send them.

¹ See pp. 88-9.

A sharp conflict between two policies was now inevitable. For months past Dowding had strongly opposed the sending of any fighters to France until his needs were met. He had yielded only under protest to demands which had cost him more than the equivalent of a dozen squadrons since the beginning of the war. In the autumn of 1939 he had argued forcibly in favour of conservation of the air defences to meet a 'knock-out blow' whose consequences might be decisive. 'The continued existence of the nation, and all its services,' he had written on one occasion, 'depends upon the Royal Navy and the Fighter Command.' Admittedly it could be argued that the gravity of the situation in France now made that attitude untenable; but the fact remained that to send another ten squadrons of fighters across the Channel would certainly weaken the defences, and would not of itself ensure the success of a counter-attack which called primarily for offensive weapons.

Meanwhile the eighteen heavy bomber squadrons had yet to make their contribution. The Allied Supreme War Council had agreed on 23rd April that, in circumstances such as had now arisen, they should attack the German oil industry; but a decision by the War Cabinet was needed before executive orders could be given. By 14th May Dowding had come to the conclusion that the proposed attacks were not only calculated to ease pressure on the Franco-British armies, but would tend rather to promote the interests of home defence than otherwise. They might draw reprisals on the United Kingdom; but his forces would, he thought, be far better employed in dealing with such reprisals than in engaging the enemy over France, without the benefit of the well-organised system of early warning and control available at home. Having been invited some days earlier to give his views, he now wrote on those lines to the Vice-Chief of the Air Staff. Learning that the sending of more fighters to France was about to be discussed at the highest level, he also sought and received permission to put his views personally before the War Cabinet.

Accordingly he attended the meeting next day at which the French appeal for more fighters was discussed. There he strongly opposed the despatch of the ten squadrons, declaring that if the fighter squadrons already in France continued to lose aircraft at the current rate, the supply of Hurricanes would soon be exhausted. At the same time he affirmed his readiness to meet such reprisals as might arise from the bombing of the Ruhr. Clearly impressed by his arguments, the War Cabinet decided not to send the squadrons. That night 96 aircraft of Bomber Command were sent to bomb the Ruhr, 78 of them with orders to make oil targets their primary objectives.

But the respite was short-lived. On the 16th the War Cabinet, learning more of the plight of the French armies, resolved that a

supreme effort must be made to save France from collapse. They therefore so far fell in with M. Reynaud's wishes as to agree that the Air Ministry should order another eight half-squadrons of Hurricanes across the Channel. Fighter Command was thus reduced to the equivalent of thirty-six or thirty-seven squadrons—about two-thirds of the force considered necessary for home defence when the Luftwaffe was limited to bases in its own country.

Later on the same day Mr. Churchill left for Paris. After discussing the situation with M. Reynaud, he asked his colleagues in London to send six more squadrons. They would necessarily be Hurricane squadrons, for there were no facilities in France for the maintenance of British fighter squadrons otherwise equipped.

For two reasons the request could not be fully met. In the first place, there were now only six Hurricane squadrons at home which had not been already drawn upon; secondly, the only aerodromes available in France were incapable of taking, between them, more than three additional squadrons at one time. The War Cabinet, meeting without the Prime Minister at eleven o'clock that evening, fell back on a compromise. They arranged that the six Hurricane squadrons still intact should be concentrated in Kent. Each morning three of them would fly to France, where they would work from French bases until midday, when their place would be taken by the other three. At the same time the War Cabinet reversed their bomber policy of the previous day by agreeing, in deference to French wishes, that on the night of the 17th and succeeding nights the heavy bomber force, instead of bombing oil targets, should try to check the movement of German troops and supplies across the Meuse. In the meantime six of the eight half-squadrons ordered across the Channel earlier that day had gone; the others were to leave next morning.

Meanwhile Dowding had warned the Air Ministry that any further weakening of his command might be disastrous. He drew attention to the serious calls already made on his resources; reminded the Air Council that the possibility of defeat in France must now be faced; and asked them formally to say what they considered to be the smallest number of fighter squadrons which would suffice for home defence in that event. He concluded:

I believe that, if an adequate fighter force is kept in this country, if the fleet remains in being, and if Home Forces are suitably organised to resist invasion, we should be able to carry on the war single-handed for some time, if not indefinitely. But if the Home Defence Force is drained away in desperate attempts to remedy the situation in France, defeat in France will involve the final, complete and irremediable defeat of this country.

During the next few days the crucial issue raised by Dowding's letter was considered by the Air Staff and by the Prime Minister in his capacity as Minister of Defence. On 19th May Mr. Churchill ruled that no more fighter squadrons should leave the country, no matter what happened across the Channel. On the 20th the War Cabinet formally confirmed that decision. Meanwhile German troops had reached the Somme, and General Gort, commanding the British Expeditionary Force, had ordered his Chief of Staff, Lieutenant-General H. R. Pownall, to tell the War Office that his force might have to be withdrawn under pressure by way of Dunkirk or its neighbourhood. In that case a major fighter operation from home bases might be necessary to cover the withdrawal.

In the meantime many of the aerodromes allotted to the Air Component were threatened with capture or had already fallen. The rest were so much exposed to air attack that their defence seemed likely to absorb the entire effort of the Component's fighters. The headquarters staff had been obliged to leave their base at Arras and might soon lose touch with superior formations of their own service. On the other hand, General Gort was still in touch with London. Accordingly, on the 19th and 20th the bulk of the Component, including all its fighters, returned to bases in England, from which the squadrons continued to patrol over the far side of the Channel. The six Hurricane squadrons recently concentrated in Kent ceased to land in France each day; and after the 20th the only British fighter squadrons based in France were three with the Advanced Air Striking Force, which had retreated westwards.

(vi)

After General Pownall had telephoned the War Office on 19th May to say that the Expeditionary Force might have to be withdrawn in adverse circumstances, provisional plans for the withdrawal were begun in London. The advantage of appointing a single officer to direct embarkation of the troops and their passage across the Channel were obvious, and the choice fell on the Flag Officer, Dover (Vice-Admiral B. H. Ramsay). A number of anti-aircraft guns already with the Expeditionary Force would presumably be available to defend the embarkation area, but fighters would certainly be needed too. Accordingly Admiral Ramsay was given authority to call directly on Dowding for air support. Tactical control of the fighters would rest with Air Vice-Marshal K. R. Park, who had succeeded Air Vice-Marshal Gossage at No. 11 Group, the formation responsible for the air defence of south-east England. As a former Senior

Air Staff Officer to Dowding, Park was well aware of the Commander-in-Chief's views on the handling of the fighter force, and many of the squadrons in his group had already met the enemy over France and the Low Countries. Co-ordination between fighters, bombers and reconnaissance aircraft would be the task of Back Headquarters, a formation improvised primarily to supervise sorties over France by Army Co-operation squadrons withdrawn to England. Its base was Hawkinge, a forward fighter station conveniently close to Dover and connected by good communications with Park's headquarters at Uxbridge.

Many aspects of the withdrawal from Dunkirk lie outside the province of this volume. We are concerned here chiefly with the air fighting which accompanied the operation. Combats over Dunkirk gave the home-based fighter force its first large-scale encounter with the enemy, and had an important bearing on subsequent events which concern us more directly. In a sense the fighting was—and seemed at the time to be—a rehearsal for the more widespread struggle for air superiority over the approaches to this country which came later. Not merely for the fighter force, but also for Coastal Command, the withdrawal entailed risks and sacrifices of great moment.

When the decision to give full effect to the plan of withdrawal was made on 26th May, the plight of the Expeditionary Force seemed grave in the extreme. The hope of a great counter-offensive to restore contact between Allied forces north and south of the Somme having faded, about a quarter of a million British troops were irretrievably cut off from their original lines of communication, could be supplied only meagrely and with increasing difficulty through the few ports still open, and for some days had been on half-rations. At most about a fifth seemed likely to escape before the rest surrendered or were killed, though much might depend on the support which the fighter force could give from its home bases.

On the eve of the withdrawal the first-line strength of Fighter Command, now reinforced by squadrons recently in France, stood at rather more than 700 aircraft. About 600 were single-engined monoplanes of modern type. Reserves immediately available numbered about 230 aircraft; machines under repair or otherwise incomplete, and aircraft of first-line type in training units and the like, amounted to another 700. The German first-line strength, without transport aircraft, was estimated in London at more than 5,000 machines, including well over 2,000 bombers and some 1,500 fighters; reserves were believed to total 7,000. But in fact these estimates were overdrawn. At the height of the offensive against France and the Low Countries, the Luftwaffe disposed of about 1,500 to 1,700 bombers and 1,200 fighters in the western theatre. Reserves

of all types probably did not exceed a thousand aircraft. Thus at the worst our forces would not be quite so heavily outnumbered as was feared in London and at Stanmore.

Nevertheless, from the standpoint of the air defences the difficulties were formidable. In recent encounters over France and the Low Countries the Hurricane and the Spitfire had done well, but the Blenheim fighter had suffered heavily at the hands of the single-engined Messerschmitt 109, while the Defiant had scored only a transient success. Lying some fifty miles from the coast of Kent, Dunkirk was outside the range at which the system of early warning and control could give effective help, and could be reached by single-engined aircraft from only very few of Fighter Command's bases. Responsible as he was for defending the whole country, including vital aircraft factories in the Midlands and the equally vital naval base at Scapa Flow, Dowding could not afford to concentrate his whole fighter force in one corner of the Kingdom. Strong air cover for the withdrawal was clearly much to be desired, but he could not assume that his superiors would wish him to stake the future of the air defences on an operation which would not necessarily give him an opportunity of decisively defeating his opponents.

The beginning of the withdrawal proper on the 26th came too late to have much effect on No. 11 Group's programme for that day. Withdrawal of troops not urgently needed in France had, however, started earlier, and fighting was in progress at various points on the French coast, so that much of their effort was in any case devoted to patrols between Dunkirk and Calais. On the 27th Calais, which had fallen on the previous evening, was believed until midday to be still holding out; in consequence a great part of the morning's effort was wasted on patrols intended to support our troops there. In the afternoon Air Vice-Marshal Park's fighters paid more attention to Dunkirk, though they also patrolled inland, especially towards Saint-Omer. In the course of the day sixteen fighter squadrons made 287 sorties over north-east France, patrolling at an average strength of about one squadron. On at least four occasions our pilots were substantially outnumbered by fighters engaged in clearing the way for German bombers. Bombing destroyed a great part of the town of Dunkirk, though the outer harbour remained more or less intact. At the time these setbacks were believed to have been offset by the destruction of some 38 German aircraft for the loss of fourteen fighters; but in fact German losses on all parts of the front amounted to 35 machines, of which only ten are known to have been shot down in the immediate neighbourhood of Dunkirk. No mere numerical comparison can do justice to the achievements of our pilots, to which all who witnessed them bore tribute; but our squadrons were too few to achieve the mastery.

That night the Air Ministry warned the air force that the coming day was likely to be 'the most critical ever experienced by the British Army', and called on Fighter Command to 'ensure the protection of Dunkirk beaches . . . from first light until darkness by continuous fighter patrols in strength'. At that time the previous day's bombing was thought to have made the harbour useless, so that embarkation from the beaches only was expected.

These orders confronted Dowding with a task almost impossible to carry out, for the twin demands of strength and continuity were largely incompatible. To concentrate the entire fighter force, or most of it, on the few aerodromes from which Dunkirk could be reached would have left the rest of the country dangerously exposed, and perhaps would scarcely have been practicable even if it had been prudent. Yet the previous day's experience had shown that weak patrols were likely to be ineffective. Accordingly the course he sanctioned allowed Park to patrol the beaches with eighteen squadrons, at an average strength of about two squadrons, but to leave brief intervals between patrols. Most of the eighteen squadrons made two patrols, and some made three. On the whole the results were not unsatisfactory. No great toll was taken of the enemy—at most six or seven first-line aircraft were destroyed for the loss of thirteen fighter-pilots, though at the time the number of German aircraft believed to have been destroyed was twenty-three—but the damaging attacks of the previous day were not repeated. At the end of the day the naval authorities expressed their satisfaction with the air protection they had received. In his instructions for the morrow, Dowding received authority to use his squadrons as he thought best, the demand for continuity being tacitly abandoned.

On the 29th Park made full use of the greater latitude allowed him by using as many as four squadrons at a time, but leaving longer intervals between patrols. Consequently Dunkirk saw no British fighters for periods which ranged from forty to ninety minutes. Attempts were made to synchronise the arrival and departure of squadrons with the ebb and flow of shipping, but the consequences were far from happy. German bombers were out in force—of fifteen ships which sank that day, at least eight would seem to have succumbed to bombing—and British troops and sailors were painfully impressed by the absence of fighters at times when they would have been extremely welcome. Some thirteen or fourteen German aircraft were destroyed as against the 65 claimed by our pilots, one squadron in particular greatly over-estimating its success. Thus, while the dangers incurred by sacrificing continuity were plain enough, the absence of a compensating return from the larger formations which it permitted was not apparent.

Whether more accurate knowledge of the enemy's losses would

have affected subsequent events is a question which, for many reasons, it would be rash to try to answer. As it happened, there were only two more days on which a change of tactics could have modified the outcome. On 30th May mist and low cloud reduced the German effort to inconsiderable proportions. Next day the Luftwaffe made another determined effort to disrupt the withdrawal, though operations south of the Somme claimed some of its attention. Strong patrols separated by longish intervals were tried again, this time with better effect. Several German formations were driven from their targets, and throughout the day only three ships were sunk or seriously damaged by air attack. But on 1st June the same tactics failed to prevent heavy bombing, though our squadrons fought a number of stiff actions.

On that day heavy casualties were caused, too, by shells from German batteries newly established on the French coast. Accordingly no more withdrawals were attempted in full daylight. Thereafter Park's patrols were virtually confined to the morning and evening. Patrols over the sea at moderate strength were continued throughout the day by Coastal Command. Meanwhile troops still ashore at Dunkirk relied in the middle of the day on their remaining anti-aircraft guns. On the evening of 2nd June the British rearguard was withdrawn, but the embarkation of French troops continued until, on the 4th, an Admiralty message brought the operation to a close. Altogether some 225,000 British and 112,000 Allied troops had then been withdrawn in British vessels since 26th May.

To assess the effectiveness of the air cover given by the fighter force during that critical week is difficult, if only for lack of an agreed standard by which it can be judged. If the success of the withdrawal as a whole is the criterion, Park's patrols must be deemed successful. On the other hand, there is no denying that many eye-witnesses of the withdrawal left Dunkirk with the impression that the air force had not pulled its weight. Inevitably their views were partial. Much of the air fighting took place where they could not see it; lacking detailed knowledge of Fighter Command's problems and resources, they were in no position to say what could or ought to have been done. To many a soldier awaiting his turn for embarkation, with little food or water and in peril from an enemy at whom he could not strike back, and to many a harassed member of a ship's crew or naval landing party, anything short of continuous air cover in his neighbourhood was bound to seem inadequate. Conversely, every airman knew that cover on that scale was quite out of the question. Even so, a daily average of about 300 sorties at a period of crisis may seem less than might have been expected from a force some six or seven hundred aircraft strong. Numerical strength was, however, in some respects a bad index of Fighter Command's capacity. A number of squadrons had recently returned from France, where they had

suffered heavy casualties; others had been weakened by the well-meant but perhaps short-sighted policy of sending half-squadrons or smaller elements across the Channel during the first week of the battle, rather than a few whole squadrons.¹ Long an airman, Dowding was a soldier by training, and perhaps in a sense by temperament. Despite his keen solicitude for the claims of air defence at home, he was surely not the man to hold back when the army was in peril. Yet he told the Air Staff as early as the third day of the withdrawal that the fighter force was 'almost at cracking point'. Moreover, the number of bases from which Dunkirk could be reached was limited, as was the number of squadrons which a given base could handle. If Dowding was right, a substantially greater effort was not to be expected, even if the problems of administration and logistics which it would have entailed were soluble. But even if he was wrong—and this can only be a matter of opinion—such an effort could not have been achieved except by exposing parts of the kingdom remote from Dunkirk to fearful damage if the enemy should switch his bombers to another quarter. To assume responsibility for that risk was scarcely in Dowding's province, or even in the Air Staff's. Probably no one in the country would have been prepared to take it. While, therefore, we must leave open the question whether more air cover for the withdrawal could have been provided in any circumstances, we shall not be far wrong in concluding that, in the circumstances that did obtain, the effort made was about the biggest compatible with prudence.

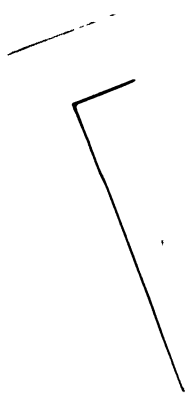
As for the results of the air fighting, at the time the conclusions drawn from them were more hopeful than the true facts warranted, yet not more so than the outcome justified. According to claims whose accuracy seems not to have been seriously doubted—though experience gained in the First World War gave grounds for scepticism—our squadrons destroyed 262 German aircraft over or near Dunkirk in the course of the withdrawal, for the loss of rather more than a hundred of their own machines and some eighty fighter-pilots. In fact the enemy's losses, including aircraft destroyed by formations other than Fighter Command, were roughly half that number.² But the unwitting exaggeration was not an unmixed evil.

¹ i.e., 32 Hurricanes, drawn from several squadrons, on the 13th, and eight half-squadrons on the 16th and 17th.

² The figures were:

	<i>Transport Aircraft</i>	<i>Others</i>	<i>Total</i>
On all parts of the front	5	151	156
In known areas remote from Dunkirk	1	18	19
At or near Dunkirk or in areas unknown	4	133	137
Losses not attributable to hostile action, included in first line above	—	5	5
Net Totals	4	128	132

Having apparently done so well in difficult conditions, the fighter force was expected to do still better when it fought in more favourable circumstances over its own territory. The onslaught on the United Kingdom which would surely follow was therefore awaited with some confidence; and that streak of good cheer was doubly welcome since the outlook in early June was in other respects extremely bleak.



CHAPTER VII

THE STOCKTAKING

(May, 1940)

WITHIN a fortnight of the opening of the German attack on France and the Low Countries, the British Government had to reckon with the possibility that France might be defeated. Besides the immediate problems discussed in the last chapter, they had therefore to consider wider issues. On their instructions the Chiefs of Staff drew up, towards the end of May, an estimate of the country's ability to carry on the war alone.

Assuming that Italy would intervene against us, that Japan would be at least potentially unfriendly, and that the United States would give 'full economic and financial support', the Chiefs of Staff came to the conclusion that much would turn on the air defences. It was, they said, 'impossible to say whether or not the United Kingdom could hold out in all circumstances'; but whether the enemy's attempt to enforce surrender took the form of blockade, invasion or a 'knock-out blow', his opening move would probably be air attack. If the air defences proved effective, and if the gravity of the threat were brought home to the nation, we should stand a good chance of survival. 'The crux of the whole problem', said the Chiefs of Staff, 'is the air defence of this country.' Meanwhile the country must be 'organised as a fortress on totalitarian lines'; in particular, potential 'fifth columnists' must be rendered harmless, and the public must be told of the dangers that confronted them.

On 22nd May, while the Chiefs of Staff were preparing their report, the Government assumed wide powers over the persons and property of British subjects resident in the United Kingdom, under the United Kingdom Emergency Powers (Defence) Act. On the following day a number of more or less prominent persons suspected of sympathy with the Germans were arrested, although all men or women colourably suspected of traffic with the enemy had, of course, been either apprehended or closely watched since the beginning of the war in accordance with ordinary procedure. Thereafter drastic steps were taken to guard against unfriendly acts by alien refugees who had applied in recent years for asylum in this country.

However necessary, these Draconian measures did little to dispel anxieties created by the news from France and rumours of the sore

plight of the British Army; but on the morrow of the withdrawal from Dunkirk, the national spirit was uplifted by a fighting speech from the Prime Minister, which turned doubt and confusion to determination. So profound were the effects of Mr. Churchill's words that their delivery can be reckoned a major step towards the better defence of the United Kingdom.

Since invasion was, of all measures open to the enemy, the most likely to be assisted by moral unpreparedness—and doubtless also for other reasons—Mr. Churchill's speech put much stress on that danger and on the Government's determination to resist it. The Chiefs of Staff had indeed urged that the public should be left in no doubt 'what they are required to do, and what not to do, if the country is invaded'. But they themselves were chiefly preoccupied, as we have seen, with the air offensive which seemed likely to come first. With the Air Component back in England, the air defences mustered rather more than seven hundred first-line fighters, of which about six hundred were Hurricanes and Spitfires. The Germans were thought to have at least twice that number of fighters and about three thousand bombers and dive-bombers.¹ Radar and a well-planned system of dispersal should enable the fighter force to escape the swift annihilation which had overtaken the Norwegian and Dutch air forces; but casualties across the Channel had been heavy—in three weeks' fighting about 430 fighters had been lost—and immediate reserves numbered only about a third of first-line strength. Anti-Aircraft Command was still weak, Balloon Command by no means strong. The Civil Defences, too, though the fruit of fifteen years of patient planning, envisaged attack from German bases, and needed drastic overhaul if they were to meet the heavier and perhaps more widespread offensive possible from aerodromes in newly-conquered countries, especially if it were accompanied by subversive measures designed to amplify the moral effects of air bombardment.

Hence the fighter force was likely to be the crucial weapon; and since reserves were scanty, its ability to sustain the struggle would almost certainly depend on fresh supplies of aircraft. The vital question, therefore, was whether the aircraft industry could turn out Hurricanes and Spitfires fast enough to meet losses. Pilots would of course be needed too; but for some time to come, machines would remain the deciding factor.

When the Chiefs of Staff completed their review, the outlook in this respect was far from promising. In the first six months of war,

¹ On paper the Germans had, in fact, about 1,800 fighters, and 2,000 bombers and dive-bombers, on all fronts. At the end of the French campaign a fortnight later the strength of their fighter units was, however, down to about 1,400 aircraft, of which 1,064 were serviceable. See also pp. 112-13.

747 fighter aircraft had been delivered, the monthly output rising from an average of 110 in the whole of 1939 to 177 in March, 1940, and 256 in April. The figure for May was expected to reach 261, or roughly five-eighths of the number lost in the last three weeks. Between June and October a monthly average of 344 machines was predicted. By concentrating on existing at the expense of newer types, the factories might be able to improve a little on these figures; on the other hand, a few successful attacks by German bombers might well upset their plans, especially as two factories made all the engines for the fighter force.

Accordingly the Chiefs of Staff urged the Government to do their utmost 'to persuade the United States of America to provide aircraft, particularly fighters, as soon as possible and in large numbers, including those from stocks now held by the United States Army and Navy.' Ultimately this suggestion—though not carried out on quite the lines proposed—brought useful additions to the country's stocks of certain categories of aircraft.¹ But the crucial problem of the fighters needed in 1940 was solved by the efforts of British factories. Under the stimulus of the emergency vividly depicted by Mr. Churchill in his speeches, and urged on by Lord Beaverbrook at the head of a new Ministry of Aircraft Production—which assumed the general responsibility for co-ordination of production hitherto exercised by the Air Ministry—the British aircraft industry strove successfully to prove better than its word. In May, deliveries of fighters exceeded the estimated figure by more than sixty aircraft; in the next five months they were about one-third higher than the Chiefs of Staff expected.² Meanwhile a brief respite helped Fighter Command to build up its strength a little, so that by the middle of July the losses suffered in France had been made good. For the moment, however, the breathing space which made this outcome possible could not be foreseen.

But in any case, avoidance of defeat in the air would not alone ensure survival. Invasion by an enemy who had not gained air

¹ Before the war orders had been placed in the United States for Hudson reconnaissance aircraft and Harvard trainers; later a number of other types were ordered, notably Fortress heavy bombers, Maryland, Baltimore and Boston medium bombers, Catalina flying-boats and Tomahawk and Kittyhawk fighters. Aircraft ordered in the Dominions before the war included Hampden bombers from Canada and Beauforts (designed as torpedo-bombers) from Australia. No Tomahawks or Kittyhawks were used in the Battle of Britain.

² The figures were:

	<i>Expected</i>	<i>Delivered</i>
May	261	325
June	292	446
July	329	496
August	282	476
September	392	467
October	427	469

superiority was perhaps unlikely; attempts to starve the country out by cutting off supplies of food and raw materials, on the other hand, would certainly be made and might perhaps succeed. On the whole, however, the country's chances of avoiding such a fate seemed fairly good. Ten battleships—the *Rodney*, *Nelson*, *Ramillies*, *Resolution*, *Royal Sovereign*, *Revenge*, *Malaya*, *Valiant*, *Barham* and *Warspite*—and three battle-cruisers—the *Hood*, *Renown* and *Repulse*—were in commission. Admittedly only three of the thirteen had been completed since the end of the First World War, and generally not more than four or five effective ships were available in home waters at one time. Even so, since Germany and Italy had between them only four capital ships—a number which might be slightly more than doubled within the next few months—the navy could hope to enforce a powerful sanction against surface raiders. At the same time, cruisers, escort vessels and destroyers were all scarce; the threat of Italian intervention had already compelled the Admiralty to base a substantial fleet on Alexandria; the collapse of France would bring fresh burdens in the western Mediterranean; and if Japan came into the war against us the long-cherished plan which envisaged a big fleet at Singapore would have to be discarded in favour of reliance on the United States to protect our interests in that quarter. Yet, all things considered, the Chiefs of Staff were confident that the naval strength available at home when other essential needs had been met would suffice to outmatch any surface effort that the enemy could bring to bear in the home theatre. By cutting out luxuries the country could manage with sixty per cent. of its normal imports, and the merchant navy had enough ships to ensure that rate of supply. The risk of underwater attack, which might upset these calculations, appeared less threatening than it might have done if a temporary shortage of German submarines—soon to be made good—had not prolonged the winter's respite. On the other hand, the Chiefs of Staff foresaw the risk that heavy air attacks on East and South Coast ports might deny them to merchant vessels, and urged accordingly that the complex problems which would arise if West Coast ports alone were so used should be faced. They recommended, too, that the country's system of intelligence should be strengthened in order to ensure good warning of the enemy's intentions and that, besides aircraft, destroyers and light naval craft should be sought in the United States.

Thus all paths led the Chiefs of Staff to the conclusion that efficient air defences were the primary requisite for survival. If they were strong, a 'knock-out blow' could very probably be resisted; the West Coast ports at least could be kept open to trade protected by the maritime defences; and invasion across an uncommanded sea would, at the worst, be made more difficult by the enemy's inability to use his air force as he pleased.

In any case, for reasons already noted—namely, the enemy's pre-occupation with events in France and the time needed to assemble shipping—invasion proper was not likely to come for several weeks. On the other hand, the dangers which had seemed so alarming when the fall of Holland was imminent would not be less so if France too collapsed. The Air Staff calculated that fewer than 5,000 parachutists, temporarily paralysing the air defences by attacking seven vital aerodromes in south-east England, might pave the way for bomber raids and landings from troop-carriers, which in turn would carry the enemy well along the road to more ambitious projects. At the same time up to 20,000 troops, accompanied by armoured fighting vehicles carried in special landing-craft from which they could be put ashore on open beaches, might be rushed across the southern part of the North Sea and descend upon us with little or no warning. To keep them out of the country would be difficult, perhaps impossible; for the navy had not nearly enough destroyers or patrol vessels to cover the whole coast from the Wash to Sussex, the local seaward defences of our estuaries and harbours were not proof against fast light surface craft, and the fixed defences were still weak. In favourable weather—or alternatively if German air superiority stifled air reconnaissance—they would have a good chance of getting ashore without effective interference. And if the enemy did gain air superiority, he might conceivably be able to protect their communications in face of our naval power, thus employing a mere raiding force to gain a bridgehead through which invasion proper might be launched.

If the enemy could not be kept out of the country, what were the chances of defeating him once he was in? On the eve of the Dunkirk withdrawal, and while it was in progress, they seemed very slender. The 'Julius Caesar' plan had been overhauled in recent weeks; but on the whole Home Forces were neither equipped nor trained to deal with an enemy well supplied with armour. General Sir Edmund Ironside, succeeding to the command on the day when the withdrawal started, was hampered just as General Kirke had been by scanty physical resources, inadequate mobility, and the legacy of tactical and strategic doctrines which the German success in Europe had already shown to be outmoded. The Local Defence Volunteers, 300,000 strong, were not yet an effective force. With the seven divisions previously training or assigned to special tasks, General Ironside had at the end of May fifteen infantry divisions and the incomplete 2nd Armoured Division. The infantry divisions averaged less than half their establishment of 15,500 men apiece. Owing to the preference given to the Expeditionary Force they had only about a sixth of the field guns and anti-tank guns to which they were entitled; and many of the field guns, instead of being modern

25-pounders, were older 18-pounders or 4.5-inch howitzers. Their deficiency in machine-guns was still greater; but of all these shortcomings perhaps the worst from the point of view of a commander who might be confronted by German armour was the lack of anti-tank guns. It was complemented by a grave shortage of the armour which he himself would need if a counter-attack designed to smash the spearhead of the invading force was to stand a good chance of success. The departure of the 1st Armoured Division had left Home Forces with some 160 light tanks, armed solely with machine-guns and therefore of little value for the purpose; and although there were in the country hundreds of other tanks of various classes (and in various states of repair), they would be of no use until they had been taken up by effective fighting units.¹ Furthermore, the standard of mobility in General Ironside's command was far below that which now seemed necessary. In general, transport was provided only for supplies and certain details; the bulk of the troops, if ordered to move faster than they could march, would do so in hired motor-coaches driven by civilians unprepared for the conditions which might await them in the event of a German landing. Arrangements had been made to assemble these vehicles and their drivers at 'short notice'; but 'short notice' meant that at least eight hours, and in some instances a whole day and night, would elapse before the troops could start. Thus quite small landing-parties bringing armoured vehicles—if indeed they got ashore—might do incalculable harm before they could be rounded up.

In face of these handicaps General Ironside, like Air Chief Marshal Dowding anxious lest such resources as were left to him should be dissipated in vain attempts to postpone defeat in France, not unreasonably disclaimed responsibility for security on land unless 'all available forces' were put at his disposal. At best he faced a double threat from seaborne troops who might land anywhere along four hundred miles of coastline—and conceivably elsewhere on the coast—and from airborne troops who might descend a long way to the rear of forces guarding the most likely stretches. His dispositions reflected these twin preoccupations. Eight of his fifteen infantry divisions were devoted primarily to coast defence, 'with their rear elements disposed to deal with airborne attack'. One corps of three

¹ According to a statement furnished by the War Office in May, 1947, the numbers of armoured fighting vehicles held by units in the United Kingdom (including depots and training units) on 1st June, 1940, were as follows:

Infantry tanks	110
Cruiser tanks	103
Light tanks	618
Old 'medium' tanks (obsolete or obsolescent)	132
Total	<u>963</u>

divisions—the 43rd, the 52nd and the 1st Canadian—he held in G.H.Q. Reserve on the line Northampton–North London–Aldershot, ‘suitably disposed to move rapidly by brigade groups to any threatened area’; the 2nd Armoured Division, also in reserve, was in Lincolnshire.

These dispositions left the vulnerable stretch from the Wash to Sussex only relatively well guarded. (See Map 6.) In Eastern Command, whose troops would take the first shock of a seaborne landing anywhere within those limits, there were six infantry divisions with less than half their approved establishment of field guns and with only a handful of anti-tank guns; though the 43rd Division, which was rather better off for field guns, was close at hand.¹ The vital sector from Sheppey to Rye was manned by the 1st London Division, with 23 field guns towards an establishment of 72, no anti-tank guns, no armoured cars, no armoured fighting vehicles, no medium machine-guns, and about a sixth of the anti-tank rifles to which it was entitled.

Thus at the end of May there seemed good ground for the opinion, expressed some time before by Dowding, that ‘the continued existence of the nation, and all its services, depends upon the Royal Navy and the Fighter Command’. Indeed, the Chiefs of Staff admitted that, ‘should the Germans succeed in establishing a force with its vehicles in this country, our army forces have not got the offensive power to drive it out’.

¹ The numbers of field guns, anti-tank guns and anti-tank rifles nominally held by units in Eastern Command and by the 43rd Division on 31st May, 1940 (with divisional establishments for comparison), were as follows. Brackets denote that some or all of the weapons in question had not yet arrived.

Divisional Establishments	Field Guns			Anti-Tank	
	25-pdr.	18-pdr.	4.5"	Guns	Rifles
18th Division	—	4	8	—	(47)
2nd London Division	—	4	8	2	(47)
55th Division	8	4	8	2	(47)
15th Division	—	6	12	4	(47)
1st London Division	11	4	8	—	(47)
45th Division	12	6	12	6	(154)
12th Division Artillery and Details	8	24	16	—	—
43rd Division	48	—	—	8	307

CHAPTER VIII
AFTER DUNKIRK
(June–August, 1940)

(i)

ACCORDING to the Chiefs of Staff, the return of the British Expeditionary Force to the United Kingdom 'revolutionised the home defence position'. This was true, however, only in the sense that henceforth equipment, not manpower, was the ruling factor. More than 224,000 officers and men came back from Dunkirk and its neighbourhood towards the end of May and in early June, and ultimately another 144,000 from ports further west. But the returning army left behind it practically the whole of its heavy equipment, including some six hundred tanks, more than a thousand field guns or guns of larger calibre (to say nothing of about five hundred anti-aircraft guns), some 850 anti-tank guns, many thousands of anti-tank rifles and large numbers of lorries, cars and motor-cycles, besides huge quantities of ammunition and supplies. Nominally twelve divisions were at one stroke added to Home Forces. But the augmented force would not become an effective weapon until a great part of these losses, with the deficiencies of the original home defence divisions, had somehow been made good.

The magnitude of the task is shown by one example. Deliveries of 25-pounder field guns had risen slowly from less than one a month in the first quarter of 1939 to roughly thirty-five a month at the time of the withdrawal. The establishment of a single home defence division was more than seventy; and there were now twenty-seven such divisions, whose equipment must be provided or replenished largely from new production. Similar considerations applied to many other weapons, including the anti-tank guns which would be so sorely needed if the enemy came ashore with armoured fighting vehicles. A number of substitutes for anti-tank guns were suggested, including mortars of new design which ultimately proved very valuable; but these, too, had to be manufactured and distributed before they could be used.

The narrow escape of the flower of the British Army, illumined by the memorable and moving words in which the deliverance was

announced by the Prime Minister, roused the inhabitants of these islands to an awareness of their country's danger, and a determination to avert it by all means in their power, for which no parallel can be found at least since Napoleonic times, and perhaps not since the crisis of 1588. After the German successes in Poland, Denmark, Norway, Holland, Belgium and now France, avoidance of the fate which threatened to overwhelm the United Kingdom in its turn might well seem unlikely; but if it occurred to observers in this country to entertain such thoughts, few who listened to Mr. Churchill's speeches can have doubted that any sacrifice they themselves might offer was infinitely preferable to acquiescence in defeat. Henceforward Government and people shared in a mighty effort to ensure that whatever perils the next few months might bring to their homeland should not find its defenders unworthy of their heritage.

Among immediate tasks, the most far-reaching in its effect on the national life was a vast acceleration of the output of almost every kind of war material. It was tackled resolutely, and on the whole with remarkable success. From that fact has sprung the legend that early in June the British people, awaking suddenly to their nakedness, proceeded to clothe themselves with lightning speed. The true course of the production drive, if no less creditable to those concerned, was less spectacular. In most respects the summer's effort was not so much a sudden spurt as a steady uphill slog. A big increase in deliveries of fighters from May onwards—achieved to some extent by mortgaging the future to the present—has already been recorded.¹ These excellent results owed much to the driving spirit of Lord Beaverbrook, something to plans laid earlier and now beginning to bear fruit, and perhaps most to a new determination among all employed in the factories concerned to do more than had hitherto seemed possible. The output of certain types of bomber, too, was raised at the expense of others less urgently demanded. But such expedients could not, in the nature of things, be applied throughout the field of war production. Deliveries of infantry and cruiser tanks showed a gradual upward trend in June, July and August, averaging 123 a month for the three months; on the other hand, output of wheeled vehicles remained almost stationary at roughly 9,000 a month. Monthly deliveries of field guns reached and remained at 42 in May and June, but rose thereafter to 60 in July and 72 in August. The total was still far short of the number potentially required. Nor was American industry yet in a position to do much, although the arrival later in the year of roughly half a million rifles went some way to solve the problem of equipping the Home Guard.

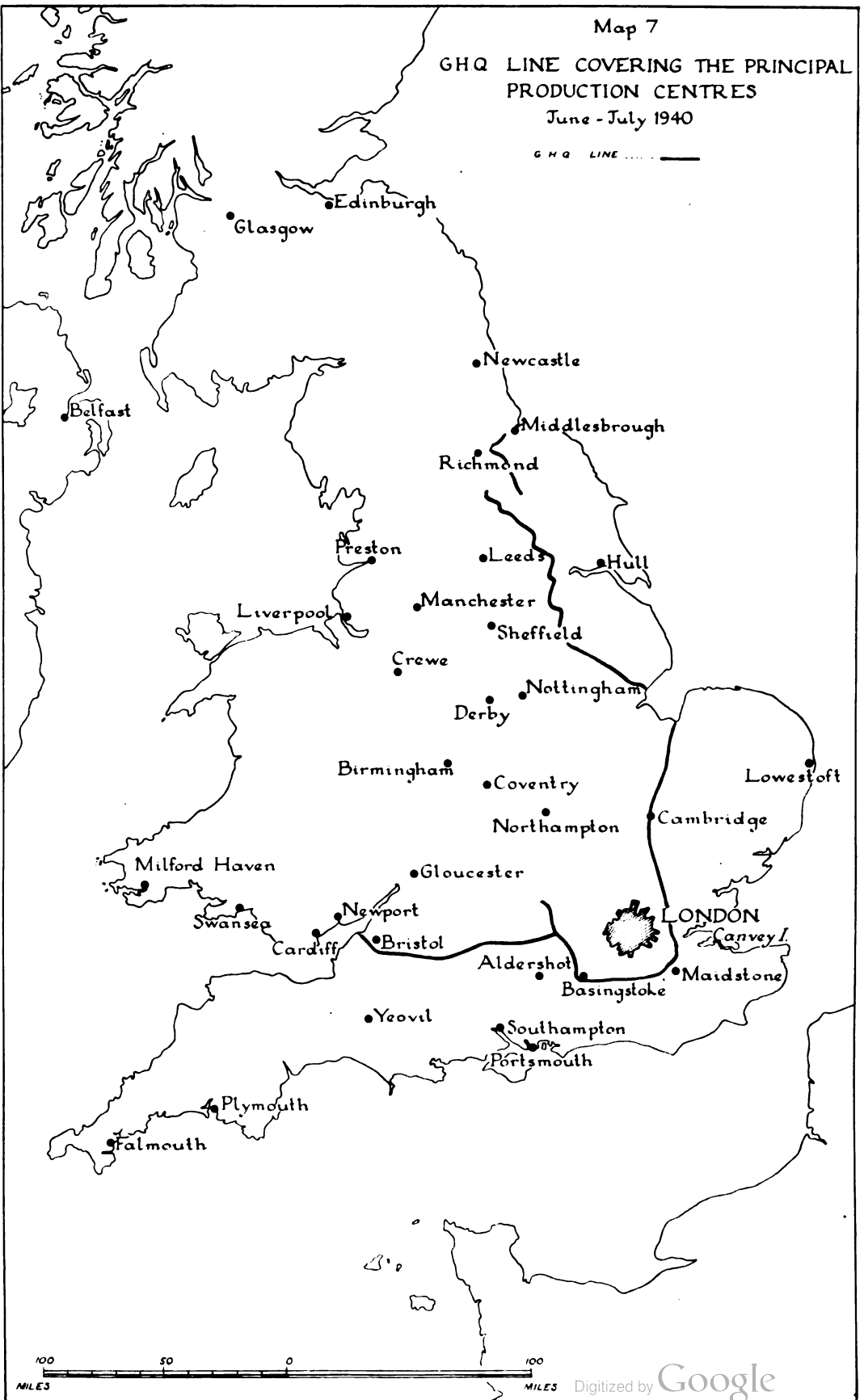
¹ See p. 121.

Map 7

GHQ LINE COVERING THE PRINCIPAL
PRODUCTION CENTRES

June - July 1940

GHQ LINE ———



100 50 0 100
MILES MILES

Largely because of this lag in production, but also on account of other factors which delayed the absorption even of existing stocks, Home Forces continued throughout the summer to be dogged by shortages of almost everything they needed to oppose an invader expected to achieve high standards of speed and hitting power. Big additions to his manpower did, however, enable General Ironside to reconsider his problems and evolve a new plan of defence. As he now saw it, his first aim must be to 'prevent the enemy from running riot and tearing the guts out of the country as had happened in France and Belgium'. He concluded that, at all costs, his troops must be deployed in sufficient depth to ensure that any substantial German force that got ashore could be halted before it reached London or the industrial Midlands. At the same time they must be ready to intercept any reinforcements whose arrival the navy and air force were unable to prevent.

To achieve both aims in the circumstances existing in the summer would be very difficult. For the most part the troops at the Commander-in-Chief's disposal were not only ill-equipped; they also lacked mobility, and their training had not envisaged tasks of the wholeheartedly offensive character which German tactics now seemed likely to impose. There were nearly five hundred miles of beach on the South and East Coasts suitable for the landing of armoured fighting vehicles, and about a third of this expanse of coast was in the neighbourhood where the invader could be most strongly supported by air power. At the same time, airborne troops might land a long way from the sea. In the absence of strong mobile forces deeply imbued with the offensive spirit, Ironside came to the conclusion that his best chance lay in combining his few mobile columns with static defences deployed over a wide area. The pivot of the new plan which he and his staff worked out in June was a G.H.Q. line of anti-tank obstacles covering London and the Midlands, supplemented by a series of command, corps and divisional stop-lines sited further forward. (See Map 7.) The G.H.Q. line, following natural obstacles such as waterways and steep inclines where they came to hand, ran from the neighbourhood of Richmond in Yorkshire to the Wash, and thence through Cambridge to the Thames at Canvey Island; south of the Thames it continued through Maidstone and Basingstoke to Bristol. Of the forward stop-lines, five ran across the Eastern Counties to check an advance from the vulnerable beaches about Lowestoft, either towards the Midlands or across the open uplands north of London. Three crossed Surrey, Kent and Sussex, barring the approaches to the capital from that direction. Generally the role of divisions in front of the G.H.Q. line was to exploit the forward stop-lines so as to confine, break up and delay an advance from the coast, thus giving time for the arrival of mobile

■

forces from the G.H.Q. Reserve. Accordingly, most of the 786 field guns available in the middle of June were sited near the coast to cover the most likely landing places, while conversely the better part of the 167 anti-tank guns which Ironside could muster were kept back in G.H.Q. Reserve. To gain further time, beaches were mined and obstructed, roads leading inland were blocked, and stocks of incendiary grenades and 'sticky bombs' (for dealing at close quarters with armoured fighting vehicles) were provided at every guard-post. Auxiliary units were trained to work in the rear of an invader, harrying his advancing columns and cutting them off from supplies of water, food and petrol.

Manifestly these tactics, harassing rather than destructive as they clearly were, would be effective in the long run only if the mobile forces, when they did arrive, could deliver something like a killing punch. And here, unfortunately, Ironside was very weak. In the middle of June his general reserve included three of the better-equipped infantry divisions and the 1st Armoured Division. The last, having left behind in France 100 infantry, 163 cruiser and 354 light tanks, had returned to the United Kingdom with nine tanks all told; and its effective strength at the end of June consisted of 81 medium tanks which had reached it in recent weeks as an instalment of its new equipment. In addition the 2nd Armoured Division, now with 178 light tanks, had moved to a position between Northampton and Newmarket, whence it could strike, as best it might with limited resources, at the rear and flank of an invader pressing inland either from the East Anglian coast or from points north of the Wash. The infantry divisions remained in the area Northampton-North London-Aldershot, in order that they might advance as rapidly as possible by brigade groups to any threatened area. The number of tanks in the United Kingdom was, indeed, much greater than the total of the effective strengths returned by the two armoured divisions; but the fact remains that most of them were not considered fit or available for use by the only formations that could use them.¹

Among the more obvious weaknesses attending these arrangements were an insufficiency of anti-tank guns to support both the forward lines and the G.H.Q. line; a lack of local reserves, as distinct from the G.H.Q. Reserve; and a lamentable shortage of the armour needed to give counter-attacks by the mobile forces a good chance of success. The plan was designed to make the best of a bad job where the first two were concerned, by allotting preference to the main line of defence; but the third was radical and inescapable. With four armoured divisions in reserve the Commander-in-Chief would have felt that the country was reasonably secure; as it was he had, in his

¹ Compare p. 124.

own words, 'less than half the equivalent of one complete division'. For air support he could call in the first instance on two medium-bomber squadrons held at his direct disposal, and on five reconnaissance squadrons, of which two were allotted to Eastern Command and one each to Northern, Western and Scottish Commands. The nature and extent of any further assistance from the air force would clearly depend, in practice if not in theory, on the scope and outcome of the air battles which must be expected to precede or accompany invasion.

Should the invader come, or should his coming seem imminent, the plan would be put into effect by issue of the code-word 'Cromwell'. On receiving it troops would go at once to their battle-stations; and essential telegraph lines would thereupon be taken over by the army.

In the meantime some progress had been made with the special measures of coast defence begun in May. By 12th June a first batch of 46 new batteries, each comprising two 6-inch naval guns and two searchlights, had been added to the fixed defences and was ready for action. As the army was short not only of guns but also of coast defence troops, half these guns were manned by marines or naval personnel until army crews became available later in the summer. Their primary role was seaward defence. In order to save ammunition, conceal the positions of the batteries as long as possible and offset inexperience, the gunners were told to hold their fire until the enemy began to lose sea room some three to four miles from the shore; the guns would thus be limited to about half their effective maximum range of 12,000 yards. Beach defence was a secondary role. The guns and lights were carefully hidden with nets and bunting, later supplemented by disruptive painting.

Even with these additions the fixed defences left many places unguarded or inadequately protected. At Dover, for example, the arrival of the Germans on the opposite side of the Straits raised some awkward issues. The Dover mine-barrage became largely ineffective, since German ships could now avoid it by hugging the French coast. Furthermore, the enemy not only commanded his own side of the Channel, but by mounting long-range guns near Calais and by basing aircraft in the neighbourhood was able to dispute command of the Straits themselves. Besides four 6-inch guns with a range of 12,000 yards, the fixed defences at Dover included two 9·2-inch guns, whose extreme range was about ten miles. Two modern 6-inch batteries, whose guns could fire to 25,000 yards, were being installed as rapidly as possible, and four 9·2-inch guns on improved mountings promised to increase the range of the defences to 31,600 yards (later increased by supercharging to 36,300 yards, or roughly twenty miles). But the new guns were not yet ready. Meanwhile the enemy

had the power to come at least half-way across the Straits without interference from shore-batteries, while his own artillery and aircraft gave potential protection against British naval craft and bombers. Waters whose narrowness was in any case ill-suited to major naval operations were thus made doubly dangerous to our larger warships, and even patrols by lighter craft seemed inadvisable in daylight while the shortage of destroyers was acute. The destroyers hitherto at Dover were withdrawn to Portsmouth. Our command of the Straits was thus much weakened, though the shipping-lanes were still swept and local convoys continued to pass through them, making the best use of darkness.

As a possible remedy Vice-Admiral Ramsay suggested that a number of long-range guns should be installed at Dover and put at his disposal, contrary to the usual practice which allotted immediate control of coast-defence guns to the army. A naval 14-inch super-charged gun, with a theoretical range of more than twenty-seven miles, was in fact available; but it proved unsuitable for engaging moving targets, and in practice was seldom used for fear that the enemy's more effective weapons might reply. No more guns with sufficient range to fire across the Straits could be emplaced before the end of 1940. Meanwhile the enemy enjoyed a considerable advantage. The chance that a sudden descent on the coast of Kent in fog or darkness might enable him to pass a stream of traffic across the Channel continued, throughout the summer, to trouble strategists not convinced of his reluctance to try invasion without first winning a major battle in the air.

In general the chief danger was that the weakness of the fixed defences might give the Germans an opportunity of landing armoured and other vehicles and artillery. Infantry without field guns or transport would be relatively harmless. The measures taken since May to deny ports to the enemy were intended to reduce the risk by depriving him of the quays and cranes which he would need to unload such gear from ordinary transports. Apart from demolition schemes for more than a hundred ports and harbours in all parts of the kingdom—for ultimately the plan was extended right round the coast—blockships were provided at some fifty places. There remained the risk that in fine weather armoured fighting vehicles carried in special craft might come ashore on beaches. To prevent such craft from entering the Thames, the Humber and Plymouth harbour, anti-boat booms similar to those provided at Dover, Harwich and Rosyth were installed there in the early summer. To hinder access to open beaches, about a hundred miles of a lighter and simpler form of boom, consisting of horizontal wire nets supported by floating canvas tubes filled with kapok, were laid by five specially-commissioned vessels assisted by local craft. In addition, about eighty

miles of an alternative obstruction, in the form of mines attached to wire jack-stays, were installed. The Wash was guarded by a defensive minefield and a light boom some five miles long. As floating defences were difficult to lay and maintain in unsheltered waters, a more durable substitute was later adopted, in the shape of a line of builders' scaffolding erected below high-water mark and armed with mines. Some seventy miles of coast were thus protected. About three hundred miles of scaffolding, besides buried mines, were used above high-water mark as beach obstructions. Elsewhere a variety of obstacles was installed to hold up troops who tried to wade ashore and to prevent the landing of troop-carrying or other aircraft on drying mud-flats.

A number of less orthodox measures owed their genesis to Lord Hankey, whose long career at the Committee of Imperial Defence and elsewhere had led him to a seat in Mr. Chamberlain's War Cabinet and to the Chancellorship of the Duchy of Lancaster in Mr. Churchill's Coalition Government. As early as 1914 Captain Hankey, as he then was, had been stimulated by the account in Gibbon's *Decline and Fall of the Roman Empire* of the 'Greek fire' used by the Byzantine emperors, to an active interest in the lethal possibilities of petroleum. Flame-throwers which used petroleum had been employed by both the Central and the Allied powers between 1915 and 1918, but interest in them had lapsed in this country. In 1940 the dearth of conventional anti-tank weapons after the withdrawal from Dunkirk, and the general sense of urgency, created an atmosphere exceptionally favourable to new suggestions. Conceiving the idea of 'burning the invader back into the sea' with fuel which would otherwise be wasted, Lord Hankey found a ready collaborator in Mr. Geoffrey Lloyd, whose position as Secretary for Petroleum enabled him to draw on the resources of the oil industry. Mr. Churchill and the Chiefs of Staff approved their suggestion that experiments should be carried out and that the results should be made available to the various Home Commands.

Early in June a small Petroleum Warfare Department was created, with Mr. Lloyd as Minister in charge. Its Director-General was Sir Donald Banks, a senior civil servant with considerable experience as a soldier. Under the general guidance of Lord Hankey and Mr. Lloyd, and with the willing help of the leading oil companies, short stretches of road leading inland from likely landing-places were lined with perforated pipes, connected in each case with a fuel-tank hidden at a higher level. On the enemy's approach a member of the Home Guard waiting in an adjacent observation-post would flood the road with petrol and ignite it by throwing in a flaming missile. Later, remote control and automatic ignition were introduced. Similar arrangements were made in some cases on the beaches

themselves; and at a few places—notably on the long hill between Dover and Canterbury—a small power-pump made it possible to cover a hundred yards or more of road. In addition to these ‘Static Flame Traps’, a number of ‘Flame Fougasses’, each comprising a group of forty-gallon drums containing various highly-inflammable materials, were installed in lieu of minefields at points where vehicles might be expected to slow down. Other devices tried but less generally adopted included petrol-containers disguised as wayside tar-barrels, or so disposed that they could be lobbed or cast from a height on to the invader; and anti-tank ditches filled with liquid petrol or with petrol-soaked peat.

Attempts to ‘set the sea on fire’ by means of pipes intended to cover the surface with burning petrol promised well at first, but then met many difficulties. Originally the pipes were made to terminate below high-water mark, where heavy seas often interfered with their working and sometimes even threw them back on to the beach. After a series of experiments extending well into 1941 their termination above high-water mark was found to provide a much more reliable and formidable weapon. Experiments by the Petroleum Warfare Department and other authorities with improved flame-throwers of various kinds had a long and difficult gestation, but gave birth at last to devices of great value, used in many theatres. In the meantime steps were taken, by means of open propaganda and calculated indiscretions, to give the enemy a not-unfounded impression that, if he tried to land, he would be greeted by an awe-inspiring array of novel and unpleasant weapons.

(ii)

So much for the arrangements made to impede the enemy when he had landed or as he prepared to come ashore. He could, however, also be attacked at his points of departure and on passage. The first method, whose advantages had long been recognised and were summed up in Nelson’s famous dictum, ‘the enemy’s ports are our first line of defence’, was one in which the bomber force could hope to play a useful part. Theoretically, aircraft were also well suited to attack on passage, but in practice a strong force of bombers and torpedo-bombers adequately trained for such a role was lacking. In any case, the primary responsibility for repelling a would-be invader before he landed rested with the navy.

The chances of catching an invasion fleet before it sailed or on passage would depend to a great extent on the warning provided by air reconnaissance and other sources of intelligence. In the light of

experience gained since the beginning of the war, the Admiralty judged that adequate warning could not be relied on. They concluded that their best course was to be prepared to deal with the enemy as he arrived, without committing themselves to dispositions likely to debar them from seizing opportunities of earlier engagement.

At the beginning of June the Home Fleet was weaker than at any time since the previous winter. (See Appendix IV.) Of the eight capital ships in home waters, only four—the *Rodney*, *Valiant*, *Renown* and *Repulse*—were immediately available for North Sea operations. The *Nelson* and the *Barham* were refitting, the *Hood* was undergoing repairs and was about to join a foreign station, and the *Resolution* was on the point of leaving the Home Fleet for the Western Approaches Command, whose duties were mainly concerned with the defence of ocean trade. The Norwegian campaign and the withdrawal from Dunkirk were both in progress and were making heavy demands on the Home Fleet's cruisers and destroyers.

A month later the position was only slightly better. (See Appendix V.) The *Nelson* and the *Barham* had returned or were about to return to duty; but the aircraft-carrier *Glorious* had been sunk while on her way from Norway, and fear that the French Mediterranean fleet might fall into German hands had taken a strong force to Gibraltar. The *Hood*, the *Valiant* and the *Resolution*, with the aircraft-carrier *Ark Royal*, the cruisers *Arethusa* and *Enterprise* and thirteen destroyers were all based on that station. The ships at home or in adjacent waters comprised the five capital ships *Nelson*, *Rodney*, *Renown*, *Repulse* and *Barham*, the aircraft-carrier *Argus*, eleven cruisers and eighty destroyers. Of these, the capital ships (with the temporary exception of the *Barham*, still at Liverpool), all but one of the cruisers and fifty-seven of the destroyers were at bases more or less commanding the approaches to the East Coast. But local striking forces in the neighbourhood where a landing seemed most likely were very weak. The Nore Command had only nineteen destroyers at the Humber, Harwich and Sheerness; and the Chiefs of Staff considered nearly twice that number necessary for safety. Dover (formerly a sub-command but now directly under the Admiralty) and Portsmouth had five destroyers each. Apart from the heavy ships and cruiser and flotilla forces, twenty-five fast minesweepers and 140 minesweeping trawlers were responsible for maintaining searched channels between Sunderland and Portsmouth, and an Auxiliary Patrol of up to 400 trawlers and small craft was disposed all round the coast from Invergordon to Portland to give warning of approaching hostile forces and attack them. Besides a fluctuating proportion of the thirty-four sloops and corvettes normally used for escort duties, other vessels available for defence against invasion included about

a hundred Harbour Defence Patrol Craft, of which roughly half were on the East and South Coasts, and a few Armed Examination Vessels and gunboats in the Forth and Thames. Altogether about seven hundred armed patrol vessels of one sort or another were available for off-shore reconnaissance; and throughout the summer some two to three hundred of them were constantly at sea in the threatened area between the Wash and Sussex. For reconnaissance at greater ranges the Admiralty relied on submarines—of which there were thirty-five—and aircraft.

How these forces, or others which might replace them, could best be used to repel invasion was not easily decided. The outline of the Admiralty's first plan was drawn at the end of May, to the accompaniment of fast-moving events which included the withdrawal from Dunkirk and the closing stages of the campaign in Norway. At that time the future was more than ordinarily obscure; and even later much doubt existed as to when invasion would come and the form that it might take. To support a direct assault by sea, the Germans could count on mustering at most two battle-cruisers, two old battleships and five or six cruisers, with perhaps some ten destroyers. Their possible courses of action included a diversion to the north, perhaps in the form of an attack on our Northern Patrol by their battle-cruisers, and a southward dash towards the East Coast from German and Norwegian bases. In the latter all their cruisers and possibly their two old battleships might take a hand. Whether the enemy would risk his battle-cruisers in the southern part of the North Sea was doubtful; but an attempt by his less-valuable ships to force the Straits of Dover was not unlikely. If he took the Channel ports—as he soon did—the prospect of a landing on the South Coast would be correspondingly increased. Another possibility was a subsidiary or diversionsary attack on Ireland.

The Admiralty considered that to counter all these possible moves by the enemy's main fleet they must have ready at least five heavy ships and one aircraft-carrier, with a minimum of two flotillas of destroyers. The threat of a northward diversion and a simultaneous move towards the East Coast they proposed to meet by organising the Home Fleet in two divisions, each of which (with the *Nelson* but not yet the *Barham* back in service) could be made strong enough to cope with any situation likely to arise in the North Sea. They therefore suggested to Admiral Forbes that his best-protected ships, the *Nelson* and the *Rodney*, should move south to Rosyth, and that they should be joined there by as many six-inch cruisers of the *Southampton* class as the Nore Command could spare. They contemplated moving the *Valiant* and the *Repulse* to Plymouth, leaving the *Hood* (whose orders to proceed elsewhere were temporarily in abeyance) with the *Renown* at Scapa Flow. The aircraft-carrier *Ark Royal*, whose long endurance

specially fitted her for the task, should, they suggested, remain constantly at sea to westward of a line from Iceland to the south of Ireland, accompanied by one eight-inch cruiser. All available eight-inch cruisers (which were vulnerable to air attack and would therefore be safest on the West Coast) would accordingly be stationed in the Clyde. The lighter six-inch cruisers of the *Arethusa* class, with such sloops, corvettes and anti-aircraft cruisers as could be spared from escort duties, would be spread round the coast to support a striking force of thirty-six destroyers, organised in four flotillas based on the Humber, Harwich, Sheerness and Dover (or alternatively Portsmouth). Even without the *Barham* there would thus be enough heavy ships at Rosyth and Scapa Flow to deal with a threat to the East Coast. If, on the other hand, a landing on the South Coast were attempted, the destroyers at Dover or Portsmouth, assisted by submarines, could be supported by the *Valiant* and the *Repulse* from Plymouth. Between them the *Ark Royal* and the ships at Plymouth should be able to take care of Ireland.

Within the next few weeks the departure of the *Hood*, the *Valiant* and the *Ark Royal* to Gibraltar—though partly offset by the return of the *Barham*—precluded their taking up the positions thus tentatively assigned to them, and left the Home Fleet with five capital ships instead of the six needed to put two each at Scapa Flow, Rosyth and Plymouth. A still greater obstacle to the plan was that the Commander-in-Chief, Home Fleet, who would have to put it into practice—and whose opinion was therefore of great weight—disapproved of it. Admitting that events might ultimately compel him to send some at least of his capital ships to Rosyth, Admiral Forbes preferred to keep them at Scapa Flow until he was sure that a German expedition was assembling. In the meantime he believed that, although the Germans might possibly land in Ireland, they were most unlikely to attempt a landing in England while our air forces were intact and undefeated. The Admiralty responded by telling him that readiness to counter an invasion across the North Sea must nevertheless remain his major responsibility until he received instructions to the contrary. But his preference for Scapa was not challenged, especially as the only German battle-cruiser in good shape towards the end of June—the *Gneisenau*—was known to be at Trondheim. Her sister-ship, the *Scharnhorst*, had returned to Kiel, but had been damaged by naval action and was wrongly thought to have been hit by bombs. For the moment, therefore, the circumstances which might call for the move to Rosyth seemed unlikely to arise. After further discussion the Admiralty ruled in July and August that the heavy ships of the Home Fleet should go south to break up a landing on the East Coast only if the presence of German heavy ships in the southern part of the North Sea was reported.

Accordingly the capital ships remained throughout July and August at Scapa Flow, or cruising within prudent limits. Cruisers were distributed among the home commands, and destroyers disposed as circumstances—rather than the plan drawn up in May—dictated. The bulk of the destroyers were at sea every night, and by day were ready to reach any threatened point within two or three hours of receiving an alarm. By the end of July the Nore Command had thirty-two destroyers (and five corvettes) instead of the nineteen available at the beginning of the month.

In view of these arrangements, and assuming that the destroyers would be strongly supported in an emergency by fighters, the Naval Staff believed by the middle of the month that surprise crossings by small craft, which had seemed so alarming a possibility a few weeks earlier, could now be reckoned 'a most hazardous undertaking' for the enemy. They admitted, however, that the venture was still possible. On 10th July they estimated that, in favourable conditions, 12,000 troops might be landed by such means between the Wash and Dover, and perhaps 5,000 between Dover and Land's End. A larger force would, they thought, have great difficulty in reaching the South Coast without detection. Should a more ambitious expedition, involving perhaps fifty ships of moderate size, be made from German harbours in thick weather, they believed that possibly 50,000 men with armoured fighting vehicles might get ashore on carefully chosen beaches between Rosyth and Southwold.

(iii)

We have seen in the last few paragraphs that, while in some respects British plans to meet invasion in the summer of 1940 were based on the assumption that the blow might fall at any moment, they were modified in others by the reflection that the Germans were unlikely to attempt a landing without first joining battle in the air. Without going so far as Lord Keith—who declared on a famous occasion in the nineteenth century, 'I do not say the enemy cannot come: I only say he cannot come by sea'—Admiral Forbes expressed the more hopeful view when he wrote: 'The enemy has realised that he can only defeat this country if he can sever our lines of sea communication. He knows that he cannot do it by surface forces, and hopes to do it by air and submarine forces.'

The Air Staff were substantially of the same mind as Admiral Forbes. In their view, seaborne invasion was 'not a practicable operation of war' unless Fighter Command were first defeated. If Germany did mean to invade this country, she must begin by gaining air superiority over the approaches to it.

This attitude could be regarded as a logical extension of the opinion expressed by the Chiefs of Staff in their 'stocktaking' review in May; but whether it implied that invasion was not a present danger depended, of course, on the account which the fighter force could be expected to give of itself in such a contest. On the whole, the outlook in this respect was considerably more favourable in July than it had appeared two months earlier. The fighting in France had cost the air force the best part of a thousand aircraft, including nearly five hundred fighters; but before the month was out the fighters lost had been replaced, although the relatively experienced pilots shot down over France were a different matter.

It followed that henceforth the main preoccupation of the fighter force must be readiness for the air assault which—according to the Air Staff—would precede any attempt to land substantial German forces in this country. The bomber force would make its contribution by striking at German air bases, aircraft factories and ancillary plants, and in case of need at ports where an expedition might assemble or was known to be assembling.

Meanwhile, Coastal Command had a vital part to play. Apart from its responsibility for spotting an invasion fleet on passage, it now had the task of detecting preparations which might well begin before the preliminary air battle had been fought. In general, photographic reconnaissance was unquestionably the best means of detection, although unfortunately some possible places of assembly were too far away to be photographed by aircraft yet in service. As it was desirable that one commander should be responsible for detecting both preliminary moves and a fleet on passage, Air Marshal Bowhill took control of the Photographic Development Unit—renamed the Photographic Reconnaissance Unit—which was now the main source of air photographs submitted for examination to the Photographic Interpretation Unit at Wembley. The unit at Wembley also dealt with the relatively few photographs taken by the general reconnaissance squadrons, while Bomber Command—which had its own Interpretation Unit—sent to Wembley those of the photographs taken by its squadrons which were not of purely domestic interest. A special Combined Intelligence Committee—comprising in the first instance two naval officers and one each from the army and the air force—had already been set up in London to examine and collate all evidence bearing on invasion, whether from photographs or otherwise. To meet the risk that an expedition might sail without warning, the general reconnaissance squadrons daily flew an elaborate series of patrols—including occasional sorties by aircraft fitted with the new A.S.V. (Air-to-Surface-Vessel) radar—designed to cover all probable approaches to the United Kingdom. Map 8 shows the programme for a typical day in the middle of the summer.

The tasks to be performed by the air force if and when invasion was once launched were laid down by the Air Staff only in broad terms. Their plan recognised three 'principal phases' of invasion. First would come the assembly of troops and shipping at the points of departure; next the voyage from the Continent to the British Isles; finally the establishment of a bridgehead. Bomber Command's task would be to attack, in the first phase, the enemy's embarkation ports and ships assembling there; in the second phase and the early part of the third phase, ships on passage. Later in the third phase, the bomber force would switch to German troops and their equipment on British soil. Coastal Command would continue its reconnaissance programme throughout all phases, would take every opportunity of attacking German ships, and during the second phase would also provide long-range fighters to protect our naval forces if they engaged the enemy on passage. The task of Fighter Command, again in all three phases, would be to oppose the enemy's air forces, and above all to beat off attacks by his dive-bombers during the second and third phases. If, however, the Air Staff were right in thinking that invasion would not come unless our fighter force were first defeated, the chances of carrying out the later stages of this programme would be small.

Throughout the summer months that part of the Air Staff's plan which aimed at the detection of an invasion force before it sailed or on passage was carried out to the furthest extent permitted by the weather and the means available. Between mid-June and the end of August over 300 sorties, of which a high proportion covered possible invasion bases for the benefit of the Combined Intelligence Committee, were made by aircraft of the Photographic Reconnaissance Unit from bases at Heston (near London), St. Eval (in Cornwall), Wick (in the north of Scotland) and Leuchars (on the Firth of Forth). Some of this work was done by Hudsons; the greater part by Spitfires specially lightened to increase their speed, range and ceiling. Thousands of photographs were minutely scanned, and the scraps of evidence they furnished compared with information from other sources. Aircraft of the general-reconnaissance squadrons set out at dawn and towards evening to quarter the North Sea from the Shetlands to East Anglia; the approaches to the British Isles from east, south and south-west were searched at least once daily unless the weather was prohibitive, and at night continuous patrols were flown between the Humber and the Nore to detect fast light surface craft if they should leave Dutch ports after sunset. The Channel ports from Dunkirk to Dieppe and from Le Havre to Cherbourg were watched at frequent intervals—normally twice daily—and in moonlight or at close of day an aircraft reconnoitred Brest.

Thanks largely to photographs brought back by the Photographic



Plate 7. Hudson Aircraft of Coastal Command on Patrol over the North Sea.

Plate 8. Destroyers on Patrol off the East Coast.





Plate 9. General Sir Edmund Ironside, General Officer Commanding-in-Chief, Home Forces, May-July, 1940.



Plate 10. General Sir Alan Brooke, General Officer Commanding-in-Chief, Home Forces, July, 1940-December, 1941.

Reconnaissance Unit and to the expert work of the interpreters at Wembley, an invaluable picture of German preparations for invasion was built up. With their first report at the end of May the Combined Intelligence Committee were able to scotch alarmist rumours by pointing out that there was 'nothing at present to indicate any large movement of troops or aircraft intended for the invasion of the United Kingdom, and insufficient evidence to suggest when invasion will start, where forces will assemble or their objective'. About ten days later reports from Stockholm, which mentioned substantial movements of German troops to Norway, were outwardly corroborated by signs of naval activity at Trondheim; and towards the end of June unusually large numbers of barges were seen in Dutch waters. But in general the photographs examined up to the end of August gave little support to the view that German preparations to invade this country were well advanced.

Meanwhile Bomber Command, under Air Marshal Sir Charles Portal, devoted some of its attention to the enemy's air bases and aircraft industry. The Air Staff decided on 19th June that for the time being the primary aim of the bomber force must be reduction of the potential scale of air attack on the United Kingdom; but the directives which they framed in consequence proved too wide to achieve their purpose. On the 20th they ordered that both heavy and medium bombers should attack first aircraft factories, secondly communications, thirdly oil targets and fourthly crops and forests. One squadron of Hampdens, already occupied in laying mines in enemy coastal waters, would go on doing so. In addition, the medium bombers were to seize opportunities of bombing aerodromes in France and the Low Countries. Less than a fortnight later reports of impending invasion, arising chiefly from the abundance of barges in Dutch waters, caused the emphasis to shift momentarily to ports and shipping. Soon afterwards the Air Staff not unnaturally came to the conclusion that too many targets were being tackled. They therefore ordered that for a limited period the heavy squadrons should concentrate on ten aircraft factories and, less urgently, on five oil plants, while the mediums devoted their main effort to large concentrations of barges or shipping and to aerodromes likely to be used by German striking forces bound for the United Kingdom. The outcome of these frequent changes, and of the latitude which even the firmest of the directives conferred on Air Marshal Portal, was that in practice only about 47 per cent. of the tonnage dropped by Bomber Command in July and August was aimed at the German aircraft industry and aerodromes, rather more than 13 per cent. at barges, ships and naval targets, and the rest at oil targets and communications. The fighter force took part in a few attacks

on aerodromes recently vacated by the Advanced Air Striking Force, but were soon fully occupied on their own side of the Channel.

(iv)

By the third week in June about 150,000 civilians, besides troops, were engaged on the defensive works required by the new plan of defence on land. Notwithstanding the hope that victory in the air might postpone or even preclude invasion, the task was undertaken in a spirit of great urgency. The consequent allotment of much of the work to civilian contractors without experience of military engineering led to many blunders. A large number of road-blocks proved useless, as armoured vehicles could go round them; some pillboxes were sited facing the wrong way, or so placed that they could not be occupied by troops or served no useful purpose. A more radical objection was that the garrisoning of so widespread a system of static lines, in addition to large numbers of 'vulnerable points', left too few troops available for counter-attacks and threatened to direct attention too exclusively to purely defensive measures. Divisional commanders, finding that the manning of the stop-lines would consume most of their manpower, and knowing that even in favourable circumstances reinforcements could not reach them in less than twelve hours, were worried by the smallness of their local reserves and their consequent inability to take offensive action. Ironside, who would himself have liked nothing better than the opportunity to frame a more offensive strategy, admitted that the plan left fewer troops in local reserves than could be wished. But he pointed out that, as most of the forward divisions had little artillery or transport, and were not fully trained, their ability to counter-attack would be small in any case.

Even so the plan was widely criticised. The Vice-Chiefs of Staff maintained that to make no major attempt to halt the enemy until a great part of the country had been overrun was a suicidal policy. The Chiefs of Staff, while conceding that Ironside's dispositions met the requirements they had laid down, agreed that the balance of the defence leant too far on the side of a thinly-held crust on the coast, with insufficient mobile reserves in immediate proximity to points where penetration must be expected. The Naval Staff (some of whose opinions applied also to later plans) were made uneasy by the thinness of the crust near Dover, where lack of room for big ships to manœuvre might offset the German lack of surface strength. Finally, airmen were far from content with the arrangements made for the defence of aerodromes. Believing that at vital air bases everything

Map 9

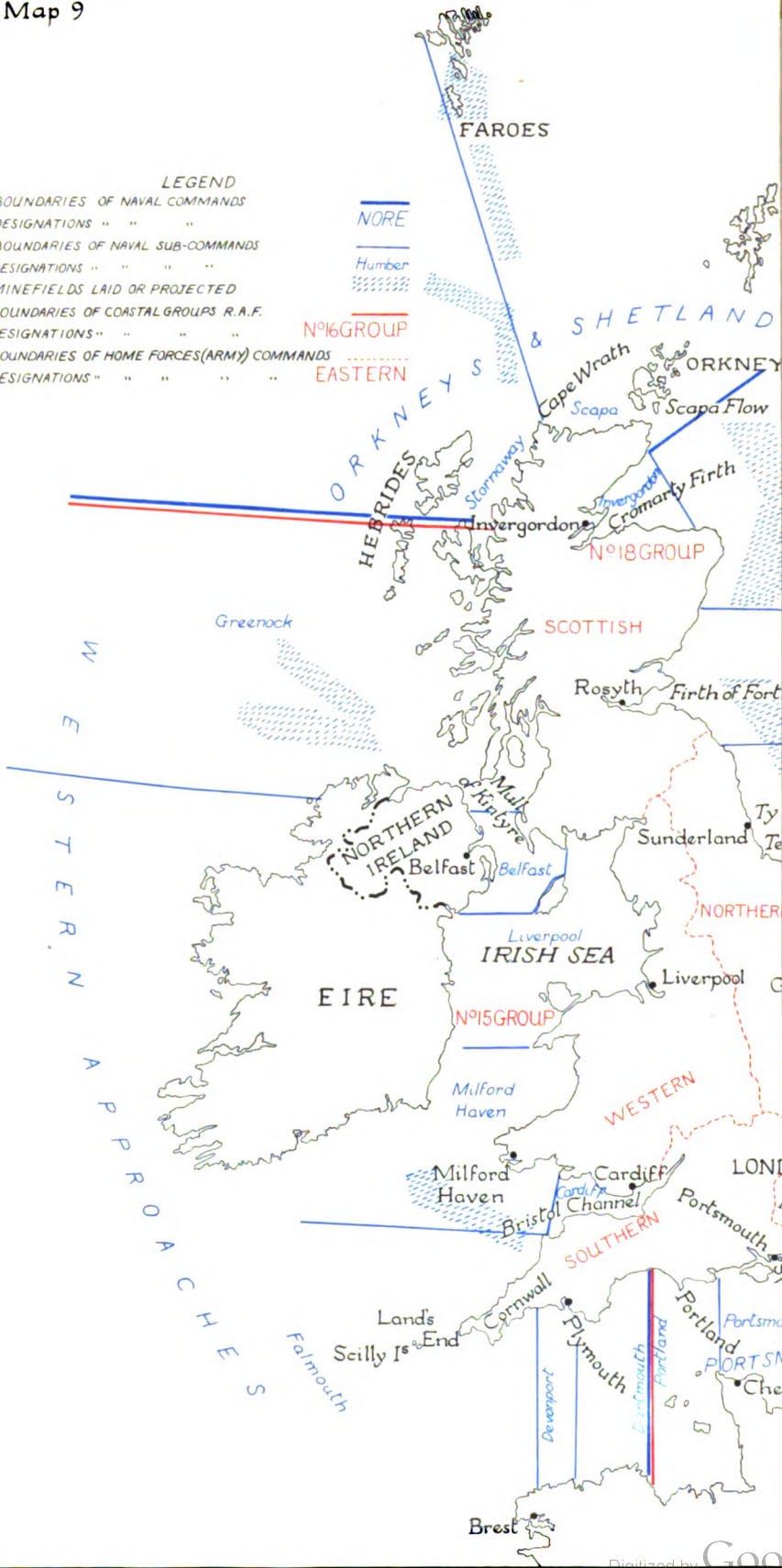
LEGEND
 BOUNDARIES OF NAVAL COMMANDS
 DESIGNATIONS " " " "
 BOUNDARIES OF NAVAL SUB-COMMANDS
 DESIGNATIONS " " " "
 MINEFIELDS LAID OR PROJECTED
 BOUNDARIES OF COASTAL GROUPS R.A.F.
 DESIGNATIONS " " " "
 BOUNDARIES OF HOME FORCES (ARMY) COMMANDS
 DESIGNATIONS " " " " " "

NORE

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N^o16GROUP

EASTERN



should be done to prevent airborne forces from gaining even a temporary foothold, the Air Staff had urged on General Kirke in May that local guards should be supplemented by first-class troops generously supplied with automatic weapons. But he and his successors argued that the comparatively few trained troops available were better employed as counter-attack formations, so placed as to be able to arrive within two to three hours of an alarm. In the outcome the local guards were supplemented in June by parties of airmen armed with rifles, and open lorries were fitted with Bren guns as a means of dealing rapidly with airborne troops or parachutists who might descend in awkward places, such as the centre of a landing-area. The value of these additions was debatable, if only because they might tend to divide or at least confuse responsibility.

Mr. Churchill's views lent only partial support to the Vice-Chiefs of Staff. In his estimation the strength of the defences on a given stretch of coast must be measured, not by the number of troops immediately available, but by the number of hours within which strong counter-attacks could be delivered. It ought, in his opinion, to be possible to concentrate 10,000 well-armed men within six hours, or twice that number within twelve hours, at any point where the enemy had come ashore in strength. He suggested that groups of 'Storm Troops' or 'Leopards', drawn from existing units, should be held ready to pounce within four hours on the points of lodgement, and that their aggregate strength should be not less than 20,000 men. In his view everything would turn on the 'rapid, resolute engagement' of all parties landed. Rapid, resolute engagement should, he added, not be beyond the power of Home Forces as long as their field troops were not consumed in beach defences, but kept in a high state of mobility.

To such criticisms of the plan he had made in June, Ironside could return the simple answer that at that time the trained troops and material resources needed to give the defences a more mobile and more offensive character did not exist. As he put it later: 'The Army had not been trained to take the offensive: to create an offensive spirit suddenly, with no mobility, no armour and no training, was impossible.' But as the weeks went by, a respite from German interference, and above all the efforts of our war-factories, created opportunities for improvement.

It fell to General Sir Alan Brooke, who succeeded Ironside on 20th July, to give a more offensive cast to the defences. More fortunate than his predecessor, he set to work at a time when vehicles and weapons were not quite so scanty. Early in August he proclaimed his intention of stamping out the idea of linear defence and making 'mobile offensive action' the keynote of his strategy. Henceforth the stop-lines would take second place, and local mobile

reserves would be held within reasonable striking-distance of likely landing-places.

Accordingly, in July and August divisions in G.H.Q. Reserve moved forward into Cambridgeshire, Hertfordshire and Surrey, taking up positions about half as far from the coast as those they had occupied in June. General Brooke ordered that work on the stop-lines should be limited to the formation of nodal points for all-round defence at important road-junctions and centres of communication, and that their garrisons should be withdrawn to strengthen local mobile reserves. In an emergency the nodal points would be manned by any troops who happened to be near them. His anti-tank guns, formerly mostly in rear of the G.H.Q. line, he moved forward to cover beach obstacles and debouchments from the beaches. Field artillery returned to a mobile role, and heavy guns were sited within range of likely landing-places for seaborne and airborne troops. But even when these changes had been made, Brooke's forces were still far short of the mobility and offensive power which would have given them a comfortable prospect of success if the Germans had landed a substantial armoured force.

Meanwhile the fixed defences had been greatly strengthened. A screen of coastguards and coast-watchers covering the whole coast now stood behind the system of naval and air reconnaissance patrols. Finally, a growing array of minefields (see Map 9) guarded the approaches to the stretches of coast best suited to a landing.

The respite gave time, too, for improvement of the means of concerting military and civil plans. As an executive body, the Home Defence Executive set up in May proved unwieldy. Retaining its old name, it became in June a co-ordinating body under the chairmanship of Sir Findlater Stewart, an experienced civil servant who acted also as Chief Civil Staff Officer to the Commander-in-Chief, Home Forces. Henceforth executive measures were initiated either from G.H.Q., Home Forces, at St. Paul's School, Hammersmith, or from the offices of the departments most concerned. The Chief Civil Staff Officer provided the link between G.H.Q. and the departments, but was much more than a liaison officer. Under his guidance new arrangements were made to avoid the hasty flight of refugees which had caused so much distress and confusion in Continental countries. By the middle of July 127,000 people, or nearly half the population, had left East Anglian coast towns under voluntary schemes and special arrangements made for children and old people; similarly some 80,000, or roughly two-fifths of the population, moved inland from coast towns in Kent. Those who remained were warned that, if invasion came, they would be expected to stay where they were till further orders, so that the roads could be kept clear for military traffic. If their withdrawal became necessary, it would be done under

the orders of local commanders, who would be advised by the appropriate Regional Commissioners. Far-reaching arrangements for denial of commodities to the invader now included the thinning-out of petrol pumps at garages in coastal areas from the Moray Firth to the Bristol Channel, and detailed plans for the destruction in an emergency of those left in working order.

The system of command was also reviewed. One effect of the national danger was to revive an old demand for a supreme commander wielding authority over all branches of home defence. At the time, the arguments for that course seemed less compelling than they may appear in retrospect. The Chiefs of Staff concluded early in July that, even if the right man to exercise so grave a responsibility could be found, he would need help from an integrated staff whose creation would 'superimpose a cumbersome and top-heavy incubus' on the existing staffs of the fighting services. Accordingly, the system outlined in Appendix III remained in force, with such modifications as the times made necessary. The Commanders-in-Chief or Flag Officers commanding the naval home commands continued to be directly responsible to the Admiralty, the Commanders-in-Chief of the metropolitan air commands to the Air Ministry. The Commander-in-Chief, Home Forces, controlled all troops in Great Britain, except anti-aircraft units and such special formations as the Free French Contingent. Under a system set up in May, each of the chief army commands was given the status and staff of an Army Headquarters and (except for Scottish Command) passed orders through one or more Corps Headquarters, according to the number of divisions in its area. Forces in Northern Ireland and Iceland remained under the War Office, but once the country was invaded all troops in the United Kingdom (again excepting Anti-Aircraft Command) would be controlled by General Brooke or his successor. Liaison officers at various formations, complemented by senior naval and air officers attached to G.H.Q. at Hammersmith, kept the Commander-in-Chief, Home Forces, in touch with the sister-services, while the Area Combined Headquarters, and the special status of the Commander-in-Chief, Coastal Command, as air adviser to the Admiralty, provided links between the naval and air branches of maritime defence. In view of his exceptional responsibilities, the Commander-in-Chief, Home Forces, was given direct access to the Government, and set up an Advanced Headquarters close to the Cabinet War Room, where he and his senior officers would be available for consultation by ministers and the Chiefs of Staff if invasion came. Early in the war arrangements had been made to move the War Cabinet and government departments to the West of England in an emergency; but as that part of the country was no longer virtually immune from air attack they were abandoned, and premises reserved

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for the purpose were used to house staffs which did not need to be, or could not be, accommodated in the capital. Should the Germans land, the War Cabinet, the Chiefs of Staff and the Naval, General and Air Staffs would stay in London. If driven from Whitehall, they would move to duplicate War Rooms in the suburbs.

CHAPTER IX

THE BATTLE OF BRITAIN: THE PRELUDE

(June–July, 1940)

(i)

WHEN their offensive against France and the Low Countries ended, the German High Command had no comprehensive plan for a direct assault on the United Kingdom. On 21st May Admiral Raeder, Commander-in-Chief of the German Navy, had raised the subject with Hitler, and earlier the leaders of all the fighting services had given some consideration to the question; but no important step was taken until six weeks later. By that time hopes that Great Britain would not fight alone were fading. Accordingly, on 2nd July the Führer ordered that plans for an early invasion should be prepared by all three services. He was not convinced, however, that their execution would prove necessary.

On the other hand, an indirect assault on the United Kingdom had been in progress since the beginning of the war. With ten months' experience of attacks on British trade behind them, the German navy and air force were now presented with a string of Dutch, Belgian and French ports and aerodromes well suited to the work. On the British side the capacity of the Royal Navy to protect convoys had been weakened within the last few weeks by losses at Dunkirk and off Norway, while the Air Staff faced the problem of finding aircraft for anti-invasion reconnaissance without sacrificing convoy-escort and anti-submarine patrols. As summer approached, good weather and the arrival of newly built ocean-going submarines further strengthened the German hand. Italy's declaration of war in early June made the situation still worse from the British point of view. Allied naval and air forces in the Atlantic theatre had already been weakened by steps taken in anticipation of the Italian move, which added twenty large and over a hundred smaller submarines to the enemy's resources.

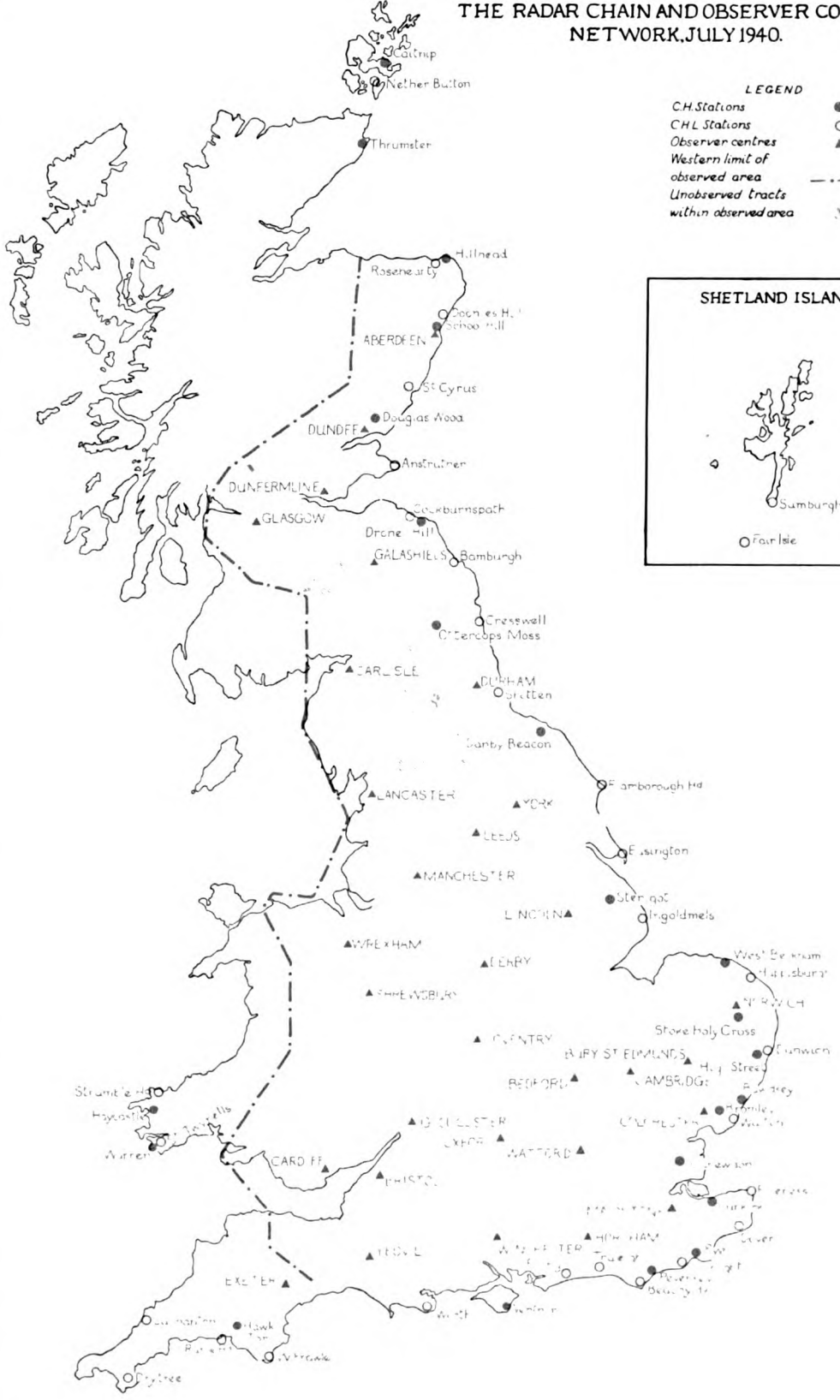
In June, losses to British trade from submarine attack were the heaviest in any month since the beginning of the war. The Admiralty were forced to conclude that the navy, lacking bases in Eire and

faced by an enemy well installed in Brittany and Gascony, could not continue to protect the existing convoy-routes through the south-western approaches. Towards the end of the month they arranged, therefore, that henceforth inbound traffic, except ships bound for Channel ports from Southampton westwards, should be routed north of Ireland. Outbound traffic would continue to use the southerly routes until the first re-routed inbound convoys reached home waters some weeks later.

In the outcome, growing fears for the safety of shipping threatened by German bombers from northern France led the Admiralty to modify this programme and anticipate its later stages. The southerly routes were not used by ocean convoys after the middle of July; thereafter passage through the English Channel was virtually confined to coasting vessels organised in small local convoys. A provisional plan, whereby inbound ocean convoys were to split up north-west of Ireland so that some of the ships could be taken northabout to the East Coast, was abandoned in favour of a single approach which brought all convoys through the North Channel to the West Coast ports. Thence a northabout link with the East Coast was provided by local convoys from the Mersey and the Clyde.

For the home defences, not merely in their naval aspect but in many other aspects as well, the change had far-reaching consequences. It did much more than merely underline the need for a growing share of such things as anti-aircraft guns and fighter squadrons at the West Coast ports; it also raised further claims which proved very hard to meet. That increased reliance on the West Coast, besides creating new problems of distribution, would place an added burden on the air defences, had long been obvious; less obvious was the extent to which the burden would spread to parts of the defensive structure as yet unready to support its weight. In the first place the defence of the western ports became more urgent, not merely because the enemy could reach them more easily from his new bases, but also because congestion resulting from successful attacks might throw the whole system of 'turn-round' and distribution out of gear. That, however, was not all. For the Royal Navy and for Coastal Command the problem of protecting ocean convoys grew more and more acute as U-boat commanders gained experience. It was soon apparent that asdic would not fulfil the hopes previously placed on it, for by surfacing to attack as darkness fell the submarines could escape detection by it while remaining almost invisible to the human eye. And similarly the task thrown on the air defences grew more and more onerous as the passage of the months made it increasingly clear that their resources must be used, not only to defend the ports themselves and all the rest of the kingdom, but

THE RADAR CHAIN AND OBSERVER CORPS NETWORK, JULY 1940.



LEGEND

- CH Stations ●
- CHL Stations ○
- Observer centres ▲
- Western limit of observed area - - -
- Unobserved tracks within observed area —

SHETLAND ISLANDS.



also to extend patrols for the protection of shipping to new areas where facilities for aircraft were particularly scanty.

Yet to a great extent the problem was foreseen before it grew acute. Well before the fall of France, for instance, the defenders were aware that the flanks of the existing system of air defence would be vulnerable if the enemy acquired either aerodromes outside Germany or aircraft of exceptionally long range.¹ In the early part of 1940 the continuous system ended on the right flank at the Solent, on the left flank at the Firth of Forth. Beyond those points there were only outposts for the defence of Bristol and Scapa Flow. West of Bristol, Fighter Command had not a single aerodrome suitable for modern fighters and radar cover was non-existent or inadequate. In many other places C.H.L. equipments had yet to be installed and C.H. stations were too far apart. The Observer Corps system was also incomplete or lacking in some areas, including wide tracts in the west.

So far as the West of England was concerned the gravest of these shortcomings was the lack of radar stations, for aerodromes of a sort were available, while observer posts, needing no elaborate equipment, could be established fairly quickly. At the time of the Dunkirk withdrawal the Air Ministry adopted an emergency programme designed to meet the most pressing need. They contemplated the early installation of eight new C.H. equipments in the West of England and in Scotland and Northern Ireland, and of fifteen C.H.L. equipments at various places round the coast, from Flamborough Head to Stranraer and Antrim. If possible, all the latter were to be ready by 8th July. In addition, a pool of twelve mobile radar stations was to be made ready to fill gaps or replace equipments knocked out by the enemy. As things turned out, six of the C.H.L. equipments and the same number of C.H. equipments had been added to the chain by the beginning of the second week in July, when the German air force led up to its main offensive of August and September by starting a series of lively attacks on shipping by escorted bombers. Map 10 shows the location of radar stations in existence or under construction at that time.

Still earlier, steps had been taken to bring into action a new fighter group in south-west England, thus freeing No. 11 Group for the defence of London and the south-east. This move had been contemplated before the war and plans had been made accordingly. Construction of appropriate headquarters at Rudloe, near Bath, began in February, 1940; and in July the newly-formed No. 10 Group took control of three sectors with headquarters at Pembrey, in South Wales, Filton, near Bristol, and St. Eval, in Cornwall. A

¹ See Chapter V.

fourth sector with headquarters at Middle Wallop, on the eastern fringe of Salisbury Plain, remained under No. 11 Group until the beginning of the second week in August. For the present the westward boundary of the area covered by the Observer Corps lay on a line extending roughly from the centre of Lyme Bay to the Gower peninsula; but in the course of the month a new Observer Centre opened at Exeter, and cover was gradually extended further west. Radar stations in the south-west were already reporting to a temporary centre at Plymouth, and continued to do so until the end of July, when a Filter Room opened at Group Headquarters. Appendix VI shows the organisation of the air defences in the summer.

When No. 10 Group first went into action its commander had four fighter squadrons to divide between his three sectors. But for some months afterwards he continued to lack permanent sector stations and a sufficiency of good aerodromes well placed for his needs. St. Eval, for example, was a Coastal Command station, where his one squadron and sector headquarters were mere 'lodger units'; Filton was a stop-gap intended to serve only until a permanent station at Colerne was ready. Worse still, as neither radar cover nor Observer Corps cover was yet complete, he could expect only an imperfect picture of enemy movements towards his sectors and across them.

In any case, the creation of No. 10 Group was far from solving the whole problem of defending the western ports, if only because its northern boundary was in South Wales. In the past, North and Central Wales, the Mersey and Northern Ireland had been fairly well protected by the broad mass of the air defences in the east and south; but the barrier had ceased to be effective now that German bombers could get there by crossing or even skirting the thinly-covered south-western counties from new bases in Brittany.

Accordingly, the Air Ministry soon projected yet another fighter group, extending from the south Midlands to the Solway Firth and westwards over Wales and the Irish Sea. Before it could go into action the extension of the radar chain up the West Coast must be carried a stage further and the area covered by the Observer Corps must be extended, not merely over the whole of Devonshire and Cornwall for No. 10 Group's sake, but over western Wales. New aerodromes and sector headquarters were needed, and a complex system of communications had to be created in an area which included wide tracts of desolate country where telephone-lines were scarce. Progress in some of these respects was disappointing. A North-Western Filter Room opened at Preston on 13th August; but the new No. 9 Group was not ready for active operations until December, and took full control of all its sectors only in 1941. Meanwhile the possibility of temporarily extending No. 10 Group's area northwards was discussed. But in practice the burden continued to rest chiefly on No. 12

Group, although that group promised to be fully occupied with the threat across the North Sea, and on the widely-scattered No. 13 Group. For the defence of Belfast, the Clyde and the North Channel, two squadrons under No. 13 Group moved to Aldergrove and Prestwick, in Northern Ireland and on the Ayrshire coast respectively.

Similarly, a third new group was clearly needed to bridge the gap between No. 13 Group's left flank on the Firth of Forth and its outlying squadrons stationed at Wick for the defence of Scapa Flow. During the spring and summer of 1940 the Air Ministry pushed on, therefore, with plans for the development of bases suitable for modern fighters in Caithness, the Orkneys and the Shetlands, and of the other facilities which would be needed to weld all the defences north of Dundee into a coherent whole. In August, a new No. 14 Group (succeeding to a designation previously used in France) began to form at Inverness. But some months elapsed before it was able to assume control of the Wick sector and of a new sector with headquarters at Dyce, near Aberdeen.

The formation of new fighter groups and sectors, the lengthening and strengthening of the radar chain, and extension of the area covered by the Observer Corps, were all important steps towards the ideal of a 'fighter umbrella' protecting the whole kingdom. But much more was needed. Apart from the parallel need for balloon-barrages, anti-aircraft guns and searchlights in some newly-threatened areas, everything depended on there being enough fighter squadrons to garrison the extended system. Here only modest progress had been made since in March Air Commodore Stevenson, foreseeing the creation of Nos. 10 and 14 Groups, had urged the formation of seven new squadrons without delay and another twenty in the next twelve months.¹ Having sanctioned three of the new squadrons before being overtaken by the German offensive against France and the Low Countries, the Air Staff were working in May and early June to a programme of sixty squadrons by September.

When France fell, Air Commodore Stevenson returned to the charge. Calculating that no less than a hundred and twenty home defence squadrons would be needed to achieve security in the circumstances likely to arise in the near future, but recognising that such an enormous increase was quite out of the question, he recommended that ten new squadrons should be formed at once and another ten as soon as possible. The output of the fighter factories had improved so much in recent weeks that some such programme might have been feasible had there been no scarcity of pilots. As it was, the supply of trained pilots from the Group Pools or Operational Training Units—itsself governed by the output of the Flying Training

¹ See Chapter V.

Schools—had begun to lag behind the demand created by casualties sustained in France. In the circumstances the best that could be done was to add four aircraft to the establishment of each of thirty Hurricane and six Spitfire squadrons, the intention being that they should be flown in an emergency by pilots who would otherwise have been on leave or resting. Fighter Command gained some slight alleviation of its difficulties through the accession in June of sixty-eight pilots hitherto serving in naval air squadrons, of whom ten were withdrawn soon afterwards for service in the Mediterranean. The broad effect of these arrangements, later supplemented by the addition of a number of Dominion and Allied squadrons, was to maintain the strength of the command throughout the summer at the equivalent of about sixty squadrons, including a varying number not fully up to the demands of active operations. In actual numbers, Air Chief Marshal Dowding had on 9th July a total of fifty-eight squadrons in various stages of efficiency, besides the Fighter Interception Unit, an experimental night-interception unit which ultimately played a useful part in active operations. Appendix VII shows where his squadrons were stationed and how they were equipped.

(ii)

Apart from the foregoing changes, the spring and summer of 1940 were notable for additions to the balloon, searchlight and gun defences. But the full effect of these additions was not felt before the autumn.

We have seen that before hostilities began the scale of balloon defence for the whole country was fixed at 1,450 balloons, that in fact 624 were flown on the first day of the war, and that afterwards unexpected losses forced Balloon Command to conserve its stocks by flying only a proportion of the balloons distributed to squadrons.¹ Thanks to this policy, by the middle of May, 1940, enough balloons were available to meet the pre-war scale. Strict economy was, however, still necessary to prevent a recurrence of the crisis. Moreover, as time went on other factors besides the risk of damage in bad weather inclined the Air Staff more and more towards a policy of close-hauling balloons except when the places they guarded were imminently threatened. Among them were the danger to growing numbers of British aircraft compelled by the needs of war to cross defended areas, and later the risk of electrical interference with gun-laying radar sets.

In any case, the fact that there were now enough balloons to meet

¹ See Chapter V.

the pre-war scale did not mean that all squadrons had their full complement; for since the beginning of the war the number of squadrons had increased. Apart from a short-lived demand for barrages at French ports used by the Expeditionary Force, new barrages had been authorised at several places, including a number of fleet anchorages and harbours. Again, some existing barrages had been made larger. By April, 1940, such additions and extensions, with an increased allocation for training and the creation of a mobile barrage suitable for swift deployment at any point which might be newly threatened, had already added some six hundred balloons to Balloon Command's establishment without adding a single balloon to its real strength.

After the fall of France the barrages at French ports were no longer necessary, but other needs became acute. In particular, more or larger barrages were urgently needed at the western ports; at the same time there was a growing demand for balloons flown from waterborne moorings as a deterrent to minelaying aircraft. Air Chief Marshal Dowding was ready with concrete proposals to deal with this situation. Besides providing an average of ten waterborne balloons at each of fourteen estuaries to meet the second need, he contemplated new barrages, with an aggregate establishment of 112 balloons, at Pembroke, Falmouth, Ardeer and Yeovil, and the addition of 96 balloons to existing barrages at Liverpool, Runcorn, Manchester, Bristol, Hull and in South Wales. The projected scale would thus rise from 2,027 balloons to 2,375. Clearly, therefore, the authorised establishment of Balloon Command was due for revision. To cover an estimated requirement of at least forty balloons at Belfast while providing a margin for further demands and unforeseen contingencies, the Air Staff accordingly fixed at the end of July a new figure of 2,600 balloons. Production, which had amounted to only 212 balloons in September, 1939, and 148 in October, had been roughly trebled since that time, largely by the erection of new plant, and was expected to reach the satisfactory figure of 1,200 a month within the next three months. Meanwhile fifty-two squadrons, with an aggregate strength of 1,466 balloons towards their nominal establishment of 1,865, were actually deployed and another two were working up. Their deployment is shown in Appendix VIII.

To meet new demands for anti-aircraft artillery was much harder. When France fell, General Pile held only 1,204 heavy and 581 light anti-aircraft weapons towards his approved scales of 2,232 and 1,860 respectively. Intake amounted during the next five weeks to 124 heavy and 182 light guns, but about two-fifths of the former and a quarter of the latter had to be allotted to training and to places abroad, including some of those now threatened by Italian intervention. Thus on 28th July the United Kingdom still had only about

one-half of the heavy and less than one-third of the light anti-aircraft weapons considered necessary before the German occupation of the European seaboard.

This was a grave shortcoming. Strong defences for aircraft factories were deemed essential; it was desirable that aerodromes should be well defended; and the western ports, a number of naval bases and many industrial areas also had strong claims. On the other hand there was no prospect, as there was where balloons were concerned, that the production problem would soon be solved. For the moment all that could be done was to allot more guns to aircraft factories, aerodromes and other specially important or vulnerable targets, mainly at the cost of temporarily depleting the defences of London and other towns. The disposition of the guns in July is given in Appendix IX. As an additional deterrent to low-flying aircraft a number of aircraft factories were furnished with an easily-made 'parachute-and-cable' device consisting of a linear arrangement of rockets to which light steel cables were attached. Searchlights were more plentiful, nearly four thousand being available towards the pre-war scale of 4,128, though here again there was a strong case for increasing a figure calculated to meet a situation much more favourable than that which now existed.

(iii)

To sum up, the air defences reached the crucial summer of 1940 with a fighter force which its Commander-in-Chief and the Air Staff were at one in thinking uncomfortably small; an early-warning and reporting system tolerably near completion in the south and east, but notably deficient in the west and parts of Scotland; a marked but scarcely acute shortage of balloons; and a grave shortage of anti-aircraft artillery and of the new devices needed to counter the night-bomber and enable the guns to engage unseen targets with success. Perhaps most serious of all so far as the immediate outlook was concerned, the fighter force, having overcome the worst of its deficiencies of equipment through the great effort made by the aircraft industry, was now threatened with an equally disturbing shortage of trained pilots. Such was the inevitable outcome of the change from a peace to a war footing and of the casualties sustained in France.

At first sight the underlying causes of the last difficulty may not be apparent. It may be thought that the shortage of pilots must have been foreseen and hence ought not to have occurred. But even if the first assumption were sound, the second would not necessarily follow from it. The immediate causes of the shortage were unexpectedly heavy losses and accelerated expansion of the fighter force to meet

the novel situation arising from the French collapse. But the roots of the problem went much deeper. On account of the time factor, the difficulties experienced in 1940 could have been avoided only by a big expansion of the Air Ministry's facilities for training and recruitment at a stage when war was far from certain; and probably no amount of foresight would have enabled the Air Staff to persuade a peacetime government to sanction such a step before the Munich crisis. Nor could they have made sure in time of peace that recruits of the right sort would be found. The standard set by the Royal Air Force for its fighter pilots demanded that they should be well and recently trained, in excellent physical condition and at the peak of their young manhood. To ensure that an ample reserve of men satisfying these conditions should be ready at a moment chosen by the enemy, the Air Ministry would have had, in the first place, to find and train them; secondly, to keep them in training after they had qualified; and thirdly, to replenish the reservoir at frequent intervals in order to replace pilots who grew too old or could no longer be counted on for other reasons. The system of short-service commissions, on which the air force relied for a high proportion of its peacetime strength, went some way to ease the problem, but could have provided a sufficient reserve of young fighter pilots with recent experience only if the number on the active list at any one time had been raised to a higher figure than in fact the peacetime service could absorb. The Royal Auxiliary Air Force, although intended to provide a second line of Territorial squadrons rather than a reserve of pilots to replace casualties in the Regular squadrons, also helped to make the air force more elastic. But its scope was limited both by the size of peacetime votes and by the number of suitable candidates who could be induced to join. In view of these difficulties it is not surprising that the Air Ministry did not solve a riddle inherent in the peacetime structure of the service.

Thus, at least as soon as fighting began in France, the leaders of the air force had reason to fear that a well-timed blow by the enemy might find them with dangerously few fighter pilots. On the other hand, they had the satisfaction of feeling that quality had not been sacrificed to a vain attempt to achieve mere bulk. Their aim had been to build a fighter force not only as well equipped as possible, but trained to an exceptional standard of efficiency; and they saw no reason to suppose that they had missed their mark. Well schooled in a system which gave wide scope to personal initiative, intensely proud of their machines and at the peak of their physical resources, the young Hurricane and Spitfire pilots were confident of their ability to do all that was expected of them, and much more. Those who had fought at Dunkirk and elsewhere knew that they had fought well; and if it is now clear that numerically they had not always been

as successful as they thought, their conviction that they could fly and shoot at least as skilfully as their opponents was none the less well-founded. They believed that they could meet the coming blow; before long they would have an opportunity of seeing whether they were right.

(iv)

By the end of May a large part of the German air force was already based in Holland, Belgium and northern France, preparing to support the army in its drive towards the Seine. Before the completion of the withdrawal from Dunkirk, and while air operations were still in progress on both sides of the Somme, a part of the bomber force was turned southwards against objectives remote from the main front. On the first two days of June, German bombers attacked towns and centres of communication in the valley of the Rhône and southern France. Next day they made a sharp attack on the outskirts of Paris. Clearly the main object of these raids was to support the army by delaying the arrival of reinforcements in northern France; but inclusion among the targets attacked of oil refineries and aircraft factories seemed to mark a shift towards the 'strategic' conception of air warfare. Consequently a raid on London in the near future appeared not at all unlikely.

On June 5th the German army began its final thrust towards Paris and the lower Seine. Within a few hours a new stage of the air war opened not, indeed, with a raid on London, but with a scattered attack on many parts of the United Kingdom. That night and the next, small numbers of bombers flew over the country, interrupting sleep and causing the sirens to sound over a wide area, but otherwise doing little harm. Most of the bombs they dropped were aimed at aerodromes, but some fell harmlessly in open country.

In London and at Stanmore the small scale and wide distribution of these raids, and of others which followed later in the month, aroused much speculation. At least one government department suspected that they were a rehearsal for the dropping of parachutists as a prelude to invasion. Another and better founded theory was that the German air force was trying out methods of navigation which would enable its crews to find their targets in conditions of weather and visibility otherwise prohibitive. There was no doubt that, by taking bearings and cross-bearings on a series of German medium-frequency radio-beacons, each transmitting a characteristic signal capable of being changed from time to time in the interests of security, aircraft on their way to raid this country could fix their positions well enough to make the finding of a prominent landmark

fairly simple. But Dr. R. V. Jones, a physicist introduced to the intelligence branch of the Air Ministry for the special purpose of studying enemy weapons and methods, suspected something more. A document recovered from a German bomber brought down in March had mentioned a '*Knickebein* beacon' described as operating on a certain bearing from darkness until dawn. Later the wreckage of another aircraft, belonging to the same unit as the first, had yielded a diary in which was written the same word *Knickebein*—an evident code-word roughly translatable as 'googly'. A third item of intelligence connected the word with a town in western Germany and a geographical reference corresponding to the neighbourhood of a manufacturing centre in the Midlands.

Such scraps of evidence led Dr. Jones to suspect the Germans of planning something far more dangerous than a mere array of beacons. He feared that they were experimenting with a system of directional radio beams capable of being made to intersect over a given spot. Such beams could be used to guide the pilot of an aircraft equipped to receive their signals to an unseen target and let him know when he had reached it. If the Germans succeeded in perfecting such a system their bombers might be able to find our towns with considerable accuracy on the darkest nights, and perhaps in weather which would hamstring the defences.

At first, many of Dr. Jones's colleagues doubted whether such a device was feasible. Some scientists argued, for example, that a radio wave of the postulated frequency could not possibly be made to bend round the earth from Germany so much as to be receivable in a bomber over England. But Jones persisted. At least he could show that, although his hypothesis might not be sound, its implications, if it should prove so, were serious enough to make failure to test it inexcusable. Ultimately the matter was discussed on 6th June at a meeting over which the Prime Minister presided. Nine days later prisoners of war, who had hitherto been reticent, at last made admissions which went some way to confirm the existence of the beams; and on 18th June an organisation was created under the Air Ministry to investigate signals on the suspected frequency, both from a specially-fitted van and from an Anson aircraft.

The German raids were resumed that night, when the first bomb dropped on Greater London fell at Addington. They continued on a small scale throughout the rest of the month. On its second flight the Anson found firm evidence that a radio beam crossed the English coast at the mouth of the Humber on a bearing consistent with the theory. After Dr. Jones had expressed the opinion, on 28th June, that the device would enable the Germans to 'place an aircraft within 400 yards over a point in this country', further discussions were held, in which Mr. Churchill again took an active part. The sequel was the

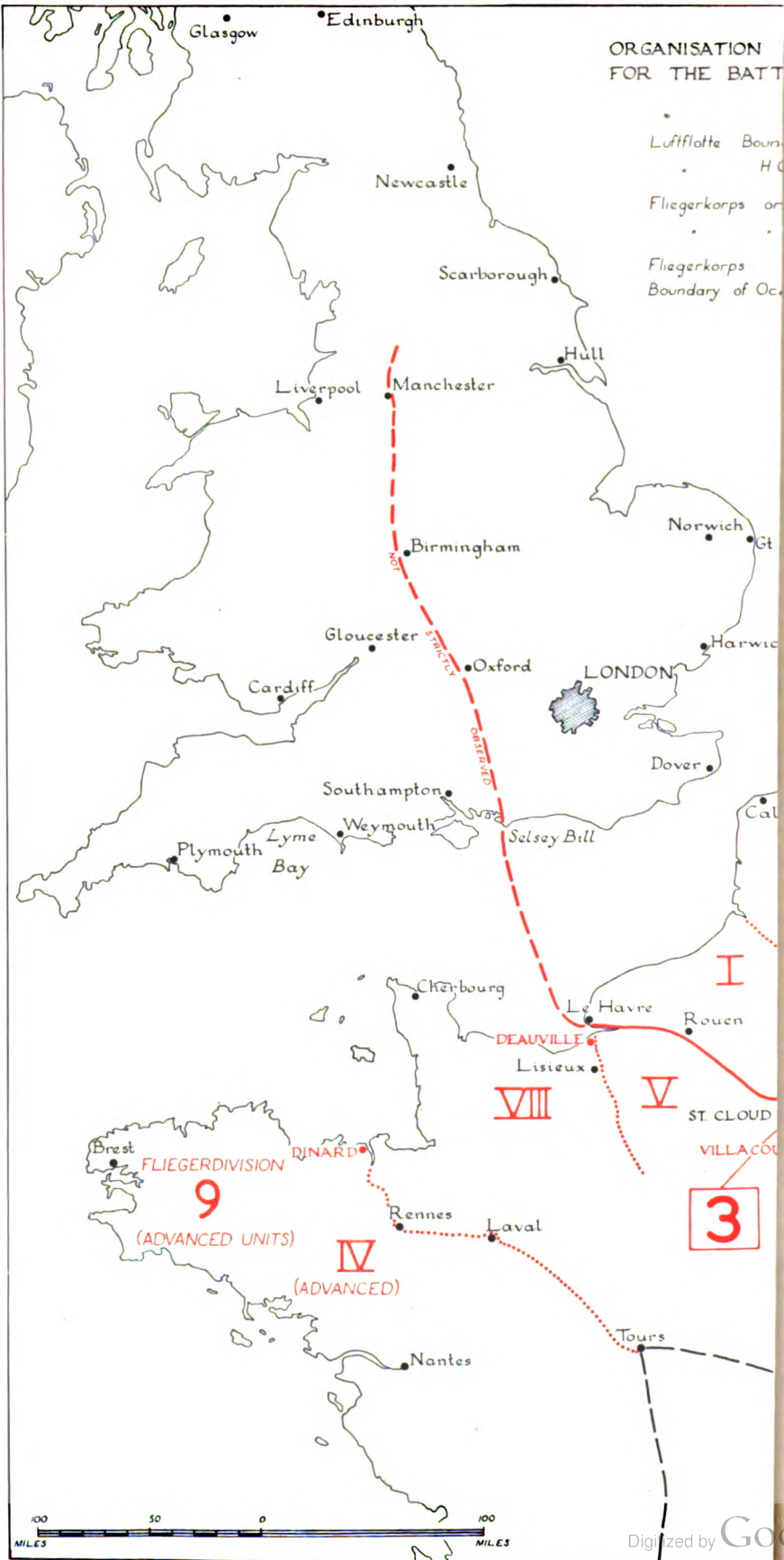
formation in July of No. 80 Wing, commanded by Wing-Commander E. B. Addison, a signals expert, for the purpose of taking measures designed to counter a variety of German aids to navigation. Under Wing-Commander Addison's direction arrangements were made both to jam *Knickebein* and to re-radiate transmissions from the medium-frequency beacons in such a way that bomber-crews would be presented with an embarrassing choice of apparently authentic signals. In the interests of security and in view of its dependence on sources of information with which operational commanders were not directly concerned, No. 80 Wing worked under the immediate control of the Air Ministry, but kept in close touch with the operations room of Fighter Command at Stanmore. There it was represented by liaison officers who also controlled the working of our own radio transmitters so that they should help the enemy as little as possible.

Thus on balance the June raids were a poor investment for the German air force. In the course of the month thirteen aerodromes, sixteen industrial plants and fourteen port areas were bombed, but the bombing was nowhere heavy enough to do lasting damage. The heaviest casualties caused by a single attack occurred at Cambridge, where nine people were killed on the night of the 18th. A few German bomber units gained experience of night-flying over the United Kingdom, but at the heavy cost of compromising one of their most important aids. Begun at a time when the British Government was called upon to decide how far the few fighter squadrons left in France after the withdrawal of the Air Component should be reinforced, the raids were of too minor a character to bear heavily on that issue; and such effect as they may have had upon it was scarcely calculated to advance the German cause. Moreover, their immediate cost in aircraft lost was fairly heavy. Either because they underestimated the defences or because their navigational researches required it, German pilots flew too low for safety. Of twenty-two night combats between German bombers and British fighters in June, five occurred at altitudes below 9,000 feet and only three above 12,000 feet. The average height of the bombers was probably about 10,000 feet. Consequently the imperfections of the defences were minimised. In the absence of the airborne radar and improved gun-laying devices with which he and General Pile were still experimenting, Dowding relied on searchlights to supplement the ordinary methods of interception used in daylight. At such low altitudes the searchlight crews, although handicapped by old-fashioned sound-locators, proved capable of holding and illuminating their targets quite well, even on moonlit nights. In the course of the night raids eleven bombers were brought down. German losses for the month also included a minelaying sea-plane and a reconnaissance aircraft of bomber type.

These results were flattering to the defences. They were not a

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reliable foretaste of what might happen if more concentrated night attacks were made in the near future by bombers flying higher. In that case airborne radar, new equipment for gun-laying and search-light control, and other devices still in embryo would be badly needed. If they were not yet ready, it was because priority had necessarily been given to early-warning radar, the watchdog of the defences at all hours.¹ For the moment, however, Dowding judged, quite rightly, that a big daylight offensive was the first important trial he would have to face. Meanwhile the night raids provided useful experience for both the air defences and the Civil Defence services. Perhaps not least important, they made the practice of routine precautions familiar to many citizens, while providing a good test of the public warning system. The authorities soon found that the existing practice, whereby the sirens were sounded in all areas even remotely threatened by hostile aircraft, resulted in much needless loss of sleep and played into the enemy's hands by allowing a handful of bombers to keep most of the country under warning. Moreover, the frequent sounding of sirens in places where no bombs were dropped seemed likely to rob the warning of significance. Towards the end of the month, therefore, a new policy was tried. Henceforth a distinction was drawn between the probability of attack and its bare possibility. Greater discretion was exercised in the issue of public warnings, and more use was made of precautionary messages whereby the Civil Defence services in a locality only remotely threatened could be warned for action without sounding the sirens. The policy entailed some risk: on the night of the 26th, for example, when it was first applied, Cardiff was bombed though the sirens had not sounded; but on balance the new system was a great improvement on the old and served the public interest better.

(v)

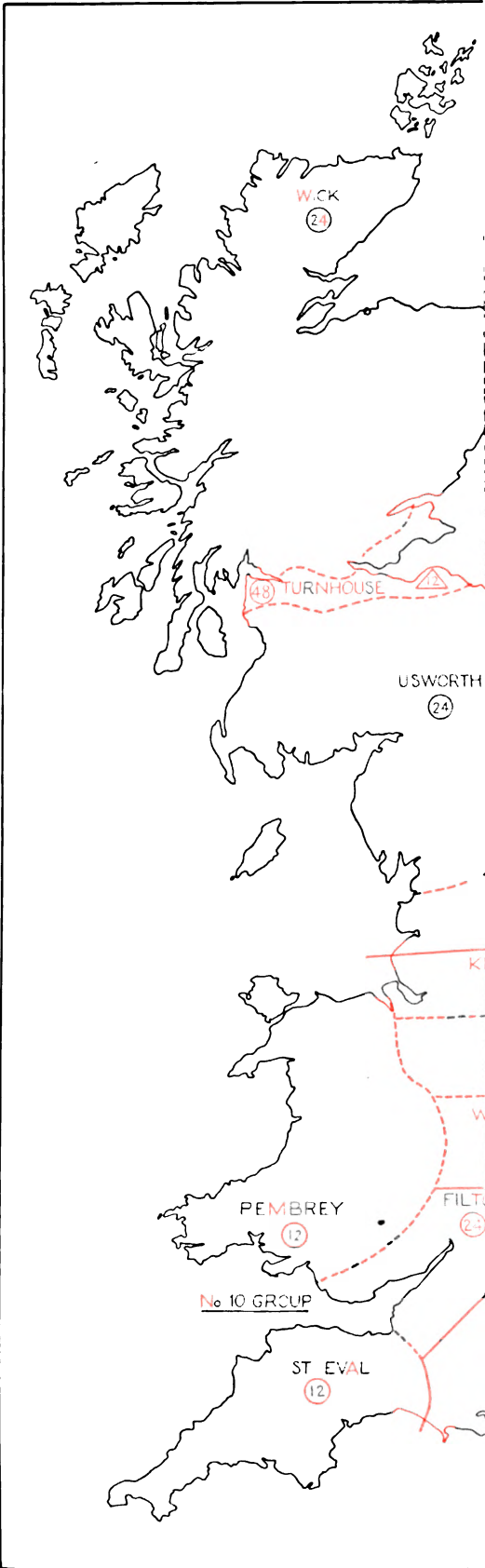
At an early stage in their discussion of invasion plans the German High Command acknowledged that they could not conquer the United Kingdom without first defeating the Royal Air Force. In his first invasion directive of 2nd July the German Chancellor expressed the view that a landing in England was possible if air superiority could be achieved, and called upon the Luftwaffe to calculate the chances of achieving it. Ten days later a more detailed appreciation laid down the principle that control of the air over the landing area and the sea approaches to it was essential to atone for naval weakness, and that in consequence no crossing could be made until the

¹ See Chapter II.

Royal Air Force had been robbed of the power to intervene effectively. A further directive issued on 16th July gave the air arm the huge task of preventing all air attacks on the invading forces, destroying coast defences covering the landing points, breaking the initial resistance of the British land forces and annihilating reserves behind the front. Although the British Army was known to be in difficult straits after its heavy losses of equipment in France, it was expected to fight fiercely, so that the final clauses of this instruction alone were clearly a tall order.

Accordingly, the chief concern of the Luftwaffe in early July was to prepare itself for these responsibilities, or at least for such of them as seemed to its leaders likely to arise in practice. At the close of the campaign in France a number of units went back to Germany to rest and re-equip. During the next few weeks large numbers of captured aerodromes in France, Belgium and Holland were made ready, stocks of bombs and fuel were built up, and widespread preparations were made for the great air blow which was either to render an opposed landing in England possible, or make it unnecessary by forcing the defenders to give up. Recognising that the Royal Air Force was not likely to succumb in the day or two allowed in earlier cases, the German Air Staff proposed, with remarkable self-confidence, to devote four days to the subjugation of the fighter defences south of a line from London to Gloucester, and four weeks to the conquest of the air force as a whole. Besides directly attacking the ground organisation on which the Royal Air Force depended, they intended to compel our squadrons to consume their resources in defending shipping, ports and aircraft factories. By this means they hoped to prevent rapid replacement of equipment destroyed on the ground and in air combat without abandoning their attempt to sever our supply lines. The air battle proper would begin in August, so that a landing could follow early in September, when good weather for the trip across the Channel might be expected.

Ultimately some amendment of this programme became necessary. Meanwhile the High Command allotted responsibility for the main attack to the two air fleets which had supported the German armies so successfully in France and the Low Countries. *Luftflotte 2*, whose units were based in northern Germany, Holland, Belgium and France north of the Seine, would be concerned mainly with the area east of a line from Le Havre through Selsey Bill to the Midlands; *Luftflotte 3*, based in western France, would deal similarly with objectives west and north-west of that line. (See Map 11.) Each *Luftflotte* was to attack shipping off its own stretch of coast. Diversions attacks, intended to draw off part of the defences from the south, would be made on north-east England, south-east Scotland and shipping in adjacent waters by *Luftflotte 5* from Norwegian and Danish



bases. Field-Marshal Kesselring and Sperrle, commanding *Luftflotten* 2 and 3 respectively, were perhaps the ablest and certainly the most experienced operational commanders in the German air force. Besides their work in France and the Low Countries, the former had commanded *Luftflotte* 1 in Poland; the latter had commanded the Kondor Legion in Spain in 1936 and 1937, thus furnishing the German Air Staff with new foundations for its strategic doctrine.

By the third week in July dispositions for the battle were substantially complete. Thereupon the units concerned were ordered to assume 'full readiness', although detailed plans for their employment had still to be perfected. Between them *Luftflotten* 2 and 3 had at their disposal some 1,130 long-range bombers; about 320 dive-bombers; roughly 800 single-engined and 250 twin-engined fighters; 60 to 70 long-range reconnaissance aircraft (besides a number of long-range earmarked for armed reconnaissance of ports and shipping); and some 90 short-range reconnaissance machines.¹ The last were of no value for the initial air assault, but would be needed for the close support of any troops which might ultimately land in Britain. *Luftflotte* 5, under General Stumpff, had available for use against the United Kingdom and its shipping some 130 long-range bombers, 30 to 40 twin-engined fighters and about 50 long-range reconnaissance aircraft. Normally about two-thirds of the bombers in each *Luftflotte* were expected to be serviceable at one time, the remainder being grounded for inspection and minor repairs; but the proportion would tend to rise in quiet periods and fall after a few days of active use. Generally the serviceability of the fighter units was somewhat higher; some units, for example, had had nearly all their aircraft serviceable in the closing stages of the French campaign, when they were working on extended communications and had been busy for several weeks. In broad terms, the two *Luftflotten* responsible for the main assault were capable of putting into the air rather less than 800 long-range bombers and 250 dive-bombers supported by about 820 fighters.

As for the opposition they must expect, the German Air Staff put

¹ More precisely, the figures on 20th July were:

	Strength	Aircraft Serviceable
LUFTFLOTTE 2 and 3		
Long-range bombers	1,131	769
Dive-bombers	316	248
Single-engined fighters	809	656
Twin-engined fighters	246	168
Long-range reconnaissance	67	48
LUFTFLOTTE 5		
Long-range bombers	129	95
Twin-engined fighters	34	32
Long-range reconnaissance	48	33

In addition, *Luftflotten* 2 and 3 disposed of some 90 short-range reconnaissance machines and *Luftflotte* 5 of 84 single-engined fighters for local defence.

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Fighter Command's strength at fifty squadrons of single-engined fighters, or a total of 900 first-line aircraft, excluding the twin-engined Blenheims. Of these they expected about 675 to be serviceable on a given day. In fact, Air Chief Marshal Dowding had forty-eight such squadrons ready for action on 9th July and four more forming or re-equipping; but the first figure included two Defiant squadrons of limited value for day fighting. His six Blenheim squadrons, like the Fighter Interception Unit, were now primarily night fighters—a fact known to the Germans—although for certain minor tasks they might still be used in daylight. Towards his authorised establishment of 1,450 pilots Dowding had 1,253. Reckoning his squadrons at their normal tactical strength of twelve machines apiece, he could not count on putting more than some 600 day fighters into action at one time, even in the unlikely event of his committing all his day squadrons simultaneously. Theoretically the number would rise to 700 or more if pilots could be found to man the additional machines attached to certain squadrons.¹ Map 12 shows how these forces were disposed. As for Dowding's other resources, the German Air Staff rightly thought the number of anti-aircraft guns in the United Kingdom far from adequate; and in fact there were still fewer light guns than they supposed. They regarded the searchlight defences with a respect attributable to their recent performance against night-bombers, but attached little importance to the balloon defences in view of their limited altitude and their susceptibility to damage in bad weather.

In most respects, then, the German appreciation of the defences was not too wide of the mark. But in one respect the Luftwaffe miscalculated badly. Although aware of the existence of the radar chain, if not of its extent, they thought so little of its effectiveness that their formal survey made no mention of it. From the British standpoint, on the other hand, it seemed likely to be the crucial weapon. Dowding and his subordinate commanders could have no doubt that success or failure would turn largely on their ability to distinguish between main and subsidiary attacks. Where the speed of the enemy's advance was reckoned in hundreds of miles an hour instead of ones or tens, the time left for decision would be very short; and only the information furnished by the radar chain could help them to decide swiftly and correctly. If the oracle spoke clearly and was understood, they might win with their six or seven hundred fighters; if it failed them or they mistook its message, then defeat was almost certain.

¹ See p. 152.

CHAPTER X

THE BATTLE OF BRITAIN: THE PRELIMINARY PHASE¹

(July–August, 1940)

(i)

AT THE beginning of July the Luftwaffe continued its policy of harassing the United Kingdom by means of light and widely-scattered night attacks. By flying higher than in June its bomber-crews escaped serious interference from the defences while causing a good deal of inconvenience. South Wales and the West of England were easily reached from bases in Normandy and Brittany by well-marked routes which skirted the more heavily defended areas, and therefore received most attention; but between the 2nd and the 10th of the month bombs fell on one or more nights in every seaside county south of the Tyne. Attempts to limit warnings still more stringently than in June, by confining them to districts where severe attack was likely, failed because the officers who had to give the warnings could not draw such a distinction without running undue risks. The heaviest casualties suffered during the first half of the month occurred at Aberdeen, where more than fifty people were killed or seriously injured on the night of the 12th in an attack delivered when the sirens had not sounded.

The beginning of the month was also notable for a new series of daylight raids, differing markedly from the occasional attacks on ports which had been delivered in the past. These raids were of two kinds. On the one hand bombers flying singly or in small formations, and relying on cloud-cover or evasive tactics, started to penetrate well inland, reaching places as far afield as the Thames Valley, Norfolk, North Wales and Glamorganshire. On the other, formations sometimes escorted by fighters began to attack ports more heavily than heretofore and to visit places hitherto immune. During the first nine days of July Falmouth, Plymouth, Portland, Weymouth and Dover were all bombed in daylight and seven attacks were made on Channel convoys. At least six of the raids were made by some fifteen

¹ For a summary of operations, see Appendix X.

or twenty bombers escorted by about the same number of fighters, and several brisk engagements were fought between the German aircraft and our own.

In consequence, the effort made by the British fighter force rose sharply at the beginning of the month. Between nine o'clock and six o'clock on 8th July, for example, Fighter Command flew well over three hundred sorties, or roughly the same number as it had put over Dunkirk in one day at the height of the withdrawal. At the same time the raids revealed a new and particularly awkward aspect of an abiding problem. Since the previous autumn protection of shipping off the East Coast had proved burdensome, but comparatively inexpensive; protection in the Channel, where the emphasis now seemed to be shifting, threatened to be still more burdensome and far more costly. Already, as a result of a few attacks by a small fraction of the German air force, the task imposed on Fighter Command had trebled almost overnight and had cost fifteen aircraft and twelve pilots in nine days. To improve the chances of intercepting aircraft attacking shipping between Lyme Bay and the Nore, Dowding ordered Park to move a number of squadrons to forward aerodromes in the Hornchurch, Biggin Hill and Middle Wallop sectors; at the same time he was able to bring into the line a few squadrons hitherto unfit. But interception was one thing, protection of shipping by escort or cover quite another. Dowding foresaw that any big increase in the scale of attack might put it out of his power to do what was expected of him. He hoped, indeed, that before long abandonment of the south-western ocean convoy-routes would so reduce the importance of traffic through the Channel that the Admiralty would be content with less protection there; even so he took the precaution of warning the Air Ministry that heavy attacks on inland targets might soon prevent him from escorting convoys unless he had more aircraft. Pointing out that recent attacks on shipping had not been made merely by one or two bombers, as in the past, but by substantial formations with fighter escort, he calculated that full protection for all shipping between Land's End and the Humber would alone absorb some forty squadrons. As it happened, events soon answered his tacit question; for within a few weeks the pace grew so hot that strong and continuous escort for all Channel convoys was clearly not to be expected.

(ii)

From the German viewpoint the preliminary phase of the air assault on the United Kingdom may be said to have begun soon after the middle of July, when forces assigned to the task were ordered to assume 'full readiness', and the assault proper four weeks later on

Adler Tag or 'Eagle Day'. But by the middle of the second week in the month pressure on Fighter Command was severe enough to make many people in this country think that the decisive struggle was at hand. Accordingly, the Battle of Britain is reckoned from the British standpoint to have begun on 10th July, so that those who lost their lives on or after that date are deemed to have fallen in the battle. In point of fact, the rise in tempo was so gradual that any boundary drawn between the prelude and the preliminary phase must be arbitrary. Hence a still earlier date might quite well have been chosen.

The first day of the battle, according to the British reckoning, began as usual with widespread weather- and shipping-reconnaissance flights by the German air force. As a rule, the weather-aircraft which ranged daily over the North Sea and the Atlantic kept well clear of the British coast. They were often tracked for part of their course by the radar chain, and sometimes one would pass over an outlying corner of the kingdom; but in general they gave few chances to the defences. Similarly, long-range aircraft in search of convoys west of Ireland were seldom within reach of land-based fighters. Aircraft searching for coastwise shipping or reconnoitring harbours, on the other hand, were always liable to interception. Even so their discovery was seldom easy, for often early-morning haze or patches of sea-fog helped them to escape unseen. And even in clear weather the limitations of the radar chain made the interception of single aircraft or small formations far from certain.

Not long after sunrise on the 10th a Spitfire from the Coltishall sector overcame these handicaps and engaged a German bomber-reconnaissance machine near Yarmouth. Three hours later a section of Hurricanes, patrolling a southbound convoy off Lowestoft, saw and were probably responsible for driving off two bombers which left the convoy unmolested; but an unescorted convoy in the same area was not so lucky, losing one ship when attacked by a couple of bombers about noon. Further south an attack on yet another convoy by two more bombers, this time accompanied by single-engined fighters, led to a skirmish near Margate, in which some twenty British fighters from the Biggin Hill and Hornchurch sectors were involved.

Thus the first half of the day passed almost uneventfully. The first hint of anything unusual came a little before half-past one, when radar stations in south-east England saw signs of a substantial muster behind Calais. A westbound convoy was off Dover at the time, and six Hurricanes from Biggin Hill had been ordered to keep guard above it. While they were doing so about twenty German bombers arrived over the Straits escorted by some forty single-engined and twin-engined fighters. Within the next half-hour the Hurricanes from

Biggin Hill were joined by elements of four more squadrons from neighbouring sectors; and a lively action followed. At the cost of three or four of their own number the German fighters protected the bombers from heavy loss, but the attack on the convoy was not very successful, only one small ship being sunk. Meanwhile, further to the west a single aircraft from Brittany bombed Falmouth, where one ship of six thousand tons was sunk and two others of about the same size were set on fire.

If 10th July was the opening day of the Battle of Britain, then the action off Dover was the first considerable engagement of the battle. On the whole its outcome was not unsatisfactory. Given such warning as the radar chain could reasonably be expected to provide, the fighter force had shown itself capable of dealing with quite large numbers of the enemy in circumstances which called for swift co-operation between aircraft drawn from several sectors. Even so the intercepting fighters had not arrived in such good time as to suggest that escort for convoys could be abolished, off this particular stretch of coast at any rate, unless the traffic were reckoned so unimportant that lost ships did not matter.

Next day the main interest shifted westward. Besides the usual weather-flights the day began with reconnaissance sorties by German aircraft over the Channel and Thames Estuary. Most of the aircraft over the Channel in the early hours were detected only on their way home; hence no fighters were sent to intercept them, although a convoy was passing eastwards across Lyme Bay. But a bigger threat arose soon after half-past seven, when the radar chain detected two formations moving north from the neighbourhood of Cherbourg. Thereupon No. 11 Group ordered six Spitfires from Warmwell, in the Middle Wallop sector, to patrol the convoy and sent forward three Hurricanes from the same base to meet the enemy. A little before eight o'clock the Hurricanes made contact with a greatly superior force, comprising some nine or ten Junkers 87 dive-bombers loosely escorted by about twenty single-engined fighters, and lost one aircraft. About five minutes later the Spitfire pilots saw the Junkers 87's diving to attack the convoy. Half of them made ready to engage the dive-bombers while the rest protected their rear, but the German fighters broke through our rearguard and shot down two Spitfires. Nevertheless the attack on the convoy failed, not one ship being sunk.

Thereafter cloudy weather kept activity to a minimum until the middle of the forenoon, when a rather disturbing incident occurred near Portland. The protagonists on the British side were a flight of Hurricanes from Tangmere, originally ordered to intercept a German aircraft believed to be on its way back from a protracted reconnaissance of Wales, but later sent south to deal with a raid apparently

making for Lyme Bay from the neighbourhood of Cherbourg. 'Raid' was a technical term, which might denote any number of aircraft from one upwards; but in most cases radar stations could give an early estimate of size, which frequently had to be amended later. In the present case only a single aircraft was believed to be involved. The six Hurricane pilots were therefore surprised to meet, not a single bomber or reconnaissance aircraft, but some fifteen dive-bombers escorted by thirty or forty twin-engined fighters.

As soon as the true position became known at Uxbridge and Rudloe both groups sent up more fighters, but none arrived in time to do anything useful before the dive-bombers reached their target. Credit for a bold move which did much to retrieve the error of the radar chain goes, therefore, to the original six pilots of No. 601 (County of London) Squadron. Being up-sun from the enemy and at a greater height, they exploited these advantages by diving on the Junkers 87's and shooting down two before the German fighters could intervene. Their prompt action may well have averted serious damage to Portland and its shipping; as it was, the harbour escaped unharmed and only one merchant ship was hit. The bombing was followed by a stiff action between our own single-engined and the enemy's twin-engined fighters.

The last important engagement on the 11th followed in the late afternoon. A little before six o'clock the radar chain again gave warning of a formation flying north from Cherbourg. Once more No. 601 Squadron were in the forefront. Sent forward by No. 11 Group to meet the enemy over the Channel, they came upon a dozen Heinkel 111 bombers and the same number of twin-engined fighters approaching the South Coast. The squadron split into two flights, one of which engaged the bombers while the other climbed to attack the fighter escort; but the bombers succeeded in reaching Portsmouth and dropping about twenty bombs there. Afterwards No. 601 were joined by another squadron from the Tangmere sector, and both squadrons took part in a running fight across the Channel. Several pilots claimed successes, but on the whole the verdict on this action must be that our fighters were too few and too late.

(iii)

The fighting on 10th and 11th July was the stiffest yet experienced by Fighter Command on its own side of the Channel, but still only a foretaste of what must be expected. Even so the fighter force had flown more than six hundred daylight sorties on the 10th and roughly two-thirds of that number on the 11th. Its experiences went far to confirm the Commander-in-Chief's view that Nos. 10 and 11 Groups

would need most of their resources for interception and so have few aircraft left for guarding convoys.

There remained the question whether timely interception could be expected. On the assumption that the function of the defences was not merely to inflict losses but also to hamper bombing, approaching forces clearly ought to be met, if possible, before they reached their targets. So far that had not been always done. In Kent the radar stations had proved capable of giving some twenty minutes' warning that attack was likely; further west they had been less successful and at least one fairly large raid had come as a surprise. And even when good warning was received the response of the fighter groups had not always been impeccable. Group commanders and their deputies had done their best, but as yet they had little experience of such attacks, and their difficulties were great. In the most favourable conditions the warning was shorter than it seemed, for about four minutes intervened between any observations made by a radar operator and the appearance of the corresponding plot on the operations table. In those four minutes an approaching raid might cover three-quarters of the distance from Cap Gris Nez to Dover. In addition, a Spitfire squadron ordered up in response to the warning must be allowed some thirteen minutes to climb to 20,000 feet, a Hurricane squadron about three minutes longer; and heights of that order were not at all uncommon. Thus the time left for the group commander, or his deputy the group controller, to weigh up the situation and frame his orders was very short indeed. Yet in that brief space he had to make a decision which might be crucial; for to despatch too many aircraft in response to a vague threat was quite as dangerous as to send too few in answer to a real need. If he guessed wrong, a big raid following a small one after a well-judged interval might find him with most of his aircraft running short of fuel. Not surprisingly, therefore, while they were feeling their way commanders and controllers mostly erred on the side of caution. Reluctance to put many squadrons into the air because a big formation seemed to be assembling over France was natural enough, since no one could be certain when it would cross the Channel, or that the manœuvre was not expressly designed to draw up our forces and exhaust them in preparation for an attack by another formation not yet visible.

The remedy lay partly in technical improvements to the radar stations, but mainly in growing skill on the part of radar operators, group commanders and controllers. Reliable estimation of the size of approaching or assembling raids depended almost wholly on the ability of radar operators to match their observations against previous experience. Accurate assessment of height, although governed to some extent by the extent to which radar stations could be spared from active use while their equipment was being calibrated, was also



Plate 11. Spitfires of a Fighter Command Squadron.

Plate 12. Air attack on a British Convoy in the English Channel, 14th July, 1940.

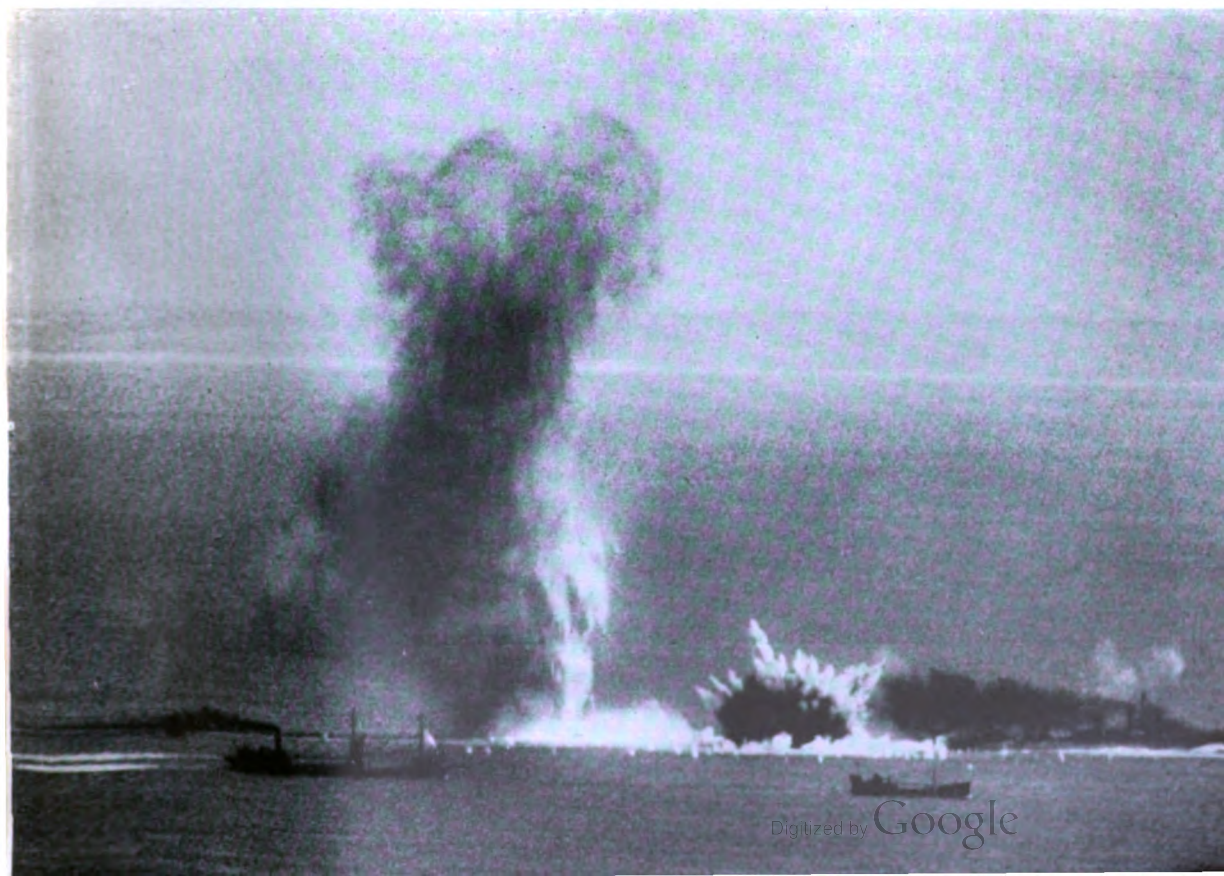




Plate 14. Air Vice-Marshal K. R. Park, Air Officer Commanding, No. 11 Group, Fighter Command, April-December, 1940.



Plate 13. Air Chief Marshal Sir Hugh Dowding, Air Officer Commanding-in-Chief, Fighter Command, 1936-1940.

determined partly by the personal element. Consequently performance improved markedly in both respects as the newer operators recruited during the recent expansion of the system grew in knowledge. And group commanders and controllers, however learned in peacetime theory, were still more dependent on the daily lessons of the battle for a working knowledge of their job.

Otherwise no very striking lessons emerged at such an early stage. As compared with ten of our own aircraft lost, the enemy's combat losses were correctly estimated at twenty-eight, a too-liberal reckoning of his casualties in the bigger engagements being offset by a too-conservative one where minor combats were concerned.¹ The twin-engined Messerschmitt 110 was clearly seen to be no match for our Hurricanes and Spitfires. On the other hand, the single-engined Messerschmitt 109 was, equally clearly, a tough opponent; but that was known already from experience at Dunkirk and elsewhere. Since May, Dowding had felt that the two-seater Defiant was of doubtful value against single-seater fighters; but he was not yet ready to exclude it from the most active sectors, although he did so later.

In the technical field the chief needs of the fighter force were constant-speed airscrews, which in fact were being gradually fitted to all its aircraft, and well-protected fuel tanks to give its pilots a better chance of survival under fire. In the second respect the Germans, although at first slow to provide armour for their bombers, had taken the lead by fitting both bombers and fighters with excellent self-sealing tanks. Our own designers, seeking a tank which was required to be substantially crash-proof, as well as bullet-proof, had been slower to adopt the self-sealing principle. The best having proved the enemy of the good, the wrapping of wing-tanks in a layer of self-sealing fabric had now begun. The reserve tank carried in the fuselage of the Hurricane was more difficult to deal with. As it was believed to be well protected by the armour already fitted it was left untreated. Subsequent events were to show that this belief was not well founded. Later in the battle, after a number of pilots had been badly burned by sheets of flame which filled the cockpit before they could escape by parachute, the reserve tank was covered and the cockpit shielded from it by a metal bulkhead.

In other respects, too, the importance of safeguarding pilots whose machines were hit was keenly felt. Apart from the more obvious aspects of the question, a pilot who baled out was not lost to the battle if he could be quickly brought back to his unit: hence one result of early combats over the Channel was to draw attention to the need for a means of rescuing those who came down in the sea. The German air force already possessed an organisation for the purpose and had

¹ In addition, the Luftwaffe lost five aircraft from other causes.

equipped it with both marine craft and aircraft. Although the British Government did not agree with the German claim that aircraft so used should be treated as flying ambulances and allowed free access to territorial waters, the Air Ministry were not slow to follow the German lead. Within a few days of the opening of the battle they arranged with the Admiralty that small craft should patrol inshore when heavy air fighting was in progress. Soon a number of high-speed launches under Coastal Command were working regularly from bases between the Solent and the Nore. Later some Lysander aircraft were given the task of 'spotting' for the launches, and ultimately a full-blown 'air-sea rescue service', with a variegated establishment of amphibian and other aircraft, was brought into being.

The preliminary phase of the Battle of Britain lasted from 10th July until 12th August. Throughout the greater part of that time events conformed closely to the pattern set on the first two days. Ports and shipping were the targets for nearly all daylight attacks of any size; yet, notwithstanding what has been said about the strategic objects of the German High Command, the purpose of the attackers was probably not so much to damage ports or sink ships as to wear down the defences in preparation for the main assault. They failed to achieve that purpose largely because their operations were neither planned nor carried out in such a way as to make the most of Fighter Command's weak spots. Knowing that British fighter pilots got their orders from the ground, German staff officers believed them to be rigidly tied to the immediate vicinity of their bases, and those who gave the orders to be debarred by their position from distinguishing between large raids and small. In fact, the fighter system was not wholly free from such defects, but they were neither so widespread nor so fundamental as was believed by the German Air Staff. The Germans overlooked recent improvements in radio equipment and the ability of radar operators and others to profit from experience. Hence the attackers were ill served by a policy which gave the defenders every chance of learning from their mistakes, instead of overwhelming them by a series of well-concerted blows delivered without prolonged rehearsal.

To a limited extent the failure of the preliminary offensive to achieve anything of value to the Germans can be measured by the crude yardstick of statistics. Between dawn on 10th July and nightfall on 12th August German aircraft attacked merchant shipping in the Channel almost daily. Yet in those five weeks only some 30,000 tons of shipping were sunk by aircraft between Land's End and the Nore, out of a volume of coastwise traffic amounting to nearly a million tons a week. On the thirty-four days Fighter Command flew more than 18,000 daylight sorties, or a daily average of about 530. The

number of sorties flown by the Luftwaffe is not known and cannot be estimated with even approximate accuracy; but the German effort is likely to have been smaller than our own, which included a large number of routine and precautionary patrols. Even so our squadrons were often locally outnumbered. Yet in all their daylight combats Fighter Command lost only 148 aircraft, nearly half of them on three days during the second week in August. Another two were lost at night. The Luftwaffe lost 286 aircraft in operations against the United Kingdom, of which all but a very few succumbed in daylight battles. Of that number 105 were single-engined or twin-engined fighters. On the three days in August which cost us 73 aircraft the Luftwaffe lost a hundred. Thus over the whole period the Luftwaffe lost nearly twice as many aircraft of all classes as Fighter Command lost fighters, for a very small return in merchant shipping sunk. In terms which cannot be measured by statistics the preliminary phase was still less profitable to the attackers, for, as we have seen, it taught Fighter Command some useful lessons without advancing the German strategy in any discoverable way.

What those lessons were has been suggested in earlier paragraphs, where the conclusions drawn from two days' fighting were discussed. On the whole the events of the next few weeks confirmed them without adding a great deal that was novel. Apart from certain technical shortcomings, the main weaknesses of the defensive system continued to be the partial inability of radar operators to give reliable estimates of height and strength and the occasional failure of groups to oppose raids early enough or with large enough formations, in most cases because the radar picture was confused or incomplete. Despite the improvements already sketched, attempts to gauge height were always likely to be defeated by the time-lag between an observation and the appearance of the corresponding plot in the operations room. Moreover, approaching aircraft could climb so quickly as they crossed the Channel that a group commander or controller could never be sure that a formation was where it appeared to be, even if the latest radar estimate was well founded. On the whole, his safest course was to order his fighters to fly substantially higher than the enemy's estimated height, thus lessening the risk of their being pounced upon; but in cloudy weather there was always the fear that they might miss the enemy altogether, especially if—as sometimes happened—the fighter leader exercised a similar discretion by flying higher still. The remedy lay in a careful study of the enemy's habits as revealed by reports from squadrons; in intelligent anticipation; and in the growth of mutual confidence between pilots and those from whom they received their orders which usually followed a few successful interceptions.

Even so the frequency with which our squadrons were outnumbered was disturbing, especially as the improvement to be

expected from added experience was limited. The Germans could assemble large formations beyond or below the limit of radar cover and were in fact accustomed to use the *Gruppe* of thirty aircraft as a tactical unit. Fighter Command's normal tactical unit was the squadron of twelve aircraft. Over Dunkirk our fighters had often flown in wings of two, three, or four squadrons; but in present conditions little time could be spared to assemble wings if German formations were to be met before they reached their targets. Hence our squadrons often went into combat singly, and in consequence sometimes found themselves outmatched. That a good toll was nevertheless taken of both bombers and escorting fighters shows how well our pilots faced their task.

The situation confronting Dowding towards the end of the preliminary phase was, then, that so far the burden had fallen chiefly on No. 11 Group and especially on the coastal sectors from Middle Wallop to North Weald. In terms of casualties inflicted and suffered the battle had gone well, but some formations had been intercepted only by small forces and after they had bombed their targets. Characteristically, he nevertheless resisted the temptation to strengthen the south-eastern sectors at the expense of others, foreseeing that to do so would invite a flank attack which he would be ill prepared to meet. Throughout the anxious opening phase of a contest whose issues were clarified by no rules derived from well-thumbed textbooks he maintained his opening dispositions almost unchanged; and such small changes as he did make were chiefly designed to strengthen the West Country and No. 11 Group's right flank rather than its more obviously threatened centre. Thus on 12th July he moved the Spitfires of No. 152 Squadron from Acklington in No. 13 Group to the Middle Wallop sector. Six days later he moved the single flight of No. 247 Squadron, equipped with the only Gladiators still in the Command, from Sumburgh in the Shetlands to a small aerodrome at Roborough, in No. 10 Group. Roborough was unsuitable for Hurricanes or Spitfires, but could accommodate the Gladiators, whose new task was the local defence of Plymouth. To replace them at Sumburgh a flight of Hurricanes moved there from Wick. On 20th July the Hurricanes of No. 245 Squadron went from Turnhouse to Aldergrove, in Northern Ireland; and next day the Defiants of No. 141 Squadron, which had been outfought over Dover on the 19th after moving south from Turnhouse, were withdrawn from the busy Biggin Hill sector to Prestwick, in Ayrshire, where they might still do good service against unescorted bombers. The other Defiant squadron, No. 264, moved temporarily to Kirton-in-Lindsey, whence a flight was detached to Ringway for the defence of Manchester, but later went south again to the Hornchurch sector and for some days were in the thick of the day fighting. Other changes in July

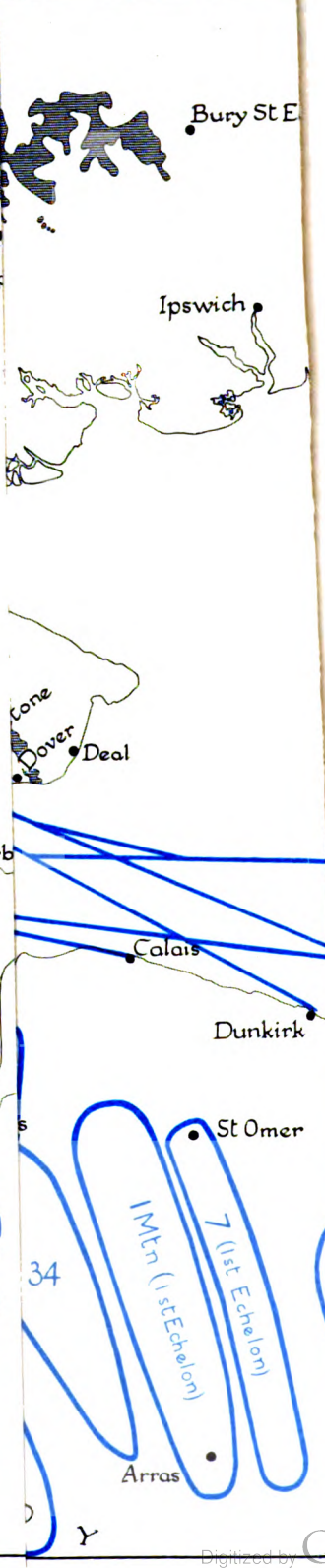
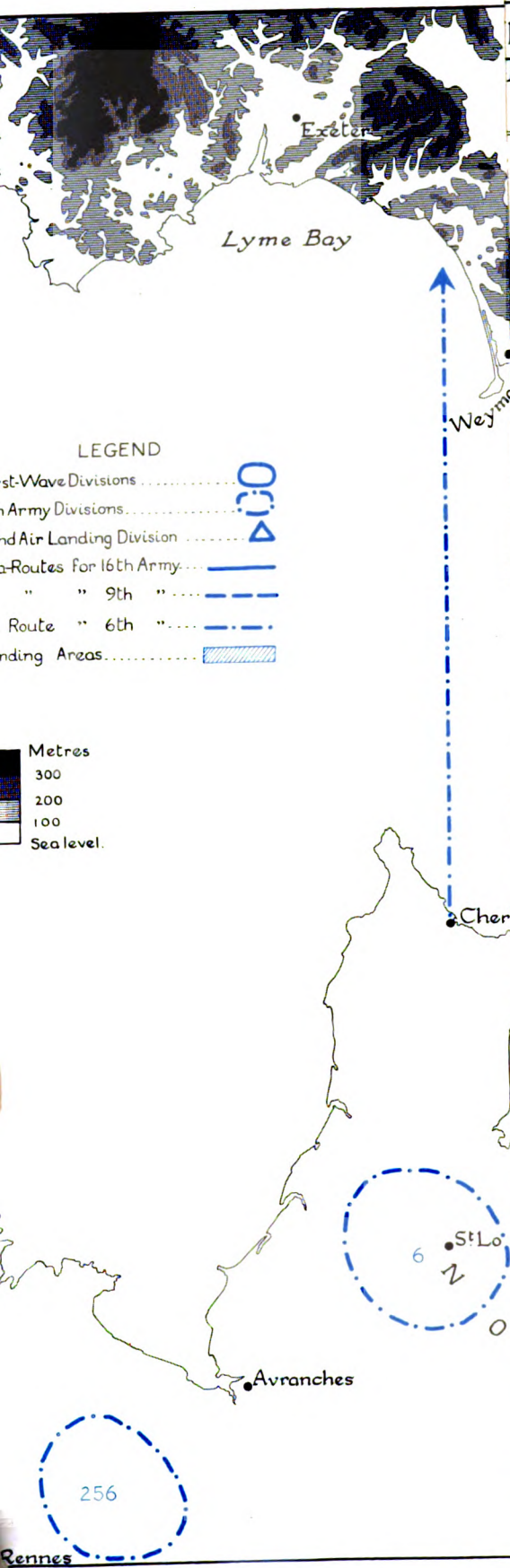
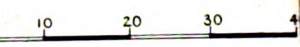
include a strengthening of the anti-aircraft defences of some western ports.

From this account may perhaps emerge the picture of a rigid system of sector-stations, each with its fixed quota of fighter squadrons. The reality was otherwise, for in each sector there were a number of other aerodromes serving a variety of purposes. Some, like Croydon and Martlesham, were quasi-permanent bases for squadrons detached, on tactical or administrative grounds, from the headquarters of the sector. Others, like Hawkinge and West Malling, were more often used as temporary bases or forward landing-grounds, although they too might serve as more permanent bases if the need arose. Administratively these bases fell into a number of fixed categories; tactically the use that could best be made of them depended on a variety of factors, some of them not easily assessed except by those with local knowledge. While, therefore, the disposition of squadrons within a given sector was a matter on which much discretion ought clearly to be allowed to local commanders, it was also one which gave much room for differences of opinion. This became quite clear on 29th July when, after ships off Dover and in harbour there had been repeatedly attacked by German aircraft, the Air Staff urged the Commander-in-Chief to make more use of stations near the coast for the purpose of meeting the enemy with 'superior forces and large formations'. Their diagnosis was sound, but their remedy was open to question, first because a more generous use of forward bases would not necessarily enable No. 11 Group to do what the Air Staff wanted, secondly because the stations in question were already getting more use than they seem to have supposed. In the two sectors fronting the Straits there were six forward aerodromes besides the sector-stations at Biggin Hill and Hornchurch.¹ Of these six, three at Gravesend, Rochford and West Malling were some way from the coast. A fourth, Lympne, was useful only in emergencies. The remaining two, at Manston and Hawkinge, were so exposed that, although in fact one squadron was based at Manston, the practice followed by No. 11 Group and endorsed by Dowding was to use them mainly as daytime points of departure and return for squadrons whose ground organisation and reserves remained as far as possible in safer quarters. On these terms both were in constant use as forward landing-grounds. Had excessive deference to the Air Staff's wishes led the Commander-in-Chief to reverse his policy by ordering the Group Commander to move several squadrons permanently forward he might have had cause to regret it, for the stations were soon to be viciously attacked. As it was, no material change in the disposition of the squadrons in the south-east followed the Air Ministry's *démarche*,

¹ A seventh at Redhill was used by the Kenley sector though administered from Biggin Hill.

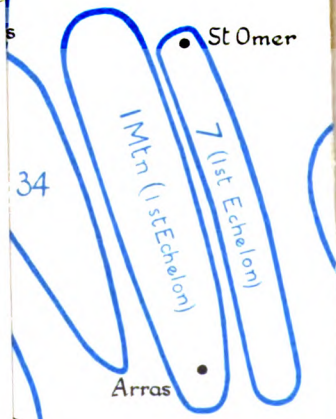
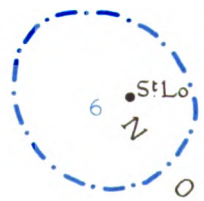
although the point at issue was not overlooked. Ultimately the difficulty of meeting the enemy forward of his targets in sufficient strength compelled No. 11 Group to resort to different measures; but by that time the focus of attack had shifted inland.

PLANNED SEA LION PLAN SEPTEMBER, 1940.



LEGEND

- 1st Wave Divisions
- 2nd Army Divisions
- 3rd Air Landing Division
- 4th Routes for 16th Army
- 5th " " 9th "
- 6th Route " 6th "
- 7th Landing Areas



CHAPTER XI

OPERATION 'SEALION'

(July–September, 1940)

(i)

WHEN the German High Command approached the problem of invasion they first pictured the voyage across the English Channel as an 'extended river crossing'. Accordingly the plan drawn up by the German Army in July contemplated a landing on a broad though discontinuous front extending from Ramsgate to Lyme Bay. Troops would be provided by Army Groups A and B, which had taken up positions from the Low Countries to Brest and from south of Brest to the Pyrenees respectively, still under their victorious commanders, Field-Marshal von Rundstedt and von Bock. The whole operation, so far as the army was concerned, was under the personal direction of the Commander-in-Chief of the German Army, Field-Marshal von Brauchitsch, with General Halder as his Chief of Staff.

Ultimately, as a result of naval objections, the army plan was modified to allow of a crossing on a more restricted front. Meanwhile preparations continued on the assumption that the troops would cross on a broad front, if at all. A vast system of special training, not confined to troops as yet assigned to the plan, was in motion by the last week in July. Within the next few days thirteen divisions from various parts of France arrived on the coast to prepare for the first stage of the landing. Each was divided into two echelons, the first comprising about 7,000 men with eight mountain-guns, eight smoke-projectors, forty-nine tanks, a high proportion of the divisional machine-guns, mortars and anti-tank guns, and the essential minimum of wheeled vehicles; the second comprising the remaining 12,000 men of the division, with forty field-howitzers, the rest of the automatic weapons and the bulk of the divisional transport. Even so the transport allotted to the first echelon of each division included upwards of three hundred horses and close on two thousand bicycles. Thus the thirteen first echelons amounted together to about 90,000 men, nearly 650 tanks and close on 4,500 horses, with large numbers of weapons and much other gear; while the second echelons comprised about 160,000 men, nearly 60,000 horses, between thirty and

forty thousand vehicles, some five hundred field-howitzers and much else besides. In addition, the embarkation of fifty-two anti-aircraft batteries with the first echelons was proposed. Together the first and second echelons, with elements of mobile formations and supported by the anti-aircraft batteries, would form the first wave of the assault. Behind them would come another seventeen infantry, six armoured and three motorised divisions in three more waves.

Should operation 'Sealion' be put into effect, the task of conveying these troops and their equipment rapidly to England would rest upon the German navy. It fell to the Naval Staff, therefore, to make plans for the passage and prepare the necessary shipping. They calculated that, even if two-thirds of the anti-aircraft batteries were left behind, conveyance of the first echelons would call for 45 transports, 640 barges, 215 tugs and 550 motor-boats, and would absorb the entire facilities of every suitable harbour from Ostend to Cherbourg. Conveyance of the second echelons in one lift seemed to them quite impracticable, for the two million tons of shipping needed were not available, and in any case could not be accommodated in the area of embarkation. They suggested, therefore, that the movement of the first wave, including a second instalment of anti-aircraft batteries despatched with the second echelons, should be spread over about ten days. In that case conveyance of the two echelons of the first wave would call for 155 transports totalling about 700,000 tons, besides 1,722 barges, 471 tugs and 1,161 motor-boats. The assembly and preparation of such a fleet (which would serve also to carry later waves) could not be completed before the middle of September; thereafter the first suitable period for a landing would fall towards the end of the month, when long spells of fine weather could no longer be expected.¹ At the end of July they therefore recommended that the operation should be postponed until the spring of 1941. Meanwhile preparations should be continued in the hope that they might help to induce the enemy to come to terms.

As the spreading of the first wave over ten days was distasteful to the General Staff, while postponement of the venture until 1941 seemed hard to reconcile with the Führer's order that all preparations should be completed by the middle of August, operation 'Sealion' was already in troubled waters. The speed with which the second echelons should follow the first was not, however, the only, or even the main, point at issue between the army and the navy. Both the Naval Staff and Admiral Raeder, the naval Commander-in-Chief, were convinced that the proposed crossing on a broad front would be disastrous. They opposed it with a wealth of technical and professional argument, but the main basis of their opposition can

¹ Moon and tide would be favourable from the 19th to the 27th, and most favourable on the 24th.

be briefly stated. Lacking surface power, they felt sure that their only hope of a safe passage for the armada lay in a narrow passage hedged by minefields, submarines and aircraft. Raeder admitted that if the crossing were confined to a narrow front in the narrowest part of the Channel some of the navy's other difficulties would not loom so large, and that the operation might then be possible in 1940, after all. He was convinced, however, that air superiority over the area chosen for the crossing was essential.

On 31st July the Admiral had a conversation with the Führer, who accepted the view that 'Sealion' could not be launched before the middle of September. Whether it should be undertaken at all in 1940 would depend, he said, on the results of the forthcoming air attack. If the air force failed to do substantial damage in the first week or fortnight of the main assault, then the invasion would be postponed until the spring. Next day the Führer ordered the Luftwaffe to 'destroy the English air force as soon as possible', adding that the intensified air attack might begin about 5th August, but leaving the air force free to choose its own date in the light of the weather and other factors. On the same day the army was ordered to continue its preparations on existing lines and complete them by the middle of September.

By early August the army's preparations were well advanced. Of the eleven infantry and two mountain divisions which made up the first wave, six were grouped in three corps between Ostend and Abbeville under the 16th Army (General Busch); four in two corps about Rouen, Le Havre and Caen, under the 9th Army (General Strauss); and three, comprising the single corps which was Army Group B's contribution to the first wave, between Avranches and Cherbourg under the 6th Army (Field-Marshal von Reichenau). Of the six armoured and three motorised divisions which made up the second wave, the majority were south of Paris, and all nine, organised in three corps, were due to assemble within a day's march of the coast by 16th September. By that day the nine infantry divisions comprising the third wave would also be assembled near the coast, while the eight comprising the fourth wave would be ready for embarkation two days later.

Meanwhile the navy were collecting shipping. Transports amounting to roughly a third of the required tonnage, besides large numbers of barges, tugs and motor-boats, could be got by requisitioning in France, Belgium and Holland—a task in which the navy were assisted by the army. Even so the Naval Staff discovered that the total could not be made up without withdrawing from German industry about a third of the merchant fleet, all trawlers still employed in deep sea and coastal fishing and nearly all large tugs. Consequent reductions in supplies of food, coal and iron-ore had to be, and were,

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accepted. But the navy's difficulties did not end there. Abnormally bad weather held up the arrival of vessels at the ports of embarkation, and further delays were caused by British bombing. On 30th August the Naval Staff announced that their preparations could not be completed before 21st September. A few days later their shipping section reported that the whole transport fleet would probably be ready by the 19th; but much minesweeping remained to be done before the fleet could have sailed, even if other conditions had been favourable.

(ii)

Towards the end of August the fundamental disagreement between the German General and Naval Staffs was outwardly resolved. The staffs agreed that in the first place landings should be restricted to two short strips of coast in Kent and Sussex. Forces under the 16th Army, starting from ports between Rotterdam and Calais, would land on a front from Folkestone to New Romney and in the neighbourhood of Camber, Rye and Hastings; on their left flank landings by the 9th Army from Picardy and Normandy would prolong the front to Worthing (later amended to Brighton), with a gap round Beachy Head. (See Map 13.) Simultaneously, parachutists would capture Brighton itself and the high ground north of Dover, though later the proposal to use parachutists at Brighton was abandoned and a single 'dropping area' north-west of Folkestone was adopted. Army Group B's forces would take no part in the early stages. If things went well they might start later from Cherbourg to land in Lyme Bay and capture Weymouth as the preliminary to an advance on Bristol.

The initial task assigned to General Busch was to take Dover and advance at least as far as a line extending from the heights between Canterbury and Folkestone through Ashford to the neighbourhood of Hawkhurst. Meanwhile General Strauss was to advance towards a line from Hadlow Down to the high ground west of Lewes. Between them the two armies would thus occupy a bridgehead about fifteen miles deep from the middle of East Kent to the northern escarpment of the South Downs north of Brighton. 'After the arrival of sufficient forces on British soil,' ran the instruction signed by Field-Marshal von Brauchitsch, 'the Army Group will attack and secure possession of the line Thames Estuary-heights south of London-Portsmouth. As soon as the situation permits, mobile formations will be pushed forward to the area west of London in order to cut off London from the south and west and to capture crossings over the Thames for an advance in the direction of Watford-Swindon.'

The new plan called for a redistribution of the first-wave divisions and a substantial reduction in their number. By the middle of September one mountain and three infantry divisions under the 16th Army, with two infantry divisions and elements of a second mountain division under the 9th Army, were grouped between Rotterdam and Abbeville; the rest of the dispersed mountain division and two infantry divisions, also under the 9th Army, remained near Rouen. Thus the total strength of the first wave was reduced from thirteen divisions to nine, in each case supplemented by mobile elements. In addition, two infantry divisions under the 6th Army were quartered near Rennes and Saint-Lô respectively, ready to sail from Cherbourg to Lyme Bay if the opportunity arose. Special weapons allotted to the invasion force included some 250 amphibian tanks, 38 anti-aircraft ferries equipped for a dual role against aircraft and surface targets, and 72 rocket-projectors capable of firing a grand total of 432 rounds up to a range of 6,000 metres within five seconds. The second wave under the 16th and 9th Armies now comprised four armoured, two motorised and two infantry divisions, with two additional motorised regiments; the third wave, six infantry divisions. In addition, a parachute division was earmarked for use near Folkestone, and an airborne division would be employed in the 16th Army sector or elsewhere as circumstances might dictate. Fourth-wave divisions were to be designated ten days before the landing. Meanwhile (on 6th September), Army Group C (General Ritter von Leeb) had succeeded to the functions hitherto exercised by Army Group B, including control of the 6th Army and its 'Sea-lion' divisions.

The new plan was not altogether acceptable to the General Staff, who would still have preferred a landing on a broader front. In any case, by the time the plan was ready the poor progress of the Luftwaffe had made a landing in 1940 most unlikely. Nevertheless, the army continued its preparations with great thoroughness. Besides the troops assembled for the invasion proper, substantial forces in Norway, Holland and western France were busily preparing to land between Edinburgh and Newcastle, from the Wash to Harwich, and from Wexford to Dungarvan in Southern Ireland. Only a few senior officers at the headquarters concerned were aware that these preparations formed part of a vast deception plan and were not intended to culminate in real landings. A naval feint towards the East Coast was designed to add verisimilitude to the threat from Norway. Plans were made for the spreading of false reports and distracting rumours through secret service channels, calculated indiscretions gave inhabitants of the occupied countries glimpses of the more misleading preparations, and care was taken to issue no orders to the deception forces which were obviously impracticable. Dotting the i's

and crossing the t's of the main plan, the German General Staff and, in particular, the Quartermaster-General's staff drew up a series of instructions for the organisation and working of a system of military government in occupied England. A directive signed in draft by Field-Marshal von Brauchitsch decreed, in terms which brooked no interference from mischance, the establishment of law and order as 'an essential condition for securing the labour of the country', and the rapid internment and despatch to the Continent of the able-bodied male population between the ages of seventeen and forty-five. Other measures which seem to have been contemplated in-

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des Befehlshabers der Sicherheitspolizei
für Grossbritannien betreten werden.**

**No entrance without permission of the
Chief-in Command of the German Se-
cret Police for Great Britain.**

Reproduction of bilingual notice prepared by the Germans for use after invasion of this country.

cluded the seizure by Army Commanders (in circumstances not specified) of 'agricultural products, food and fodder of all kinds, ores, crude metals, semi-finished metal products of all kinds including precious metals; asbestos and mica; cut or uncut precious or semi-precious stones; mineral oils and fuels of all kinds; industrial oils and fats, waxes, resins, glues; rubber in any form; all raw materials for textiles; leather, furs and hides; round timber, sawn timber, timber sleepers and timber masts'. The only goods exempt would be those included in normal household stocks or retained by farmers, tradesmen, artisans and innkeepers to meet the essential needs of retail customers.

(iii)

Among the many hypothetical questions which arise from the subject-matter of this history, few have attracted more attention than those bearing on the feasibility of operation 'Sealion'. In particular, the true opinion of the German High Command as to the likelihood of success has been much canvassed. How highly did they, as men accustomed to weigh such problems, rate their chances of crossing the Channel without disaster, establishing a bridgehead, and defeating Home Forces on British soil?

Even the most tentative answer to this question must depend, of course, on what is meant by the German High Command. The respective heads of the fighting services, the Führer himself and the men about him, each had his own opinion, which was nevertheless not wholly his, since it was subject to influences derived not only from the others but also from professional advisers and staff officers, whose own opinions also counted in the scale and were no less liable to fluctuation.

First, the Führer. He considered that the British Army, in view of its slow rate of expansion, brief experience of modern warfare and heavy losses of equipment in northern France, would be capable of little in 1940, but would be formidable by the spring. In short, he believed that if a landing was to be made at all, it had best be done before the winter. But, apart from the question whether invasion was desirable from the standpoint of grand strategy, he did not underrate the difficulties of the crossing, nor did he contemplate any decisive move before the opposing air force had been disabled. Admiral Raeder, for his part, was no enthusiast for the project, to which the consensus of naval opinion was scarcely favourable; while Reichsmarschall Göring, the head of the Luftwaffe, is said on naval authority to have taken little interest in 'Sealion', but to have believed firmly in the ability of his service to force a decision on its own account. On the other hand, the General Staff showed much enthusiasm for invasion, at least in the early stages; but the news that conveyance of the first wave across the Channel would take ten days came as a shock to General Halder, who thereupon declared that if that were the case 'all previous statements of the navy were so much rubbish and we can throw away the whole plan of an invasion'. Although later he condemned the Führer's apparent reluctance to complete the project even in the teeth of such discouragement, both he and Runstedt seem thereafter to have doubted the wisdom of attempting a landing on the relatively narrow front proposed by the Naval Staff. To sum up, insofar as a common doctrine is discoverable, it seems to have been that, while invasion of the United King-

dom before the year was out might or might not be desirable in theory, in practice the chances of success were slender unless the defenders showed unmistakable signs of collapse before the crucial moment of landing was at hand. All agreed that in any case local air superiority was needed to make the project feasible.

On the other hand the leaders of the German Army would seem to have had little doubt that, if indeed they could establish a strong bridgehead on British soil, their prospects would be good. In their estimation, certain manifest weaknesses of British generalship were only partly offset by the good qualities which they conceded to the British fighting man. German troops who had met British regiments in Belgium acknowledged that their handling of tanks and use of camouflage and cover were exemplary, that the British soldier was 'tough and dogged', and that 'his conviction that England would conquer in the end was unshakeable'. Moreover, the British Army was expected to fight particularly well on the defensive. But on balance the Germans thought that inexperience of modern fast-moving warfare would tell so heavily against the British High Command that stern resistance in the early stages would not endure if local successes were quickly followed up. The news that Home Forces were inclining towards a more offensive strategy than that contemplated earlier—which reached them by the middle of the second week in August—seemed to them rather encouraging than otherwise. They believed that the British Commander-in-Chief and his subordinate commanders were ill-placed to make a success of mobile operations, and that the mobile reserves, especially if impeded by air attacks and the movement of refugees, would arrive too late to be effective. 'Once we can gain a foothold on the enemy coast with strong forces and are advancing inland,' wrote Runstedt on 23rd August, 'our superiority in this form of operation will show itself clearly.' And if later he and other army officers seemed less confident, it was not because they saw reason to depart from that opinion—which indeed, the inadequate mobility of Home Forces went some way to justify—but because they feared that German naval weakness might prevent them from getting such a foothold.

CHAPTER XII

THE BATTLE OF BRITAIN: THE FIRST PHASE¹

(13th–23rd August, 1940)

(i)

WHEN the Führer ordered the Luftwaffe to 'destroy the enemy air force as soon as possible' he suggested that the process might begin on 5th August, but left Göring and his generals free to choose the date that seemed to them most suitable. In due course they chose one five days later than that first mooted. Meanwhile, on 2nd August, the Operations Staff of the German Air Ministry issued instructions for the conduct of the battle. They were discussed at Göring's personal headquarters on the 6th. But as the appointed day drew near, unfavourable weather forecasts led the Reichsmarschall to postpone the start of the offensive, first until the 11th, then until the morning of the 13th.

The intervening day was fine and sunny, apart from early-morning haze, but the 13th began inauspiciously with dull, cloudy weather over southern England and poor visibility in northern France. Last-minute orders were given for a further postponement until the afternoon, but reached some units too late to be obeyed.

If conditions at the beginning of the second week in August were too unpromising for the long-awaited 'Eagle Day', they did not prevent a marked stiffening of the preliminary offensive. At nine o'clock on the morning of 8th August, in cloudy weather which probably did hamper bombing, Hurricanes from Westhampnett repelled an attack on a convoy near the Isle of Wight by strongly-escorted bombers or dive-bombers. Later in the day rather similar conditions, more skilfully exploited, helped another German formation to sink four ships in a convoy of thirty-one, and to damage another six. The 11th, another cloudy day, was also marked by heavy fighting, some of our squadrons faring badly; Portland was severely bombed and two ships were seriously damaged near the Norfolk coast. And on the 12th, in

¹ German air strength and serviceability on the eve of the first phase are shown in Appendix XI; the equipment and location of the British fighter force in Appendix XII. A summary of operations is given in Appendix XIII.

better weather, the Luftwaffe struck its first real blow at Fighter Command's ground organisation by attacking aerodromes at Manston, Lympne and Hawkinge and radar stations in Kent, Sussex and the Isle of Wight. Portsmouth and shipping in the Thames Estuary were also attacked, the latter without much effect.

As we have seen in Chapter X, these closing operations of the preliminary phase were expensive for both sides, the Germans losing a hundred aircraft and Fighter Command seventy-three. The damage done to shipping, too, was heavier than usual. More significant was that done on the 12th to Royal Air Force stations. At Lympne, an emergency landing-ground of small importance, and also at the more valuable Hawkinge and Manston, buildings were destroyed or damaged, some casualties were suffered, and landing-surfaces were cratered. All three aerodromes were serviceable again by the next day, but their usefulness was impaired for at least some hours. Of six radar stations attacked, five suffered no damage of lasting consequence, but the sixth at Ventnor was put out of commission. The gap in the chain was not filled until the 23rd, when a station opened on another site at Bembridge.

Fortunately for Fighter Command, the Germans seem not to have grasped the significance of these events. Heavy and repeated attacks on radar stations and fighter aerodromes during the next week or ten days might have brought them close to the attainment of their object. As it was, they failed to follow up their limited success of the 12th, wasting much of their bomb-load for the next few days on irrelevant or unimportant targets. The opening of the main offensive on the 13th was not only marred by errors which caused the order for postponement until the afternoon to go unheeded by some units; it also failed to produce a single successful attack on a Fighter Command station. Seeking the destruction of coastal, bomber and other air force units before the fighter force had been disposed of, the German planners dispersed their effort far too widely. In some cases they seem, too, to have exaggerated the effect of attacks already made, and so to have missed the opportunity of striking cumulative blows.

(ii)

On the morning of the 13th the defences had their first warning of impending attack at half-past five, when two forces apparently totalling about sixty aircraft were detected over Amiens. As they did not begin to move north until half an hour later, No. 11 Group had time to put up an appropriate defence. By a quarter past six two squadrons from Croydon and Hornchurch were patrolling near the

damaged aerodromes at Hawkinge and Manston, another from North Weald was protecting a convoy in the mouth of the Thames, and sections drawn from two more squadrons were over the flanking sectors centred on Debden and Tangmere. (See Map 14.) No. 10 Group, newly responsible for the Middle Wallop sector, had a section patrolling near the coast at Warmwell.

As the two forces already spotted began to move north a third, apparently about a hundred aircraft strong, was picked up near Dieppe. A fourth, believed to be at least forty strong, appeared just north of Cherbourg. Shortly afterwards a fifth and smaller formation was detected near the Channel Islands. In response, No. 11 Group ordered a section from Northolt to take up a position over Canterbury and three more sections from Tangmere to patrol a line from Arundel to Petworth. In No. 10 Group the section over Warmwell was joined by the remainder of the squadron. As the last of these aircraft took off at half-past six, No. 11 Group further reinforced their right flank by sending another whole squadron up from Tangmere, and shortly afterwards strengthened the force over the Thames Estuary by adding three sections from Kenley. A little later, when action had begun, No. 10 Group guarded against a westward extension of the threat by putting up a squadron and an additional flight from Exeter.

In the light of subsequent knowledge these dispositions may appear inadequate. It may seem that, ideally at least, the sections ought to have been squadrons and the squadrons wings. As things were, the position at half-past six was that altogether about seventy British fighters were ready to oppose approaching forces estimated at three times their own number. About three-quarters were over Kent and the Thames Estuary; about a quarter between Weymouth Bay and Petworth. Within the next few minutes they were joined by the equivalent of another four squadrons. But the total of roughly a hundred and twenty fighters was still well below the presumed strength of the enemy.

Action was first joined over the Thames Estuary, where from eighty to ninety bombers of *Luftflotte 2* approached in two distinct formations on their way to attack the Coastal Command aerodrome at Eastchurch, in Sheppey, and the neighbouring harbour at Sheerness. Both forces came in unescorted. Flying up the estuary above a thick bank of cloud, the larger emerged near Whitstable to find the squadron from Hornchurch ready. The Spitfires engaged the rear-most bombers with good effect, but were not numerous enough to head off the leaders, who went on to drop their bombs at Eastchurch, where two fighter squadrons temporarily attached to Coastal Command were caught on the ground but escaped unharmed. A satellite aerodrome close by was also hit. The smaller formation was less

fortunate. Engaged near the North Foreland by the squadron from North Weald, and between Herne Bay and Whitstable by Hurricanes from Croydon, the bombers failed to reach Sheerness and dropped their load to little purpose further east.

Meanwhile, on No. 11 Group's right flank two formations of *Luftflotte 3* were meeting stiff opposition over Sussex. About half the bombers, with escorting fighters, were bound for the Royal Aircraft Establishment at Farnborough; a similar force was bound for Odiham, not far away. Both forces were intercepted almost as they crossed the coast. The squadron originally ordered from Northolt to Canterbury, but later sent south-west to reinforce the Tangmere sector, engaged one near Bognor almost at the same moment as one of the Tangmere squadrons (No. 43) met the other slightly further east. Two more squadrons (Nos. 601 and 64) went into action shortly afterwards. The second German formation was not well served by its escort, which was too far to the rear. Hampered by our fighters and also by bad visibility, both forces missed their targets. Eighty-eight dive-bombers which followed with a strong fighter escort retired without accomplishing their mission.

So far no attacks on fighter aerodromes had been attempted, for neither Farnborough nor Odiham was in that category. Only the force bound for Eastchurch, opposed by insufficient fighters, had reached its target, and Eastchurch was not a Fighter Command station. The aerodrome was badly damaged, but even so was fit for use within ten hours.

The next alarm of consequence came a little before midday. At twenty minutes to noon a force estimated at twenty or more aircraft was picked up near Cherbourg at the gratifying range of nearly eighty miles. In fact, it comprised a slightly larger number of twin-engined fighters which took off prematurely and flew without the bombers they were intended to escort. Despite the gap at Ventnor the force was continuously tracked to Portland, where it arrived about noon. Meanwhile No. 10 Group ordered two squadrons from Warmwell and Exeter to patrol Portland while No. 11 Group sent a squadron from Tangmere over the group boundary to Swanage. Probably because visibility was far from perfect, action was not joined until about ten minutes after the arrival of the German fighters on their pointless errand. A squadron from each of the two fighter groups then came upon the Messerschmitt 110's some distance below them and in no position to put up a good defence. Within the next few minutes the Germans lost five aircraft. With their rear assailed by a third British squadron which had just arrived from Exeter, the survivors then withdrew to brave the wrath of their superiors at home.

In the afternoon the German offensive began its legitimate career

with a repetition of the morning's two-pronged thrust. The plan was for about fifty escorted bombers of *Luftflotte 2* to attack the Coastal Command aerodrome at Detling, the fighter aerodrome at Rochford and another aerodrome on the north bank of the river, while some forty of *Luftflotte 3* attacked Middle Wallop, a less important aerodrome at Andover and targets at Southampton and elsewhere.

This time the force from Normandy was noticed first. About half-past three, three formations, each apparently of about thirty aircraft, were detected approaching Southampton and St. Alban's Head. Later two more of the same size were spotted flying north above the Goodwins.

In the morning the first shock of the attack from Normandy had fallen on No. 11 Group's right flank, strengthened in the nick of time by the diversion of a squadron from Canterbury. This time No. 10 Group made strong dispositions to meet a threat which came a little further west. A squadron from Warmwell (No. 152) was already patrolling near the group boundary, but clearly needed reinforcement. (See Map 15.) Accordingly the group sent two squadrons from Exeter and Middle Wallop (Nos. 213 and 238) to patrol Portland above and below cloud and another from Middle Wallop (No. 609) to take up a position over Warmwell. A few minutes later No. 11 Group ordered a squadron from Tangmere (No. 601) to patrol over the Isle of Wight. Sections from Pembrey (No. 10 Group) and Tangmere (No. 11 Group) were also ordered up and afterwards directed to the scene of battle.

On the other flank the first alarm found No. 11 Group with a section from Debden over a convoy off Clacton, two aircraft from North Weald over another convoy off Harwich and one flight from Manston over Dover, where the rest of the squadron (No. 65) were about to join them. Between fifteen and five minutes to four the group put up the equivalent of two more squadrons in an arc from Martlesham to Dungeness. As they left the ground a further hostile formation was reported south of the South Foreland.

The position immediately before action was joined at four o'clock was, therefore, that on the defenders' right flank some sixty to seventy fighters were ready to meet forces estimated at roughly ninety aircraft, while on the left some forty prepared to meet what seemed to be a substantially smaller threat. Over much of Kent and the Thames Estuary thick clouds, mostly between four thousand and six thousand feet up, promised to hinder bombing without offering much cover to the attacker.

Fighting began about the same time on both flanks. On the British right a big formation of German fighters, drawing well ahead of the striking force, was intercepted off Portland by squadrons from Exeter and Warmwell (Nos. 213 and 152). The bombers then

approached in two or more waves, each accompanied by more fighters. A squadron of Hurricanes from Middle Wallop (No. 238) met one wave near the coast, but were vigorously engaged by German fighters and could not prevent the bombers from going on to Southampton. Another, with its escort well behind it, was engaged by No. 609 Squadron from the same base, apparently with good effect. Bombs fell at widely separated places in Wiltshire, Hampshire and Dorset, including several air force stations; but Middle Wallop came to little harm, and only at Andover—a station not in Fighter Command—was any important damage done. On their way out German formations were further engaged by No. 601 Squadron from Tangmere and by elements of four other squadrons.

On the left flank, too, the first squadron to engage (No. 65) saw only fighters. Meanwhile a formation of bombers slipped through the defences and successfully bombed Detling. But clouds prevented the force detailed to bomb Rochford from discovering its target. Turning south over the Thames Estuary, the bombers were engaged by a squadron from that base (No. 56) and afterwards dropped their load blindly near Canterbury. A Spitfire flight armed with Hispano-Suiza cannon, already tried in Hurricanes, were not in action and had no opportunity to see what they could do.

These were the last important actions of the day. Minor attacks on shipping, with a subsequent night-attack aimed chiefly at the Morris works at Castle Bromwich, brought the Luftwaffe's effort for the twenty-four hours to the impressive total of 1,485 sorties, about two-thirds of them by fighters. Fighter Command flew seven hundred sorties in daylight and twenty-seven towards dusk or during the ensuing night. The fruits of this ambitious effort by the Luftwaffe were three moderately successful attacks on aerodromes not in Fighter Command, some damage to Southampton and Castle Bromwich and a number of minor incidents elsewhere. None of these things affected the capacity of Fighter Command to carry on the battle. Furthermore, the balance of losses in air combat was markedly in our favour. In the twenty-four hours the Luftwaffe lost forty-five aircraft, including at least thirty-nine destroyed by the defences. Fighter Command lost thirteen aircraft but only seven pilots. Thus the long-heralded 'Eagle Day' brought the German air force the worst rebuff it had yet received and cost the air defences very little. On the other hand, the day's experiences emphasised once more the difficulty group commanders and controllers had in meeting the enemy with forces large enough to rout him.

(iii)

The German effort on the 14th was much smaller, amounting to fewer than five hundred sorties. The main events were an attack on Manston by twin-engined fighter-bombers, and a prolonged but widely-scattered series of attacks by aircraft of *Luftflotte 3* on aerodromes and other targets in the western half of England.

The attack on Manston was made by about ten bomb-carrying Messerschmitt 110's of the unit responsible for the previous day's abortive raid on Rochford. The fighter-bombers approached with a small escort shortly before noon, while larger forces consisting mainly of fighters with a few dive-bombers threatened Dover. No. 11 Group responded briskly, getting two and a half squadrons into the air before the leading German aircraft reached the coast and ordering up another squadron as they were about to cross it. A few minutes before the attack a squadron from Manston and a flight from Rochford were both near the threatened aerodrome and a squadron from Biggin Hill was bound for the same neighbourhood. Meanwhile a squadron from Kenley was ready to intercept the force off Dover. Fresh orders then took the Spitfires from Manston south to reinforce the Kenley squadron, with the result that they missed the formation bound for their base, while the flight from Rochford, their view impeded by thick clouds, saw only some single-engined fighters flying fairly high, and engaged them in ignorance of what was going on below. Four hangars at Manston were destroyed or damaged. Nevertheless, the fighter-bombers bought their achievement dearly, for light anti-aircraft guns at Manston opened fire on them and brought down two. Meanwhile one flight of the squadron from Biggin Hill saw some single-engined fighters and climbed to engage them off the coast.

Some twenty-five minutes later the bulk of the German aircraft which had been over the Straits for the last forty minutes came inshore near Folkestone, shot down seven barrage-balloons at Dover, swept inland to Ashford and retired after dropping a few bombs near the coast. Elements of the force attacked the neighbouring Varne light-vessel. Coming upon a number of dive-bombers as they released their load, one flight of the Kenley squadron engaged them vigorously, but could not prevent them from finishing off their harmless quarry. Other actions were fought by the squadron up earlier from Biggin Hill and another which joined it from the same base.

The novel plan pursued by *Luftflotte 3* in the afternoon was not very effective and earned the *Luftflotte* a rebuke from Göring. Attacks by a large number of bombers drawn from three *Geschwader*

were spread over about five and a half hours, beginning at half-past three and ending towards nine o'clock. With few exceptions the bombers flew unescorted in formations of two or three aircraft; their targets were mostly aerodromes or rail-centres. Happily the radar stations were capable of estimating strength well enough to avoid gross confusion. In most cases No. 10 Group detailed only single sections to individual raids, and their policy proved sound. In eleven combats Fighter Command's aircraft were outnumbered only once, when a flight from Exeter met a superior formation south of Portland; and when evening came the wreckage of six German bombers had been counted. Of eight air force stations which reported attacks the most important to Fighter Command were the fighter aerodrome and sector station at Middle Wallop; Colerne, a Maintenance Command station and future sector headquarters; and Sealand, near Liverpool, where a valuable maintenance unit was installed. At the first a hangar and some office buildings were destroyed, at the second work was not affected, at the third all damage was repaired by the next morning. Attacks on railways caused serious interruption of traffic only at Southampton, where débris blocked the line.

On this, the second day of the main battle, the Luftwaffe lost nineteen aircraft, including at least seventeen destroyed by the defences. Fighter Command lost eight fighters. Altogether the command had lost ninety-seven aircraft by day and two at night since the first stiffening of the preliminary offensive on 8th August; but many pilots whose machines were destroyed had escaped unhurt, while others were more or less seriously wounded and would ultimately rejoin their squadrons. Even so the drain was serious, for every pilot was needed. Furthermore, in the course of the week gross wastage of Hurricanes and Spitfires from all causes, including accidents, had overtaken output, so that reserves were dwindling. But with a big bag of German bombers and fighters to their credit both pilots and anti-aircraft gunners were in good heart. They had in fact destroyed well over a hundred and fifty aircraft in the last week, and believed they had destroyed about two hundred and forty.

The Luftwaffe miscalculated far more grossly. They claimed that in the seven days they had sunk some forty thousand tons of merchant shipping, made thirty or more successful attacks on aerodromes and aircraft factories and destroyed more than three hundred British fighters in air combat—about three times the true number. Nevertheless, the strength of the opposition, the manifest failure of some raids, and big losses already sustained by certain units gave their leaders much to think about. Conferring with his senior commanders on the 15th, Göring condemned the lack of foresight which had sent so many bombers of *Luftflotte 3* on difficult missions suitable only for

picked crews. He also deplored the waste of effort caused by choosing targets of no strategic value as 'alternatives' for crews unable to reach their primary objectives. Believing on rather slender evidence that 'the enemy is concentrating his fighters against our dive-bomber operations', he went on to suggest that his subordinates should allot escorts in the proportion of three fighters to one dive-bomber, reminding them at the same time that twin-engined fighters were scarce and must not be wasted as on the afternoon of 13th August. In general, he recommended concentration on objectives valuable to the Royal Air Force, but seems not to have grasped the importance of limiting the choice still further to those on which the fighter force relied. Not knowing that Ventnor had been put out of action, he was too hasty in deprecating further attacks on radar stations, and did nothing to check the bombing of bomber and coastal stations which might well have been left on one side while the fighter force was being tackled.

(iv)

On 15th August the battle reached a climax. Between midnight and midnight the Luftwaffe made 1,786 sorties, or about three hundred more than on 'Eagle Day'. For the first time the planned scheme of co-ordinated attacks in daylight by the three *Luftflotten* deployed from Norway to Brittany was put into effect; and the innovation proved exceedingly expensive. Attacking across the North Sea with large, weakly-protected bomber forces, *Luftflotte 5* created precisely the conditions for which the Reorientation Scheme and its successors were designed. Nos. 12 and 13 Groups, backed by the guns of the 7th Anti-Aircraft Division, made good use of their chances, inflicting heavy casualties and turning back many bombers well short of their targets. In the south, Nos. 10 and 11 Groups, again backed by the guns, had as usual to meet repeated blows by forces well protected by single-engined fighters. On the whole they were less successful in keeping bombers from their targets, but they too punished some German units very heavily. In the twenty-four hours the Luftwaffe lost seventy-five aircraft, while Fighter Command lost thirty-four. But these figures do not reflect the whole significance of the day's events. The moral effect of General Stumpff's failure to pierce the left flank of the defences cannot be assessed with any certainty and was partly offset by a too-sanguine estimate of British losses. Nevertheless, there is ground for the opinion that August 15th was one of the great turning-points of the battle and perhaps of the whole war.

The day began quietly with the usual reconnaissance flights. Between nine o'clock and half-past ten the appearance of small hostile

formations over the Straits led No. 11 Group to put up a squadron to safeguard two convoys off the north shore of the Thames Estuary, but they made no contact with the enemy.

The first signs of a bigger threat came about a quarter to eleven, when a substantial force was detected moving from Cap Gris Nez towards Kent. No. 11 Group responded by ordering four squadrons to patrol the coast from Manston to Dungeness. At half-past eleven nearly forty dive-bombers of *Luftflotte 2*, escorted by single-engined fighters, arrived near Dungeness and at once turned north to bomb the aerodromes at Lympne and Hawkinge. The nearest British squadron, correctly informed of the enemy's position, were able to attack from up-sun and were probably responsible for two casualties known to have been suffered by the dive-bombers. Two other squadrons were in action with mixed success. Accurate bombing at Lympne put the station out of use for the next two days, but Hawkinge—a more important aerodrome—suffered little damage.

Later in the morning flights over the Channel by small German formations led No. 11 Group to put up three squadrons as a precaution, but they saw nothing of the enemy. A reconnaissance aircraft which flew over Shoreham, Kenley, Croydon and Northolt was not intercepted.

The next important event occurred much further north. Just after midday the radar chain detected a force estimated at twenty or more aircraft many miles east of the Firth of Forth. Within the next three-quarters of an hour, while the enemy was still far out to sea, this estimate was raised to thirty or more aircraft, apparently making for Northumberland in three formations.

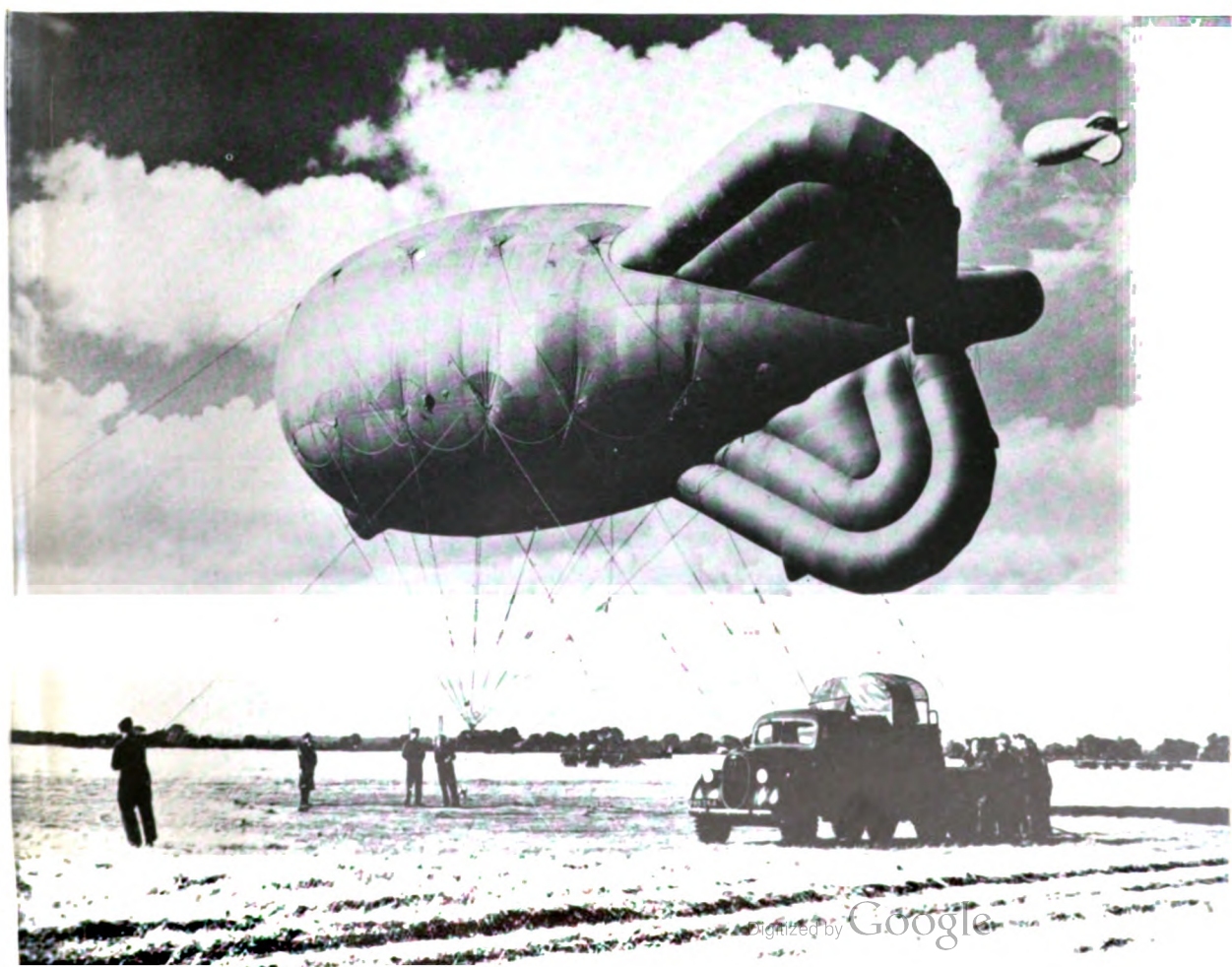
Meanwhile No. 13 Group, responding vigorously to the first big threat to their territory in daylight, were preparing to do battle. (See Map 16.) By half-past twelve a squadron of Spitfires from Acklington (No. 72) were on their way to meet the enemy to seaward of the Farne Islands, and a squadron of Hurricanes from Drem (No. 605) to patrol near Tyneside. Within the next few minutes the group added a further Spitfire squadron from Catterick (No. 41 Squadron, formerly at Hornchurch), and a quarter of an hour later, when action was just beginning, put yet another Spitfire squadron (No. 79) in the probable path of the oncoming enemy. Still later a squadron of Hurricanes (No. 607) went up from Usworth. To meet a force believed to comprise some thirty aircraft, nearly forty fighters were thus airborne well before the battle and were later reinforced by two more squadrons.

In reality the force fast closing with our squadrons at half-past twelve was very much larger than the British estimate. It comprised some sixty-five Heinkel 111 bombers of *Kampfgeschwader 26*, inadequately escorted by about thirty-five Messerschmitt 110 fighters of



Plate 15. An Observer Corps (later Royal Observer Corps) Post at Work.

Plate 16. A Barrage-Balloon Close-Hauled.



Zerstörergeschwader 76. The whole force was bound from Stavanger in Norway for a number of targets between the Pennines and the coast. Two objectives, the bomber aerodromes at Linton-upon-Ouse and Dishforth, were well south of the neighbourhood for which the enemy at first seemed bound.

The honour of striking the first blow in this memorable action fell to No. 72 Squadron from Acklington. Making roughly eastwards from the Farne Islands as they had been told to do, they met the enemy some thirty miles from the coast. The bombers were flying at 18,000 feet in a broad reversed wedge whose leading edge comprised some thirty aircraft in groups of three. The Messerschmitts were flying a thousand feet above in two waves about three-quarters of a mile apart. Heavily outnumbered by the Messerschmitts alone, No. 72 Squadron nevertheless had the advantage of being a good three thousand feet higher and slightly to the south, so that they were between the enemy and the sun. The squadron at once turned in to attack, four pilots engaging some of the Messerschmitts while the rest dived on the bombers from astern. The results were startling. Apparently taken by surprise, some of the bombers jettisoned their load and took refuge in the clouds. The Messerschmitts, which seem to have been flying without rear-gunners in order to increase their range, were powerless to do anything but form defensive circles for their own protection, and could only leave their charges to their own devices. How many German aircraft were shot down in this particular engagement cannot be determined. No. 72 Squadron claimed, probably with justice, that several were destroyed, and had the additional satisfaction of emerging without a single hit on any of their Spitfires.

Thereafter the German formation split in two, one portion making for Tyneside while the other turned further south. Within the next few minutes the second Acklington squadron, No. 79, met the northerly band just off the coast. Engaging the Messerschmitt 110's, the squadron broke up, but afterwards re-formed and went on to find the bombers approaching Newcastle, where their primary objective would seem to have been the aerodrome at Usworth. Engaged as they reached the coast by the Tyne guns and by one flight of the Hurricanes from Drem, the Heinkels dropped some bombs which fell largely in the sea. The southerly force, severely buffeted by Nos. 14 and 607 Squadrons from Catterick and Usworth, and by the Tees guns, also distributed their load to little purpose, mostly near Seaham Harbour. On their return to Norway survivors reported that 'the effect of attacks on Linton-upon-Ouse and another airfield to the north were not observed'.

In all the engagements *Kampfgeschwader 26* and the accompanying escort unit lost eight bombers and seven fighters respectively.

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Fighter Command lost no aircraft. Bombs were widely scattered about Tyneside and on villages further south, but only at Sunderland, where some houses were destroyed, was any major damage done. As no objective of military value came to harm, No. 13 Group and the 7th Anti-Aircraft Division, commanded respectively by Air Vice-Marshal R. E. Saul and Major-General R. B. Pargiter, could justly claim to have fought one of the most successful air actions of the war.

Meanwhile another action was in progress some ninety miles further south. Here a force believed to comprise at first about six and later some thirty or more aircraft had been detected about half an hour after midday, apparently making for Spurn Head. In fact, it consisted of nearly all *Luftflotte 5's* remaining bombers, comprising about fifty Junkers 88's of *Kampfgeschwader 30*, bound from Aalborg in Denmark for Yorkshire without an escort. The main objective was the Bomber Command aerodrome at Driffield.

The task of dealing with this threat fell mainly on No. 12 Group, commanded by Air Vice-Marshal T. L. Leigh-Mallory. (See Map 16.) At one o'clock, when the enemy was still some miles distant, the group ordered a squadron of Spitfires from Leconfield (No. 616 Squadron) over Hornsea. Five minutes later the Defiants of No. 624 Squadron from Kirton-in-Lindsey were sent to patrol a convoy in the Humber; a minute afterwards they were followed by a Hurricane squadron from Church Fenton (No. 73), with orders to devote one flight to its base and the other to a second convoy off the coast. At ten minutes past the hour No. 13 Group, already heavily committed in the north, contributed a Blenheim squadron (No. 219) from Catterick. The whole force airborne in the threatened area when the enemy drew near five minutes later thus comprised two squadrons of single-engined fighters and one each of Blenheims and Defiants. The Blenheims, and perhaps also the Defiants, would be outmatched if the oncoming force included fighters, but might be useful against unescorted bombers. As we have seen, there were in fact no fighters; but the Junkers 88 was a difficult aircraft for Blenheims to bring down in a running fight.

No. 616 (South Yorkshire) Squadron were first in action. Ordered northwards from Hornsea, on arriving at Flamborough Head they saw the enemy approaching in irregular formation. The squadron turned east and opened fire some miles off the coast. No match for the Spitfires though numerically superior, the Junkers 88's sought refuge in the clouds and offered little return fire. A few minutes later the flight of Hurricanes previously covering the second convoy, but afterwards ordered north, met them just off the coast and fought them as they crossed it. Nevertheless, some thirty or more reached Driffield and bombed it heavily and accurately, destroying or badly

damaging about a dozen Whitley bombers, four hangars and three blocks of buildings. Others dropped bombs at Bridlington, where some houses were destroyed, and (apparently fortuitously) on an ammunition dump six miles away. The Blenheims from Catterick fell in with some of them over Yorkshire and chased them for long distances over land and up to a hundred miles out to sea. The Defiants, tied to their convoy in the Humber, had no chance to engage, nor did the rest of the Hurricanes at Church Fenton.

In these engagements *Kampfgeschwader 30* lost eight aircraft and Fighter Command none. The two raids thus cost General Stumpff nearly one-eighth of his entire bomber force and about one-fifth of his long-range fighters.

For the rest of the day honours were more even. About an hour after the attack on Driffeld nearly forty dive-bombers with accompanying fighters slipped through the defences in Essex and Suffolk. After successfully attacking the fighter aerodrome at Martlesham and a neighbouring signal station they withdrew without loss, though engaged by the Harwich guns. The equivalent of seven squadrons of British fighters were ordered to intercept, but were either by-passed or drawn off by the German escort. A few reached Martlesham as the dive-bombers were withdrawing.

Meanwhile, nearly a hundred bombers with their escort were approaching East Kent. To oppose them four British squadrons were patrolling between Manston and Hawkinge, but many of our fighters were held off by the German top-cover while the bombers crossed the coast unseen or out of reach. The bulk of them flew to the neighbourhood of the Thames and Medway estuaries, where some made a heavy attack on Rochester while others bombed Eastchurch and the railway close by. Hawkinge, too, was hit for the second time that day. Losing four or five aircraft to Fighter Command's nine, the enemy scored damaging hits on two aircraft factories at Rochester and on the aerodrome at Eastchurch.

The next big raid was launched by *Luftflotte 3* with some seventy to eighty bombers and dive-bombers escorted and covered by large numbers of single-engined and twin-engined fighters. Warned between five o'clock and twenty minutes past that from two to three hundred aircraft were approaching the South Coast, the two southern fighter groups put up the largest force yet used to counter a single operation by the enemy. No. 10 Group's contribution comprised three squadrons with orders to intercept a force approaching Portland, and a squadron and section to patrol Swanage and Ringwood respectively. Later two more squadrons took off hurriedly when their base was imminently threatened with attack. No. 11 Group began by putting up five squadrons to cover the south and south-west approaches to London and the Medway, afterwards

adding another two. So doing, the group ran some risk that a threat to their left flank by *Luftflotte 2* might find them with too many squadrons committed on their right. We shall see that, when the threat in fact arose a bare hour later, they were able to counter it with the better part of ten squadrons, including three recently in action and one already airborne for an hour.

Action began at twenty minutes past five off Portland Bill, where nearly fifty dive-bombers escorted by single-engined and twin-engined fighters were met by one of No. 10 Group's squadrons from the Middle Wallop sector. After diving out of the sun on to the dive-bombers, the squadron climbed to engage the close escort of twin-engined fighters flying two thousand feet above and themselves protected by single-engined fighters. Two more of No. 10 Group's squadrons then went into action. Relinquishing his primary objective, the enemy dropped some bombs at Portland and withdrew with heavy losses, particularly among the twin-engined fighters. Further east a Hurricane squadron from Tangmere came upon some thirty bombers with escorting fighters, but found them flying higher than had been predicted. Engaged within the next few minutes by another Hurricane squadron, and afterwards successively by no less than five squadrons and by a section of Hurricanes patrolling Ringwood, the bombers went on to attack Middle Wallop (mistaken for Andover) and a naval aerodrome at Worthy Down. The Portsmouth and Southampton guns were also in action and claimed one victory. In the whole series of engagements off Portland and elsewhere the Luftwaffe lost eight bombers, four dive-bombers and thirteen twin-engined fighters. Fighter Command lost sixteen aircraft. At Middle Wallop two hangars were hit, one aircraft was destroyed on the ground and five more were damaged. The attack on Worthy Down was almost wholly unsuccessful, seven of the fifteen bombers concerned being shot down and only three of the survivors claiming to have reached the target. Although less one-sided than the morning's encounters near the East Coast, the action was therefore a satisfactory one for Nos. 10 and 11 Groups and the 5th Anti-Aircraft Division, commanded respectively by Air Vice-Marshal Brand and Park and Major-General R. H. Allen.

It was barely over when warning came of an impending attack on No. 11 Group's left flank. Shortly after six o'clock Air Vice-Marshal Park was thus faced with the necessity of meeting some sixty or seventy aircraft said to be approaching Dungeness and Dover at a moment when many of his squadrons had just landed after making their second or third patrol that day. One Auxiliary squadron, No. 501 (County of Gloucester) Squadron, was in fact still airborne, having been up for about three-quarters of an hour, and had already been in action twice. He was nevertheless able to reinforce

No. 501 with four squadrons from his more easterly sectors and afterwards add another four and a half, including three squadrons recently in action near the South Coast. The attackers reached the coast at half-past six with the intention of bombing fighter aerodromes at Redhill, Biggin Hill and Kenley. Intercepted within the next few minutes by at least two squadrons, including the battle-weary but undaunted No. 501, they seem to have lost their bearings, and ultimately attacked quite different targets. One portion made for the neighbourhood of Maidstone, where they bombed West Malling under the impression that it was Biggin Hill, while most of the remainder dropped their load at Croydon, some crews mistaking the aerodrome there for Kenley and others for Redhill. Ironically enough, these attacks were among the most effective yet made by German bombers. Bombs at Croydon severely damaged valuable buildings, including two aircraft factories, and killed or seriously injured about eighty people, while at West Malling damage done to buildings and the landing-surface put the station out of action for several days. In a confused series of engagements Fighter Command lost five aircraft and the attackers seven, all belonging to a formation engaged with notable success by No. 111 Squadron from the Kenley sector.

So ended a day of heavy fighting which extended both sides almost to the limit. Like their opponents, many German units had made several patrols since the forenoon and several *Gruppen* had lost from seven to nine aircraft each out of their normal complement of thirty-odd. One squadron belonging to the third *Gruppe* of *Kampfgeschwader* 26 had, indeed, lost five of its nine aircraft in the disastrous raid on the East Coast. Nevertheless, the Luftwaffe did not remain quiescent during the ensuing night. In the course of the next few hours some sixty or seventy bombers made sorties over the United Kingdom or laid mines off the coast. Fighter Command responded by adding forty-two evening and night sorties to its day total of nine hundred and seventy-four; and the guns were in action at many places from South Wales to the Yorkshire coast. One bomber was brought down, probably by anti-aircraft fire. Bombs were dropped at many places, notably in South Wales and at Bristol, but only at Smallheath (Birmingham) did a target of military value suffer damage.

(v)

On the morrow of the great battles of the 15th the Intelligence Branch of the German Air Staff calculated that heavy losses since the beginning of July had reduced Fighter Command to about three

hundred serviceable aircraft. As daylight raids on the United Kingdom continued to meet stiff opposition, that estimate was not universally accepted. Later one German commander complained that he was always being assured that not more than about a hundred fighters would be met in any operation over south-east England, but that in practice anything from two to three hundred might be found. In a sense he was right, though in fact the number met at one time and place was nothing like as big as he supposed.

In reality, Fighter Command's resources on the morning of the 16th were fully twice as great as the German Air Staff thought. Combat losses had reached double figures only on August 8th, 11th, 13th and 15th. From the end of the Dunkirk withdrawal until the beginning of the preliminary phase on July 10th they had been almost negligible; from that date until nightfall on August 15th they amounted to roughly two hundred aircraft as against the German estimate of well over five hundred. Some squadrons in the south had suffered heavily in the last few days, but the Aircraft Storage Units still had 235 Hurricanes and Spitfires ready for immediate issue as replacements. Pilots were none too plentiful, but the vital single-seater squadrons nevertheless had an average of nineteen apiece, of whom from sixteen to eighteen were fit for active operations and the rest were completing their operational training alongside their more experienced companions. Thus the command, though hard pressed, was still capable of operating at its normal fighting strength of twelve aircraft a squadron. Without counting three of the more recently formed squadrons which were just about to take their places in the line, it mustered a total of 672 first-line aircraft, including the two Defiant and six Blenheim squadrons and one flight of Gladiators, or a net figure of 570 Hurricanes and Spitfires.

Even so, the battle was far from won. Stored reserves of Hurricanes and Spitfires might be ample to meet immediate needs, but had nevertheless fallen by more than fifty aircraft during the last week. At present rates of loss and estimated output they would last two months; but one or two bad days might extinguish them more rapidly, leaving our squadrons living from hand to mouth on such new aircraft as could be turned out and made ready from day to day. The supply of pilots was still more precarious. Here again the command was not yet down to bedrock; but the six or seven pilots in reserve in an average squadron were too few to cover casualties, reliefs throughout the long hours of summer daylight and other contingencies, even if all had been fully fit for active operations. To bring the single-seater squadrons up to full establishment nearly three hundred and fifty new pilots were needed; and the number due to complete their training within the next eight or nine days was less

than eighty. Again, the number of serviceable aerodromes in the most important sectors was at present ample; but if attacks like those already made on Lympne and West Malling were to impair the working of the more vital sector-stations, serious difficulties might arise. At Croydon, too, damage done to the operations room pointed to a danger soon to be emphasised by an attack on Kenley.

In the outcome, two of these three problems became acute within the next few weeks. We shall see, however, that the resulting dangers were ultimately weathered, though not without great difficulty.

On the 16th the main targets of the German air force were West Malling and Tangmere, with aerodromes outside Fighter Command at Gosport, Lee on-Solent, Brize Norton, Harwell and Farnborough. Despite Göring's discouragement a fresh attack on the radar station at Ventnor hampered efforts to repair it. At Tangmere many buildings and fourteen aircraft on the ground were destroyed or damaged. Electricity and water supplies were temporarily cut, but the landing-surface remained serviceable. In the course of the day's fighting Flight Lieutenant J. B. Nicholson of No. 249 Squadron pressed home an attack on a Messerschmitt 110 although his Hurricane was in flames and he himself was severely burned, thus gaining the first Victoria Cross awarded to a pilot of Fighter Command. In the twenty-four hours the Germans made some seventeen hundred sorties and lost forty-five aircraft; but the twenty-one British fighters lost in combat could be ill spared, even though the enemy suffered so much more heavily.

On the 17th the Luftwaffe, having operated almost at full stretch for two consecutive days, made few attacks, despite good weather; but the 18th was another heavy day. Kenley, Croydon, Biggin Hill and West Malling were all bombed; single-engined fighters machine-gunned Manston; and three aerodromes not in Fighter Command, as well as a radar station at Poling in Sussex, were attacked. Poling remained out of action for the rest of the month, and its loss was serious; at Kenley the damage was such that thereafter the station could accommodate only two squadrons instead of three. The German air force lost seventy-one aircraft in the twenty-four hours, Fighter Command twenty-seven. Thereafter indifferent weather until the morning of the 24th brought a lull in which both sides had time to digest the lessons of the battle.

Meanwhile, on the 17th the Air Ministry had taken steps to check the fast-growing shortage of fighter pilots. A few days earlier Dowding had asked that the more experienced pilots in the obsolescent Battle squadrons of Bomber Command should be withdrawn, put through a short conversion course, and drafted into his command. In principle the Air Staff rejected this proposal, partly because the Battles, though outmoded, might soon be called upon to attack invasion

forces, partly because they were about to be replaced by better aircraft for which the old crews would be needed. Yet the loss of some ninety pilots killed or missing and fifty more or less seriously wounded since 8th August gave Fighter Command a strong case for preferential treatment, especially as they had started the battle with a big deficiency.¹ In practice, the Air Staff compromised by allowing five volunteers from each of the four remaining Bomber Command Battle squadrons, and three from each of the eleven Army Co-operation squadrons administered since the fall of France by No. 22 Group, to transfer to Fighter Command after going through a six-day course at a fighter operational training unit. Thus fifty-three new pilots would be quickly added to the fighter force, besides the seventy or eighty already due to complete their operational training in the course of the next week. Furthermore, the Air Ministry arranged that the next series of courses at the three fighter operational training units should be filled to capacity by calling on Allied pilots and on specially selected candidates who would otherwise have qualified for other commands. An earlier decision to restore the normal four weeks' course in place of the two weeks' course adopted in the early summer was rescinded; and for the rest of the battle pupils were passed out with only some ten to twenty hours' solo flying in the aircraft they would fly in squadrons.

As linguistic and other problems made it desirable that Allied pilots should serve in national squadrons, the decision to call upon them in large numbers had paradoxical results; for the flow of Polish and Czechoslovakian pilots which it created could only be turned to good effect by the formation of new squadrons at a time when there were barely enough aircraft for existing units. To meet the difficulty, and at the same time fall in with the wishes of the Allied Governments concerned and of Air Chief Marshal Dowding—all of whom were opposed, from their different viewpoints, to anything which might delay the arrival of such eager warriors in the line of battle—the Air Ministry agreed that one new Czechoslovakian and three new Polish squadrons should be formed at once, but stipulated that they should begin with only half the usual establishment of pilots and machines. Moreover, they would be expected to help the hard-pressed operational training organisation by themselves undertaking

¹ The figures were:

Deficiency of pilots, 8th July	197
Deficiency of pilots, 8th August	160
<i>Casualties, 8th-18th August</i>	
Pilots killed or missing	94
Pilots wounded	60
Hurricanes and Spitfires destroyed or damaged beyond repair	175
Hurricanes and Spitfires so damaged as to need repair elsewhere than at unit	65
Hurricanes and Spitfires destroyed or damaged on the ground	c. 30

the operational training of pilots subsequently posted to them. On these terms clearly they could not be ready for many weeks, and in fact none of the new Allied squadrons was fully fit for action before October. Meanwhile, no big improvement in the supply of pilots could be expected before the end of the next series of operational training courses during the first half of September.

Happily the threatened shortage of aircraft did not come about, although the fear of it did something to impede the formation of new squadrons. By the end of the first phase the number of Hurricanes and Spitfires ready for immediate issue had fallen to one hundred and sixty-one, an uncomfortably but not dangerously low figure. The other great problem which arose in the next few weeks was that of aerodromes and their swift repair when they were damaged. But that question, as well as the tactical lessons learnt in August, will be best considered in later chapters, where the second and third phases of the battle are reviewed.

CHAPTER XIII
THE BATTLE OF BRITAIN:
THE SECOND PHASE¹

(24th August–6th September, 1940)

(i)

ON 19th August the Luftwaffe took stock of the battle. Conferred with his generals on that day, the German Commander-in-Chief reminded them that the difficulty of their task demanded the most careful planning and a nice choice of subordinate commanders. His orders were that *Luftflotten 2* and *3* should do everything they could to weaken Fighter Command while *Luftflotte 5* prepared for a night attack on Glasgow and meanwhile made minor raids on other targets. Any intention of repeating the mass raids of 15th August across the North Sea was thus rejected; and the difficulty of pressing home daylight attacks on factories and similar targets was admitted. Göring decreed that for the present such attacks should be made only at night or by single aircraft with cloud-cover. Henceforth fighter battles would be the real object of big daylight raids, and only enough bombers were to be used to tempt defending squadrons into action. He ordered *Luftflotte 3* to make plans for a night attack on Liverpool, but reserved to himself the right to order raids on that city and on London. Elsewhere bomber crews would have a free hand to seize such opportunities as might arise when they could not find their primary objectives.

On the same day his opponent at No. 11 Group embodied the lessons of the last few days in the fourth of a series of instructions issued for the guidance of sector commanders and controllers. Park wished to avoid unnecessary losses and at the same time make sure that everything possible was done to engage incoming bombers before they reached their targets. He decided therefore that the greater part of the squadrons sent to deal with a given raid must be devoted to bombers and only a small proportion to their escorting fighters. Sector-stations must be protected by substantial formations patrolling below cloud-base whenever the stations were seriously threatened; if necessary, reinforcements must be sought from No. 12

¹ For a summary of operations, see Appendix XIV.

Group to guard those north of the Thames Estuary. Finally, pilots must be told to engage as often as possible over their own territory or within gliding distance of the coast. Though unaware of what the enemy was planning, Park had no intention of being drawn into an unprofitable exchange of fighters. His adversary proposed to dangle a line baited with small bomber forces before a victim who had determined in advance to seize the worm and avoid the hook. Above all, Park was determined to preserve his sector-stations from destruction, believing that if he could do that, and could continue to inflict steady losses on the enemy, ultimate victory was assured.

When the struggle was resumed on 24th August both sides became aware of changes in the other's attitude. The defenders noticed that German formations contained more fighters and relatively fewer bombers than before. They found, too, that some fighters in every formation stayed close to their charges instead of flying so high and far behind that they could be ignored. Conversely, some German fighter units received the impression that our pilots had grown less ready to do battle with them. In fact they had, for the simple reason that they had been told to concentrate on bombers. Nevertheless, new German tactics prevented Park from going as far in that direction as he wished. Having begun the battle by sending Spitfires against German fighters and Hurricanes against bombers, he had recently decided to send both against the latter. But as the relatively small bomber formations now employed were henceforth closely escorted and were protected also by additional fighters as top-cover, he was soon forced to adopt a modification of the earlier method, sending Spitfires to meet the topmost German fighters and Hurricanes to deal with bombers and close escort. Wishing to reduce the numerical disparity so often noticed in the past, he also ordered formation-leaders to give a 'Tally Ho!' message as soon as they saw the enemy, adding particulars of height, course, numbers and approximate position. The hope that this information would help him and his controllers to put more squadrons in the right position to engage was not, however, fully realised in practice. We shall see, indeed, that ultimately the difficulty of meeting the enemy in sufficient strength gave rise to a controversy which, in the minds of some, cast doubt on some hitherto cherished principles of air defence.

(ii)

On the first day of the new phase the Germans adopted a practice which caused No. 11 Group a good deal of anxiety in ensuing weeks. Almost continuously from dawn to dusk they patrolled the Straits

with formations of varying size, whose mere presence helped to conceal preparations for genuine attacks still further disguised by occasional feints towards the English coast. From the 27th onwards *Luftflotte 3* were mainly concerned with night attacks and had little need of fighters. Thus nearly all the single-engined fighters in France and Flanders could be drawn upon to support *Luftflotte 2's* attempt to throw dust in the defenders' eyes.

But in spite of the admitted difficulty of their task the Commander-in-Chief remained reluctant to give No. 11 Group more squadrons at the expense of other areas. Even when mass raids on the provincial groups were discontinued they remained bound by commitments for night defence and the defence of shipping, while Nos. 10 and 12 Groups were often called upon to meet attacks on their neighbour's outlying sectors. And any of them might still be heavily attacked in daylight without any longer warning than that given by the radar chain. Admittedly Dowding considered that *Luftflotte 5's* recent raid on Yorkshire and Tyneside had failed dismally; but General Stumpff might not agree with him, or might hope to do better if he tried again. Dowding also refused a request from Park to comb the less harassed squadrons of their best pilots for his benefit, believing that the effect on squadrons so treated might be unfortunate. Instead he met his subordinate's need for fresh blood by a system of replacement which preserved the integrity of individual squadrons. Thus towards the end of the first phase he replaced six squadrons which had suffered heavily by others drawn from quieter sectors, and this remained his policy until an approaching crisis enforced more drastic measures.¹

At the beginning of the second phase about a third of No. 11 Group's line of battle therefore consisted of relatively inexperienced squadrons, while the rest contained an admixture of pilots more recently posted from the operational training units than their fellows and less seasoned in battle. The veterans held this dilution responsible for the higher ratio of losses to victories soon noticeable, although perhaps more skilful tactics by the enemy and larger escorts were really quite as much to blame. But in any case some such dilution was inevitable, whatever policy had been adopted. The only alternative to the method of replacement actually followed, or the more drastic combing urged by Park and afterwards practised from sheer necessity, would have been to allow the more seasoned pilots to go on fighting until they were exhausted and had to be replaced throughout by novices. However attractive to the veterans themselves, who felt they could go on for ever, such a course had nothing to recommend it in the long run.

¹ See Chapter XV.

The first big raid on the opening day of the new phase followed a series of minor threats which kept the defences busy all the morning without bringing any major engagements or damage to targets of much military value. Half an hour after midday five German formations were visible to the radar chain at various points from Dunkirk to Boulogne. One British squadron was guarding Manston at the time and another was on its way to mount guard over Hawkinge, but the first was almost due to be relieved. In addition, elements of two squadrons were patrolling No. 11 Group's flanking aerodromes at Martlesham and Tangmere.

After a series of feints, one of which brought the Dover guns into action, the force genuinely bent on mischief crossed the coast near Deal at a moment when three sections of the squadron formerly patrolling Manston had just landed there and were refuelling while the fourth kept guard above. Their relief was not yet in position. Thus favoured, the German bombers and their escort flew unimpeded to their target. On arriving at Manston they planted their load to such good purpose that later in the day the squadron based there and the bulk of the ground staff had to be withdrawn. The nine Defiants of No. 264 Squadron caught refuelling just managed to get off the ground before the bombs fell, and the whole squadron then fought a brisk action which paved the way for the Hurricane squadron lately flying towards Hawkinge. The Germans lost five bombers and two fighters, but had the satisfaction of severely damaging an objective which the defenders had taken special pains to guard.

During the next two hours more patrols over the Straits by German fighters compelled No. 11 Group to fly nearly a hundred sorties. All were sterile except one patrol which led to an engagement of little consequence for either side.

The next big action further exemplifies the difficulties which No. 11 Group had now to meet. Soon after three o'clock a threat by several formations totalling about fifty aircraft found one squadron returning from the engagement last mentioned and another four patrolling various points on the eastern and southern approaches to London. Two of the four had been up for some time and had only enough fuel left for about another hour's flying at cruising speed. Both engaged an incoming force near the North Foreland, but could not prevent a second attack on Manston within four hours. Another squadron, holding off until they were in a favourable position, attacked a second incoming force out of the sun's eye near the confluence of the Thames and Medway. But they were out-manceuvred by part of the German escort, which wheeled up-sun and accepted combat while the rest of the force passed on to Hornchurch, assailed but unchecked by two more fighter squadrons and by the Thames and Medway guns. There, as at Manston earlier in the day,

circumstances again conspired against the unfortunate No. 264 Squadron. Seven of their Defiants were about to take off when the enemy arrived, and not all were airborne when the bombs began to fall. Nevertheless, they managed to get to grips with the attackers and claimed good results for the loss of their fourth Defiant destroyed that day. In the meantime spirited action by the ground defences did much to spoil the bombers' aim, with the result that only six bombs out of a much larger number fell within the limits of the aerodrome. The enemy then retired down-river, speeded by more fire from the Thames and Medway guns.

Further north an attack on North Weald followed much the same course. But there the damage was more serious, though the station remained serviceable. Again the bombers were well guarded and our squadrons found them difficult to reach. Even so the enemy lost at least five bombers and four fighters, while Fighter Command lost eight aircraft but only three pilots killed or wounded.

Meanwhile *Luftflotte 3* were preparing for one of their last big raids in daylight. About a quarter to four the radar chain detected a substantial force just north of Cherbourg and two smaller forces near the Channel Islands. Soon afterwards some mischance whose cause remains obscure caused the radar picture to become confused, so that under cover of a real or apparent tangle of small raids about fifty bombers with their fighter escort were able to approach the English coast without betraying their strength or precise course to the defences. Meanwhile No. 11 Group had protected their right flank by posting one and a half squadrons there, while No. 10 Group had put two and a half squadrons near the Isle of Wight and had taken steps to guard their stations further west. In the circumstances only one squadron succeeded in meeting the enemy before he reached his target, and they were in a poor position, down-sun and at least a thousand feet too low. Engaged by anti-aircraft fire, the bombers dropped their load on Portsmouth town and dockyard, where more than a hundred people lost their lives. They then withdrew without being seriously challenged by our fighters.

So ended the first day of the second phase, unfortunately notable for the low proportion of fighter squadrons which had been able to engage incoming bombers before they reached their targets. It was followed by a night of widespread bombing on a far heavier scale than that of recent weeks. Altogether one hundred and seventy German bombers were sent to targets ranging from Northumberland to Kent and from Plymouth to Lancashire. London was not among the intended targets, though about a dozen aircraft were sent to attack objectives near the perimeter of the capital, including oil tanks at Thameshaven and aircraft factories at Rochester and Kingston. In the outcome many crews went so far astray that the City of

London had its first raid since 1918, and the suburbs also suffered heavily. Fires kindled in London Wall and Fore Street were attended by no less than two hundred pumps; other parts of the capital and its outskirts which attracted bombs intended for targets far away included Islington, Tottenham, Millwall, Finsbury, Stepney, East Ham, Leyton, Coulsdon and, worst of all, Bethnal Green, where about a hundred people lost their homes. In north-east England, where Tyneside, the Hartlepoons and Middlesbrough were the main targets, about twice that number were similarly afflicted at South Shields. Elsewhere bombs were dropped at Cardiff, Swansea, Birmingham, Hull, Leeds, Rotherham and several other places. In addition, many aerodromes were made objects of attack, though few were hit. At Driffield the Bomber Command aerodrome, already damaged in daylight on the 15th, attracted bombs from a single aircraft; and in view of its exposed position the two squadrons based there were withdrawn within the next few days. Otherwise the military consequences of the night's bombing were not serious; but the human suffering caused by the many bombs which missed their targets needs no stressing.

From dusk onwards Fighter Command added 45 sorties to their day total of 936. The anti-aircraft guns were in action during the night at the Tyne, Swansea, Cardiff, Bristol, Birmingham, Coventry, Portland, Bramley, Langley (Slough) and Dover. In the inner artillery zone they held their fire. A Hurricane of No. 615 (Auxiliary) Squadron, not specially equipped for night fighting, destroyed a Heinkel 111 near the South Coast; and the Swansea gunners claimed that one of their targets exploded in mid-air. Altogether the Luftwaffe lost thirty-six aircraft during the day and two at night, while Fighter Command lost twenty-two, all in daylight. In general the role of the guns at night was to hamper bombing, for neither they nor fighters could expect to shoot down many aircraft after dark until the new radar devices were ready for use in batteries and squadrons. Meanwhile, as Dowding was uncomfortably aware, the enemy had almost a free hand at night as long as he refrained from flying as low as he had done in June.

(iii)

On the 25th the Luftwaffe made no big raids until the afternoon. Feints and minor threats kept the defences fairly busy, but their first important task came only when a force estimated at a hundred aircraft or more was detected off Saint-Malo between four and five o'clock. Thereupon Nos. 10 and 11 Groups put up almost every available aircraft from Exeter to Tangmere, ordering the squadrons

to reduce the risk of damage on the ground by sending up all their serviceable fighters. A well-judged disposition by No. 10 Group, who took special pains to guard the neighbourhood of Portland, enabled two squadrons sent forward for the purpose to make early contact with a formation bound for Warmwell. They were, however, seriously outnumbered by forces totalling some forty-five bombers and upwards of two hundred fighters. A third squadron, meeting the enemy just short of the target, likewise found the German fighters too numerous to give them a clear run at the bombers, whose attack on Warmwell disrupted communications there for eighteen hours. After the bombing several more squadrons were in action, but also found the bombers hard to reach. Between them fighters and guns destroyed one bomber and eleven German fighters, Fighter Command losing eleven aircraft and eight pilots killed or wounded.

An action near Dover about half an hour later brought German losses for the day to twenty aircraft and Fighter Command's to sixteen. During the night some fifty German aircraft took off to bomb factories at Birmingham and twice that number to attack a variety of targets in southern England, the Midlands, South Wales and Scotland. The heaviest bombing was at Birmingham and Coventry. Fighter Command flew forty-three evening and night sorties and guns were in action at many places. No German aircraft were brought down.

The 26th was notable for *Luftflotte 3's* last big daylight raid for several weeks and for a successful attack by *Luftflotte 2* on the fighter aerodrome at Debden. Coming in the afternoon, these operations followed a morning of desultory bombing which did little damage and brought no big engagements. The raid on Debden was part of a wider threat aimed also at Hornchurch and North Weald; but bombers bound for the last two places missed their targets after being intercepted over the Thames Estuary, and a force apparently bound for Manston also failed to achieve anything of consequence. At Debden the defenders were less fortunate. Two squadrons of No. 11 Group witnessed the enemy's approach, but could not get through his fighters to engage the bombers; and a squadron sent from Duxford in No. 12 Group to guard the aerodrome saw nothing of the enemy, probably because they had been given too little time to reach the spot. The station was badly damaged, but remained in service. After the bombing No. 310 (Czechoslovakian) Squadron engaged the attackers, but were handicapped by unsuitable radio sets which prevented the bulk of their pilots from receiving orders from ground or air.

Luftflotte 3's contribution was a raid on Portsmouth. It was almost wholly defeated by three squadrons of No. 11 Group, which engaged the enemy independently on his way to the target, and by anti-aircraft fire. Many bombers dropped their load well short of the

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target, the rest on the outskirts of the town, the dockyard escaping what might well have been a damaging attack. Seven German aircraft destroyed in these engagements brought the total for the day to forty-one, including nineteen bombers; but Fighter Command's losses, amounting to thirty-one aircraft and sixteen pilots, were heavier than the command could well afford.

That night Birmingham and Coventry again bore the brunt of the bombing, though Plymouth was the primary target for some fifty bombers and thus also had its share. At least six aerodromes were listed for attack, but once again the aim was poor. St. Eval was saved by its decoy, which drew many bombs. At Birmingham sixty fires were kindled and several factories were slightly damaged. Fighter Command flew forty-two evening and night sorties, but conditions were unfavourable and there were no interceptions. As on the previous night, low clouds which should have hampered bombing handicapped the searchlights, setting the gunners a problem scarcely soluble without new equipment.

On the 27th the 'Tally Ho!' procedure came into force, but little opportunity arose to try it. Despite reasonably good weather outside the Midlands, the enemy made few attacks. The defences took the opportunity to hunt down reconnaissance machines, and three long-range bombers were destroyed, the Luftwaffe losing nine aircraft altogether while Fighter Command escaped with the loss of one. The score since the beginning of the new phase on 24th August was thus brought to seventy aircraft lost by Fighter Command and one hundred and eight by their opponents.

After a night enlivened by more attacks on the Midlands and elsewhere, the enemy resumed the daylight offensive on the 28th with attacks on Eastchurch and Rochford. About twenty bombers bound with escort fighters for the first arrived near Dover a little before nine o'clock under cover of sweeps by other fighters. Interception by four squadrons on the inward route failed to halt the bombers, our pilots being met by a determined escort force which shot down two of No. 264 Squadron's Defiants and damaged another four. Altogether Fighter Command lost eight aircraft and six pilots in exchange for five German aircraft shot down, and Coastal Command's much-bombed aerodrome suffered further heavy damage. A few days later Dowding finally resolved to use both Defiant squadrons primarily for night fighting. Accordingly No. 264 Squadron, who had done good service in the past, returned to No. 12 Group, there to embrace a new career in circumstances which restored the advantage of two pairs of eyes.

The twenty-seven bombers and accompanying fighters which attacked Rochford soon after midday were also intercepted by several squadrons before they reached the target, but again stout resistance

by the escort force helped the bulk of the bombers to break through the defences. No. 1 Squadron, making a bold head-on attack, were nevertheless able to turn some of them away. Apparently doomed to find themselves at the centre of the target, No. 264 Squadron were again forced to take off hurriedly, and this time just succeeded in getting away before the bombs fell. Some buildings at Rochford were set on fire, but the station as a whole was only slightly damaged. After the bombing the wreckage of two German fighters and one bomber was found, while Fighter Command lost three aircraft but no pilots.

In the afternoon German fighter formations made sweeps over East Kent at heights in the neighbourhood of 25,000 feet. Seven British squadrons were tempted to combat and lost nine aircraft. German losses were about the same, but such an exchange was scarcely profitable from the British point of view. With twenty aircraft lost during the day as against thirty by the enemy, Fighter Command was in fact experiencing a diminishing return for its efforts. And during the ensuing week, which brought the most continuously sustained series of attacks yet launched by the enemy, the margin of profit was to decline still further.

(iv)

On the night of 28th August *Luftflotte 3* delivered the first of the series of attacks on Liverpool for which they had recently been ordered to prepare.¹ By German standards the night's bombing was reckoned the first major night attack on the United Kingdom. As the process was repeated on each of the next three nights, the four raids may conveniently be considered together.

Appendix XV shows that on the four nights *Luftflotte 3* sent an average of 157 bombers a night to Liverpool and Birkenhead. About seventy per cent. of crews afterwards claimed to have reached the target, dropping on each night an average of 114 tons of high-explosive and 257 incendiary-canisters, each containing thirty-six one-kilogram incendiaries. The biggest and—as the Germans thought—the most destructive raid was made on the 29th, when 176 crews were sent, of whom 137 claimed to have reached the Mersey ports and to have dropped there 130 tons of high-explosive and 313 incendiary-canisters. On the first and third nights the attacks were accompanied by heavy raids on other targets, mostly (though not exclusively) made by aircraft of *Luftflotte 2*. Thus on the 28th, 180 bombers were sent to places other than the Mersey ports and on the 30th, 112. On the 29th and 31st only 44 and 25 respectively set out

¹ See p. 203.

to confuse the defences and interfere with sleep and work by making the usual 'dislocation raids' on widely scattered districts.

For *Luftflotte 3* the four raids involved about the biggest effort they could make without impairing their capacity to operate for many weeks to come. With minor exceptions all the units they could muster contributed some crews, including some *Kampfgruppen* lent by the naval organisation responsible for joint operations by submarines and aircraft. Machines pressed into service even included a few of the valuable and not particularly suitable Focke-Wulf 200's of *Kampfgeschwader 40*. Originally a civil aircraft, the so-called Kondor had in fact been used in Norway for both transport and bombing, but its exceptional fuel-capacity made it far more useful for spotting ocean-convoys well beyond the limits of normal air reconnaissance. An interesting feature of the raids is that in each case the attackers were led by units hitherto specialising in attacks on shipping. Some German strategists, believing that maritime blockade was Germany's best weapon against the United Kingdom, deplored the change, but their protests were unheeded.

The impression given by Appendix XV is that the raids on Merseyside presented themselves to German eyes as a series of weighty attacks well concentrated within an area admittedly large but very defined. Such was indeed the German view; but the reality was very different. On the first night the bombs supposedly aimed at Liverpool were in fact sown broadcast over a wide area. Moreover, the attack was so effectively masked by subsidiary raids that until much later the defenders remained unaware that a major raid on Liverpool and Birkenhead had been attempted. Indeed, the enemy's main objective was authoritatively supposed to have been the Midlands. Again on the second night, when more than four-fifths of all bombers which set out had the Mersey ports for their objective, Liverpool and its environs suffered only desultory bombing. In fact, barely fifty tons of high explosive fell anywhere near the Mersey, as compared with a hundred and thirty supposed by the Germans to have been dropped there. On the other hand, quite thirty tons hit Portland, Portsmouth, Bristol, South Wales and various parts of Yorkshire and north-east England. Accordingly the Ministry of Home Security reported, reasonably enough, that 'the areas mainly attacked were the Tyne and Hartlepool, South Wales, Liverpool and Manchester', adding that no serious damage had been done. On the third night only some forty tons of high explosive fell at Liverpool, Birkenhead, or close by: the docks were not hit and damage was mostly to suburban property. And even on the last night, when Liverpool was clearly the main target and suffered heavily, a fair number of bombs fell well south of the city, though only a sprinkling of German crews admitted to dropping their load between the Severn and the Dee.

The attacks achieved little success except on the last night of August, when over a hundred and sixty fires were kindled in the commercial centre of Liverpool. Some damage was done, too, at Birkenhead; but only a few bombs hit the docks. On the other hand, the very imperfections of the bombing helped to keep many parts of the country under warning, as did the 'dislocation raids' undertaken for the purpose. Alerts lasting up to five or six hours robbed many people of sleep and doubtless had some effect on production, though its extent cannot be measured. Fears that railway communications might be seriously affected proved groundless, though they might have been justified if attacks like that of August 31st had followed early in September. As it was, the volume of traffic carried by the London, Midland and Scottish Railway was slightly greater in August and the first part of September than before the bombing started.¹

One effect of the attacks was to expose the shortcomings of the night defences. In the four raids *Luftflotte 3* lost seven bombers—only slightly more than one per cent. of the whole number of sorties flown. The guns continued to do good work by forcing the enemy to fly high and hampering his aim; but neither they nor the fighter force could make much impression otherwise. Their inability to inflict punitive casualties was, indeed, so obvious that at one stage Dowding advocated wholesale jamming of German radio aids to navigation, even at the cost of hampering our own night offensive. But the Air Ministry preferred the subtler methods for which No. 80 Wing had been created. By 18th August the location of the all-important *Knickebein* transmitters had been established and nine stations for the re-radiation of signals from German beacons were in action. The precise effects of the measures taken in August could not be determined at the time, nor can they now; but the failure of many crews to find their targets shows that at any rate the attackers did not have everything their own way. Ultimately the work of No. 80 Wing proved invaluable and saved some important targets from destruction.

(v)

After making 340 sorties on the previous night the Luftwaffe contented itself on 29th August with sweeps by fighters rarely accompanied by bombers. But on the 30th *Luftflotte 2* resumed the day offensive with attacks on targets in Kent and Bedfordshire.

In the morning a layer of cloud some 7,000 feet over Kent increased the difficulties of the defences by hampering the work of the

¹ For details, see Appendix XVI.

Observer Corps. With only an imperfect picture of the enemy's movements before him, towards half-past eleven Park nevertheless became aware that his sector stations in Kent and Surrey were threatened by forces approaching from the south. Many of his squadrons had already been airborne for some time and several were committed to action with outlying German formations. He therefore took steps to meet the threat by bringing one squadron westwards from the neighbourhood of Maidstone to guard Kenley, reinforcing them with the rest of the fighters stationed there, ordering up a squadron stationed at Biggin Hill to guard their base, and seeking reinforcement from No. 12 Group. Impeccable in theory, these arrangements unfortunately broke down in practice. Moving south to join the squadron which had come from Maidstone in an attack on a German formation over Surrey, the fighters from Biggin Hill left their base in the sole care of a reinforcement squadron from No. 12 Group. Meanwhile a second German force slipped by and bombed the station unseen by its protectors, though the attackers were later brought to action by the remaining squadron left behind at Kenley. In the whole series of engagements the Luftwaffe lost at least six aircraft and Fighter Command eight aircraft and five pilots; but more serious than these combat losses was the damage done to Biggin Hill, which Park and his subordinates had been at some pains to protect.

A worse blow followed in the afternoon. Soon after four o'clock a substantial German formation, though intercepted over Sheppey and forced to jettison part of its load there, succeeded in reaching Luton, where a heavy attack on the town and civil airport killed about fifty people and damaged the Vauxhall factory; and while ten squadrons ordered up in consequence were returning to their bases a smaller formation, intercepted by a single squadron which failed to halt it, put Coastal Command's aerodrome at Detling out of action for fifteen hours. Another dropped some bombs at Lambeth. Fifteen minutes later yet another small force surprised the defences by flying swiftly to Sheppey and then turning south to make an accurate and devastating attack on Biggin Hill. The bombers were fewer than ten in number and dropped less than fifteen tons of bombs, but damage to the station was far heavier than that done earlier in the day. Wrecked workshops, stores and hangars, the severance of power, gas and water mains and the loss of sixty-five officers and other ranks killed or wounded combined to make the setback one of the worst that Fighter Command's ground organisation had yet suffered.

Thus ended a day on which Fighter Command made the largest number of sorties they had yet flown and the Luftwaffe their biggest daylight effort since the middle of the month. In the twenty-four hours the Germans lost thirty-six aircraft and Fighter Command ten fewer.

Next day a still larger effort by the Luftwaffe began a week of heavy attacks on sector-stations vital to the defence of London, fortunately interspersed with raids on objectives less important to the air defences. At the same time the ratio of casualties inflicted to those suffered became less favourable to our squadrons, though over the whole week the defences still succeeded in destroying about as many aircraft as they lost. More precisely, from 31st August to 6th September Fighter Command lost 161 aircraft, the Luftwaffe 189. Of the latter the Germans estimated that 154 were shot down by the defences and the rest destroyed or damaged beyond repair in other ways.

For Dowding and Park the week was therefore the most critical of the whole battle. The brunt of the fighting was borne by a score of single-seater squadrons and some four hundred pilots in No. 11 Group. The Commander-in-Chief had sanctioned arrangements for the tactical reinforcement of the group by squadrons from the flanking sectors in Nos. 10 and 12 Groups; he also allowed its Hurricane and Spitfire squadrons a bigger share of fully-qualified pilots than those in other groups. But he was not prepared to play into the enemy's hands by denuding outlying sectors of their squadrons, nor was he ready to strip those squadrons of good pilots for the benefit of one corner of the kingdom. Park had therefore to meet the crisis by doing everything he could to cut down losses without exposing his vital sector-stations by refusing battle. Some of his sector commanders suggested that he should seek a higher ratio of losses inflicted to pilots lost by using larger tactical formations. He agreed that big formations were desirable in themselves, but feared that the delay involved in their assembly would reduce his chances of intercepting German bombers before they reached their targets. Nevertheless, he accepted the principle that as far as possible squadrons should engage in pairs instead of singly, ordering that squadrons from adjacent sectors should, when time allowed, be brought together before they were sent forward to engage the enemy. Like Dowding, he believed this to be a sound move only when the enemy's objectives lay some distance from the coast. Another school of thought, which favoured big formations even at the cost of delaying engagement until the enemy had bombed his targets, had not yet become vocal. Later it found some highly-placed adherents, notwithstanding the directive which called on Dowding to think first of defending aircraft factories.¹

Meanwhile the virtual loss of Manston and the damage already done to Biggin Hill and Kenley gave Park ample warrant for the view that he must protect his stations at almost any cost. But unfortunately their protection was difficult even when he and his controllers did their utmost. On the 31st elaborate measures to guard

¹ See p. 79.

aerodromes north of the Thames Estuary proved insufficient, largely because at least one German fighter escort was too strong to be breached by the single squadron which engaged it. A bold engagement by nine Hurricanes of No. 111 Squadron probably saved Duxford, the bombs intended for that place being scattered unprofitably over Essex, Cambridgeshire and Suffolk. But another German force reached Debden without much interference from the several squadrons in the neighbourhood, and bombed the station heavily. Later in the day the story was repeated at Biggin Hill and also at Hornchurch, though the second was not badly damaged. At the first, on the other hand, accurate bombing set the operations block on fire, and did much other damage to buildings and communications. Coming on top of the previous day's attacks, the effect of this new blow was such that two of the three squadrons based at Biggin Hill had to be withdrawn and put under the control of adjacent sectors for more than a week afterwards.

Events during the next few days followed much the same course. Biggin Hill, Hornchurch, North Weald and West Malling, besides other and less important stations, were all bombed once or more in the first five days of September. Nominally, the new system of engaging more frequently with pairs of squadrons was introduced on 2nd September, but practically it made no difference to the fighting. Almost without exception large, well-knit fighter escorts seriously outnumbered our formations, so that often our pilots were prevented from getting at the bombers.

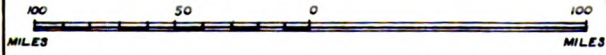
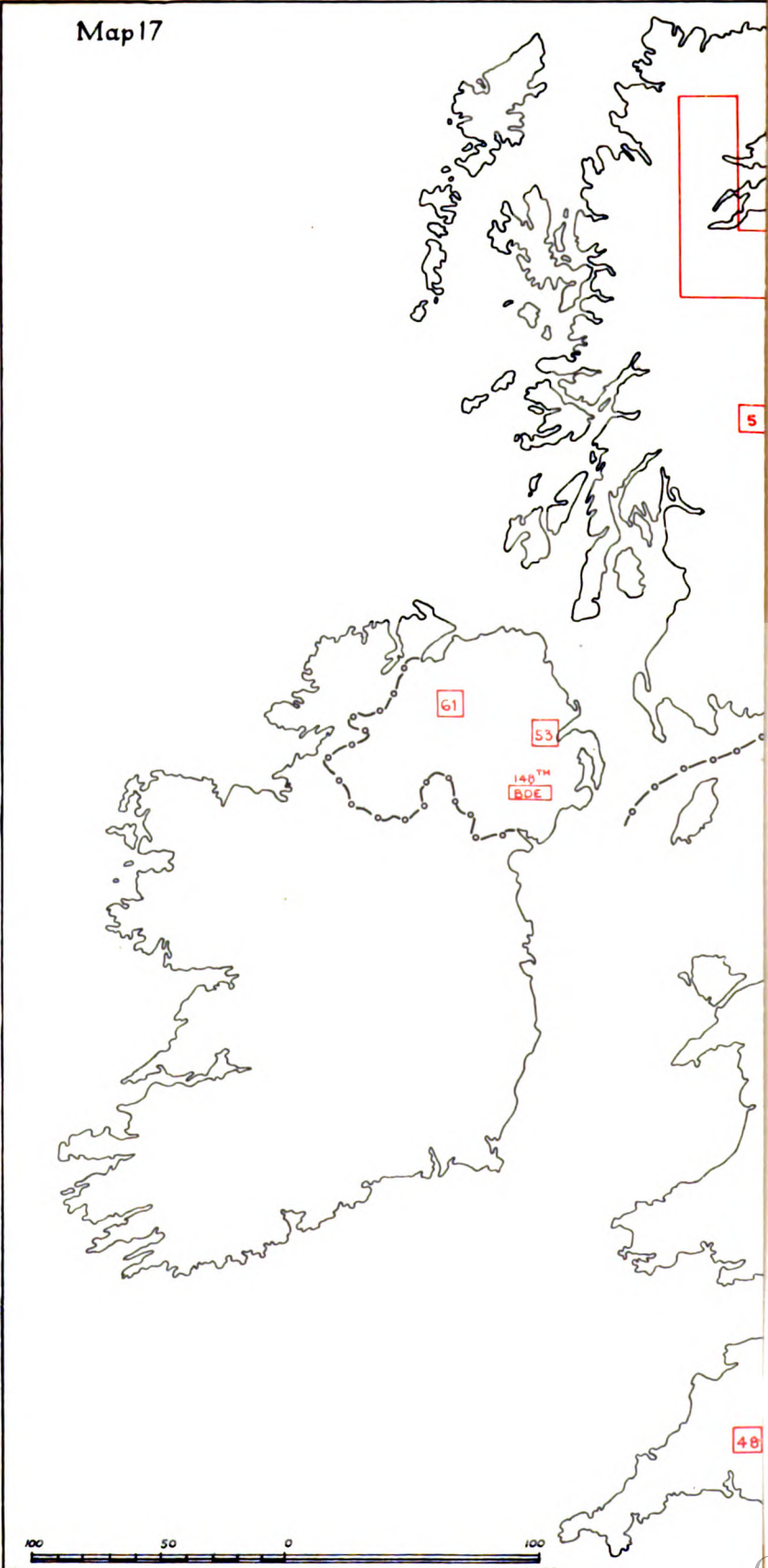
Happily the besetting sin of the German planners came to Fighter Command's aid. Too easily satisfied with incomplete successes, they failed to hammer their advantage home. Even as early as 1st September, when part of the German effort was diverted from aerodromes to the docks at Tilbury, signs of a coming change could be detected. Two days later factories in the Medway towns and at Weybridge were included among the German targets and the only air force stations hit were the relatively unimportant Lympne and Bradwell. Finally, on 6th September heavy bombing of oil installations at Thameshaven sketched the outline of a new plan of attack.

For Park the change came none too soon. In the course of the offensive, and particularly during the last few days, five forward aerodromes and six of the seven sector-stations in his group had suffered extensive damage, in several cases serious enough to impair the efficiency of the squadrons using them. Another week of such attacks might have been disastrous, for any further damage to the sector-stations would seriously have prejudiced the subsequent defence of London. 'Had the enemy continued his heavy attacks against Biggin Hill and the adjacent sectors,' he wrote a few days later, 'and knocked out their operations rooms or telephone communications,

the fighter defences of London would have been in a perilous state during the last critical phase when heavy attacks have been directed against the capital.' As it was, the premature switch to London, though it did not relieve him of anxiety, gave time for essential repairs and for some administrative changes which helped him to surmount the crisis.

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Map 17



CHAPTER XIV
THE INVASION RISK:
THE CRISIS AND AFTER

(September, 1940–June, 1941)

(i)

IN JULY and August, while German plans and preparations for invasion were moving towards the position shown in Map 13, British anti-invasion forces were doing their best to overcome the deficiencies so evident in May and June. By early September, Home Forces were stronger than in the summer, though still uncomfortably weak. About half the twenty-seven infantry divisions had had little collective training. Four divisions were fully equipped, eight fairly well equipped; the rest lacked much important gear, especially transport. Four light anti-aircraft batteries, with forty-eight guns, were ready to co-operate with the Field Army for defence against dive-bombing; but several times that number would not have been too many. Troops intended to serve as mobile brigade groups were of good quality, but lacked experience of *Blitzkrieg* tactics; and unrehearsed arrangements for bomber, fighter and training aircraft to share in a joint-service effort against the invader would doubtless have come up against many difficulties in practice.

Notwithstanding these deficiencies, the Field Army was considerably better off than in the early summer. Since the middle of June the number of field guns in service had increased substantially, 425 25-pounders having been added, of which 194 were new and the rest converted pieces. Two-pounder anti-tank guns had increased likewise from 176 in June to 498 at the end of August; and in early September the armoured units possessed some 240 medium and 108 cruiser tanks, all armed with two-pounders. Between midsummer and the early autumn the number of light tanks armed with machine-guns also increased threefold, rising from 178 in mid-June to 514 at the beginning of September. Against an enemy well equipped with armour, light tanks would, however, be of doubtful value.

In other respects good progress was made during the summer months. The Local Defence Volunteers, renamed the Home Guard on 31st July and now nearly half a million strong, had become by

September a valuable adjunct to Home Forces. Organised to fight in the neighbourhood of their homes, the volunteers provided a network of defended villages, parishes and townships which would hamper the consolidation of troops landed from the air in inland districts, and would reinforce the static defences near the coast. Afterwards mobile detachments equipped with motor-cars, motorcycles and bicycles were formed among the younger men. Meanwhile the process of strengthening and supplementing the coast defences, described in Chapter VIII, was in full swing, though the widespread system of fixed defences, local naval defences and minefields thought necessary since the fall of France was still some way from completion. To complement the extended East Coast mine-barrage, whose installation had been taken seriously in hand after the German occupation of the Dutch and Belgian seaboard and was finished in August, the Northern barrage from the Orkneys to the Faeroes was begun on 10th July, and the South-Western barrage from Cornwall to Eire on the 26th. (See Map 9.) New minefields off Northern Ireland were put in hand on 11th September; meanwhile the Dover barrage was strengthened and local minefields were laid off South Coast ports.

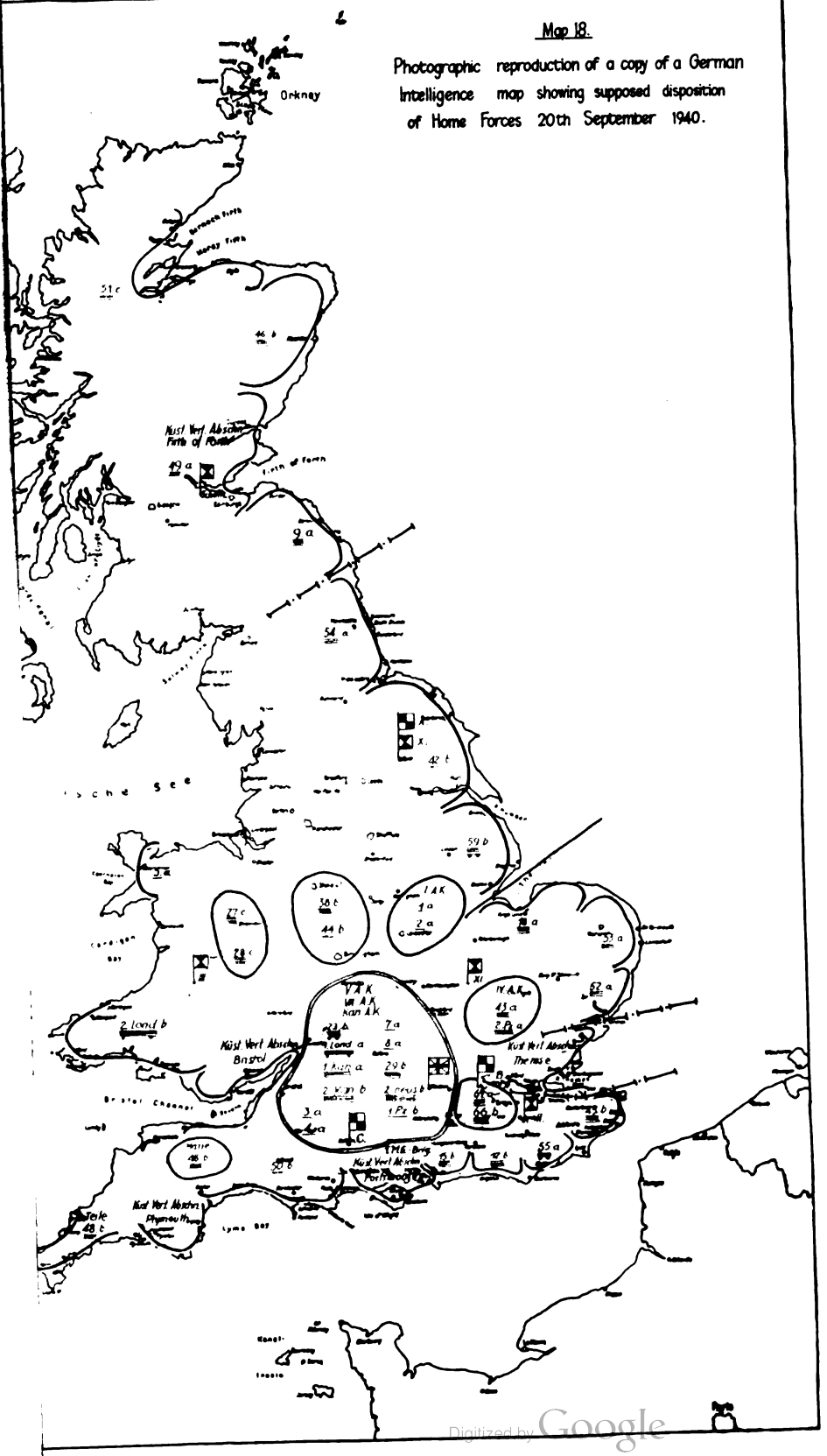
The disposition of Home Forces in early September conformed generally to the revised plan drawn up in July.¹ The greater part of the mobile reserves were behind the sector from the Wash to Newhaven, where a landing-force could be most easily covered by fighters working from Continental bases and would be on the shortest route to London. Elsewhere landings would have to be contained by local garrisons, which could expect no immediate assistance from the general reserve and would depend on the navy and air force to cut off reinforcements and supplies. The G.H.Q. Reserve consisted of two corps north and south of London. Most of the IVth Corps, comprising the 2nd Armoured Division, the 42nd and 43rd Divisions and the 21st Infantry Brigade Group, straddled the border between the Home Counties and East Anglia; the VIIth Corps, comprising the 1st Armoured Division, the 1st Canadian Division and the 1st Army Tank Brigade, were in Surrey. To supplement the passing of orders by field telephone and General Post Office lines at the disposal of Home Forces, units had been issued with civilian wireless sets, and an army broadcasting station had been set up to disseminate authentic information and so counter false reports which might be spread by German agents. Despite the progress made in recent months, shortage of armour and inadequate experience of mobile warfare were still outstanding weaknesses.

Across the Channel the situation early in September was that all first-wave divisions had reached their assembly areas or would do so

¹ Map 17 shows the disposition of Home Forces on 11th September; Map 18 what the German High Command believed to be the position nine days later.

Map 18.

Photographic reproduction of a copy of a German Intelligence map showing supposed disposition of Home Forces 20th September 1940.



by about the middle of the month. By 4th September 168 transports totalling 704,548 tons, 1,910 barges, 419 tugs (including trawlers) and 1,600 motor-boats had been requisitioned. Except in the case of tugs these numbers substantially exceeded the estimate of requirements made by the Naval Staff six weeks before.¹ The German Naval Staff expected the fleet to be ready by the 19th, but needed ten days' warning to do the necessary minesweeping and lay their own tactical minefields on the flanks of the cross-Channel route. In other words, if troops were to land in England on the 21st—the earliest day now contemplated—the Führer would have to give preliminary orders on the 11th.

In early September the Führer was still uncertain whether 'Sealion' should be carried out or not. Whatever may have been his opinion of the inherent value of the operation, he was in no position to give positive orders for its execution until a substantial victory had been gained over the opposing air force. But such a victory might itself lead to a situation which would make 'Sealion', with all its risks, unnecessary. When the 11th came he therefore renounced any intention of giving the preliminary order before the 14th. German air losses on the 11th were smaller than those inflicted on Fighter Command; and after a quiet day on the 12th he announced on the 13th that, in view of the apparently hopeful but still uncertain situation in the air, the moment to launch 'Sealion' had not yet come. After a discussion with the heads of the three services next day he postponed the warning date for three more days, thereby abandoning any prospect of beginning the invasion before 27th September—incidentally the last day, until 8th October, when moon and tide would favour a landing.

Meanwhile the Luftwaffe had taken steps calculated to ease the task of supporting a Channel crossing, but equally convenient for the next stage of an independent air offensive. Early in September *Luftflotte 2* assumed command of *Fleigerkorps VIII*, a formation hitherto under *Luftflotte 3* and responsible for a number of bomber and fighter units based in Normandy. Thereupon most of the dive-bomber units hitherto divided between the two *Luftflotten* were concentrated under *Luftflotte 2* near the Straits of Dover. At the same time the two incomplete bomber *Geschwader* previously under *Luftflotte 5* moved south from Norway and Denmark to Holland and Belgium, where they too came under Kesselring's command. Thus on the morning of the 7th—a day of crisis for the British High Command—nearly six hundred serviceable bombers and dive-bombers and some seven hundred fighters, besides reconnaissance and minelaying aircraft, were available to Kesselring either to continue the air war as an independent

¹ See p. 176.

operation, or to support a landing by the 16th Army if he were told to do so.¹ Further west, Sperrle could call similarly on some three hundred and fifty serviceable bombers and dive-bombers and about a hundred fighters, either for his own purposes or to support the 9th Army and, if necessary, the 6th Army also. By these moves the resources of General Stumpff in Scandinavia were reduced to a few reconnaissance and minelaying aircraft and some short-range fighters.

To sum up, by the middle of September the enemy's dispositions for the invasion of this country were either complete or on the threshold of completion. All he lacked to make invasion a reality was control of the intervening skies and waters, which alone could give him power to put the venture into execution if he chose to do so.

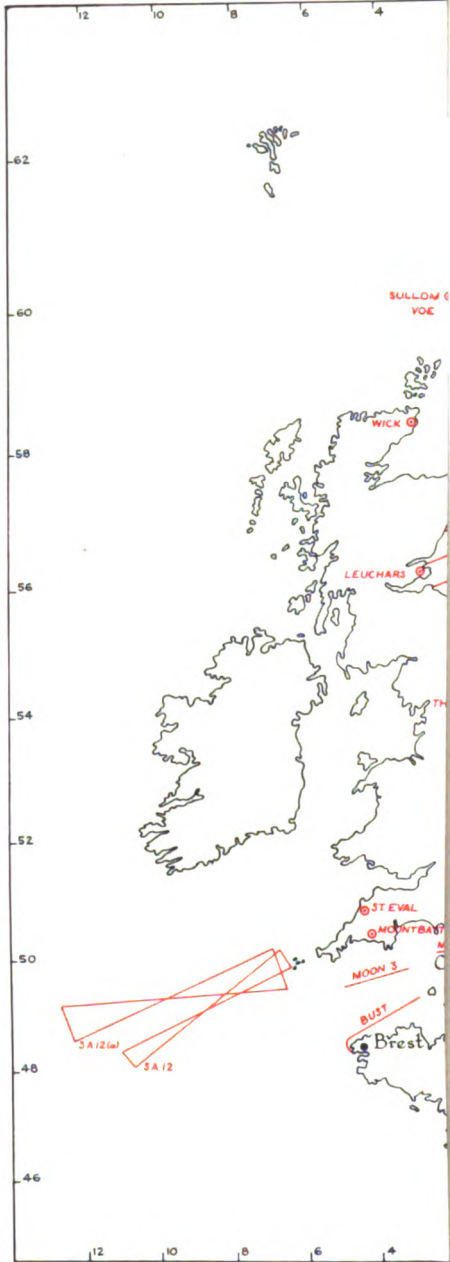
(ii)

A great part of these arrangements was hidden from the British High Command by the proverbial fog of war. By the late summer the Prime Minister and Chiefs of Staff had ceased, indeed, to fear a landing in Scotland from Norwegian harbours, despite German efforts to create the impression that such a move was contemplated. But whether the enemy meant to come across the North Sea or across the Channel was not known, and his probable strength was at first equally uncertain. On the other hand, he could not sail without first assembling a mass of shipping which would not easily escape detection. Hence air photographs, supplemented by shrewd guesswork and time-honoured sources of intelligence, ultimately revealed the state of his preparations fairly clearly.

We have seen in Chapter VIII that up to the end of August the Combined Intelligence Committee—often aptly though inaccurately called the Counter-Invasion Committee—found no evidence that such preparations were well advanced. But the next few days brought a marked change. Frequent cover of the coastal strip from the Texel to Cherbourg showed a striking increase in the numbers of barges at ports between Ostend and Le Havre, the number at Ostend alone increasing from eighteen on 31st August (and none on the 28th) to two hundred and seventy on 7th September. During the same week many barges, motor-boats and larger vessels were seen or photographed moving westwards from the North Sea coast towards the Channel ports, where the arrival of most of them was subsequently confirmed by further photographs. At Flushing about a hundred barges were found on 4th September to have arrived since the beginning of the month; at Dunkirk and Calais substantial arrivals

¹ For details, see Appendix XVII.

Map
COASTAL COMMAND
26th Septe



MOON 1 } At dusk to continue after nightfall
MOON 2 } there is a reasonable possibility of
MOON 3 } a large convoy or the wake of fast

DUNDEE } Once every 24 hrs
MATCH }
BUST } Twice daily preferably near dusk
Oct 5th.

were attested in the next two days. Thus by the morning of the 7th there was much evidence from reconnaissance alone to suggest that an early landing might be expected.

Other indications which did not escape notice were the movement of *Kampfgeschwader 26* and *30* to the Low Countries and the assembly of dive-bombers near the Straits. As if to clinch the matter, four Germans caught landing from a rowing-boat on the South-East Coast confessed that they were spies, whose task was to be ready at any time during the next fortnight to report movements of British reserve formations in the quadrilateral Oxford-Ipswich-London-Reading.

Observing that conditions of moon and tide on the South-East Coast would particularly favour a landing between the 8th and 10th, the Joint Intelligence Committee (to whom the Combined Intelligence Committee reported) therefore informed the Chiefs of Staff on the 7th that invasion might be imminent.

At a meeting which began at twenty minutes past five that afternoon the Chiefs of Staff agreed that imminent invasion had become a possibility. On looking into the states of readiness of the defence services they found that the navy had already put all small craft at immediate notice during the hours of darkness and at short notice by day. Thus the local naval commands were substantially ready to go into action without further warning. Short of bringing the Home Fleet southwards, nothing remained to be done where naval measures were concerned. The air force had already come to a state of readiness which envisaged a landing within three days; accordingly, twenty-four medium bombers stood constantly ready to co-operate with Home Forces at half an hour's notice, while half the remaining medium bombers had been earmarked for special tasks as soon as invasion was under way. The civil departments had received no special warning; in Home Forces troops 'stood to' daily at dawn and dusk and otherwise were at eight hours' notice. No provision had been made for any stage of readiness intermediate between eight hours' notice and 'immediate action'. After a discussion attended by Lieutenant-General B. C. T. Paget, Chief of Staff to General Brooke, the Chiefs of Staff took note that 'immediate action' would be ordered for troops in Eastern and Southern Commands.

Meanwhile the prospects of invasion were being studied at G.H.Q., Home Forces, in the light of the information available there. At seven minutes past eight that evening the signal 'Cromwell' was issued from that headquarters to Eastern and Southern Commands, to all formations in the London area and to the IVth and VIIth Corps in G.H.Q. Reserve, which were thus brought to 'immediate action' by the only practicable method.¹ Other commands received

¹ General Brooke was absent on duty at the time; General Paget, as we have seen, attended the meetings of the Chiefs of Staff that afternoon. According to the recollection

the signal for information only. Thereupon forward divisions affected by the warning took up action stations. In some parts of the country certain Home Guard Commanders, acting on their own initiative, called out the Home Guard by the ringing of church bells, thereby giving the impression that German parachutists were already descending on the countryside. Amidst the prevailing atmosphere of expectancy reports were received that parachutists had actually landed and that fast German motor-boats were approaching the coast, but on investigation all were shown to be without foundation.

Apart from these local excitements, reinforced by the solid reality of an air attack on London, the night passed peacefully enough. Next morning General Brooke made it clear that church bells were to be rung by order of a member of the Home Guard only if he had himself seen at least twenty-five parachutists descending, and not because other bells had been heard or on the strength of second-hand reports. He also explained that the code-word 'Cromwell' was not meant to call out the Home Guard permanently and as a whole in areas where it applied, but only certain units needed for special tasks.

Naval measures to resist invasion were carried a stage further on 13th September, when the *Nelson* and the *Hood* moved from Scapa Flow to Rosyth. The battleship *Revenge* had already been ordered to Plymouth and moved later (on 11th October) to Spithead. The system of air reconnaissance patrols, already modified early in August, was again adjusted to improve the chances of detecting an invasion force in the Channel, and ultimately assumed the form shown in Map 19. The two Coastal Command groups responsible for most of the patrols—Nos. 16 and 18 Groups—could now call on the equivalent of some nineteen squadrons, as compared with fifteen in the early summer.¹ Patrols west of 3° W. were flown with aircraft spared with difficulty from long-range convoy-escort by No. 15 Group.

Apart from purely defensive measures something could be done, and in fact was done, to frustrate German preparations or at least to hamper them. As early as the end of June Bomber Command had been ordered to co-operate with Coastal Command in attacking barges; and earlier in the month a naval air squadron had bombed barges at Scheveningen. On 4th July the Air Ministry gave Bomber Command formal directions to pay special attention to enemy ports and shipping in view of the prospect of invasion. But this, as we have seen in Chapter VIII, was only one of several tasks assigned to the bomber force. The outcome was that in the whole of July and August

of General Paget's deputy, Brigadier (later Lieutenant-General Sir John) Swayne, Brigadier Swayne authorised the despatch of the signal on his own responsibility before the outcome of the meeting of the Chiefs of Staff was known to him and on the assumption that neither of his superiors was available for consultation.

¹ For details, see Appendix XVIII.

Bomber Command aimed some 66 tons of bombs at barges and shipping outside Germany, 468 tons at aerodromes also outside Germany, and 1,454 tons at German industrial targets and communications. Coastal Command, with its small striking power, aimed some 58 tons at dockyards, shipping, aerodromes and oil-tanks. In terms of the effect of German preparations for invasion, probably the most successful of all the attacks was that made on 12th August on an aqueduct over the Dortmund-Ems canal by five Hampdens, each carrying one bomb. The crews were told to drop their bombs from a low altitude under cover of a high-level diversionary attack by six more Hampdens. Two of the five were shot down as they approached the target, but one crew succeeded in planting their bomb just north-east of the aqueduct in face of intense anti-aircraft fire. For this exploit, which blocked the canal for ten days and thereby delayed the movement of motor-boats to the invasion ports, Flight Lieutenant R. A. B. Learoyd, the captain of the successful aircraft, was awarded the Victoria Cross.

Although pressed home with gallantry, attacks on aerodromes were less effective. In July and August Bomber Command flew 1,097 sorties against aerodromes in the occupied countries and lost 61 aircraft. They destroyed five German aircraft on the ground and damaged twelve. Damage to the aerodromes themselves escapes precise assessment, but seems to have caused the enemy no serious embarrassment.

One excellent reason for not sending large numbers of aircraft to attack barges in July and August was the lack of suitable targets. The flow of traffic to the Channel ports in early September removed that objection and gave new urgency to the demand for such attacks. Accordingly, on the nights of the 5th and 6th Bomber Command devoted most of the Blenheim medium bombers to the task. Next night twenty-six Hampdens and eleven Battles joined the Blenheims. Afterwards barges and shipping in French and Belgian harbours became the main objective of the whole bomber force, absorbing about three-quarters of the total effort for the month and attracting more than a thousand tons of bombs. On the 13th, when for the first time the whole night's effort was exerted against ports and shipping, ninety-one sorties were flown for the purpose, and on the next night nearly twice that number. On the 17th eighty-four barges were sunk or damaged at Dunkirk and by the 19th the cumulative total had reached upwards of two hundred.

Partly in consequence of these attacks, which made the nearer Channel ports exceedingly unsafe anchorages for German transports, the Royal Navy found fewer good targets for their guns than might have been expected. On the night of 8th September ships of the 2nd Cruiser Squadron sent to bombard Calais and Boulogne could find

no ships at Calais; and as no barges were seen there either, fire was withheld. At Boulogne thick weather allowed only a short bombardment. Next night destroyers of the 21st Flotilla found no ships at Calais and scarcely any at Boulogne. On the 10th, two destroyers and an escort vessel fared better off Ostend, where they opened fire on trawlers as well as barges. Other spoiling operations in September and October included frequent sweeps off the French coast by destroyers and motor torpedo-boats, as well as a bombardment of Cherbourg in the early hours of 11th October by the battleship *Revenge*, escorted by seven destroyers and six motor gunboats.

(iii)

Apart from their physical effects, which were substantial but not overwhelming, the air attacks made on invasion ports in September challenged a tendency among some members of the German High Command to assume that the Royal Air Force was on its death-bed. The British bomber force was known to have been mulcted of some pilots to replace losses in the fighter force; but the attacks proved that it could still put out a substantial effort on its own account. Fighter Command drove home the lesson on the 15th, when heavy air battles over southern England cost the Luftwaffe sixty aircraft.¹

A week earlier the German Naval Staff had remarked that the undisputed air supremacy needed for invasion was still to seek, but that possibly its attainment was close at hand. Discovering within the next few days that, although losses sustained so far could be made good from reserves, the roadsteads off the principal Channel ports could not be used as night anchorages for transports while bombing continued, they had since become less hopeful. They were also worried by the failure of the Luftwaffe to take effective action against the British fleet. Remarking that this omission would throw the whole burden of protecting the seaward flanks of the cross-Channel route on to minefields, which could never be a sufficient safeguard, they came to the conclusion that 'Sealion' could not yet be carried out. On 13th September Admiral Raeder told the Führer that Göring's efforts in the air had hitherto failed to 'provide conditions for carrying out the operation'; two days later he was still of the opinion that invasion would be a desperate gamble.

In the next few days bad weather continued to hamper final preparations for the expedition, including minelaying. At the same time forecasts gave no hope of a long spell of fine weather in the near future. Accordingly, the Naval Staff were still in favour of holding

¹ See Chapter XV.

back when, on the 17th, the time came for the preliminary order for 'Sealion' to be given or withheld. Meanwhile British air opposition showed no sign of decreasing. In these circumstances the Führer decided that 'Sealion' must be postponed. He ordered that the possibility of a landing in October should be borne in mind, but that meanwhile the invasion fleet should be partly dispersed in order to prevent further losses. By 21st September more than a tenth of the transports and barges assembled or on their way to their assembly-points had been lost or damaged through British action.¹ Moreover, as the Führer may have suspected, the disposition of most barges was now known with considerable accuracy in Whitehall from the study of air photographs.

In effect, these orders disposed of the chance of a landing before the winter. Inevitably a point was soon reached where any further dispersal of the fleet, if thorough enough to give protection against bombing, would prevent the ships from reassembling in time to carry out the plan. Substitution of a new plan involving a longer interval between preliminary and executive orders was mooted but not officially adopted; in any case its execution so late in the year would have been difficult. Hitler was thus forced in October to choose between stoppage of dispersal and indefinite postponement of the whole project. He chose the latter. On the 12th he renounced a landing in 1940, promising the heads of the fighting services that they should have good warning if he later decided to try invasion in the spring or early summer of 1941. He ordered them meanwhile to continue preparations calculated to put pressure on the enemy, and to improve the fitness of their commands for the call that might eventually be made upon them. Finally, early in January, 1941, he ruled that all preparations for 'Sealion' should be stopped except the development of special equipment and measures of deception.

The scattering of the invasion fleet did not go unremarked in London. As early as 20th September six destroyers and a torpedo-boat photographed at Cherbourg on the 18th were seen to have left, and arrivals at Brest in the next few days left their destination in little doubt. Similarly there was an obvious dwindling of barges in the invasion ports, the total visible in the five main ports from Flushing to Boulogne declining from 1,004 on 18th September to 691 in the last week of September and 448 in the last week of October. At

¹ According to German sources the numbers of craft assembled and lost or damaged were:

	<i>Assembled</i>	<i>Lost or damaged</i>
Transports (including 4 in transit) . . .	170	21
Barges (including 424 in transit) . . .	1,918	214
Tugs (including those in current use) . . .	386	5

In addition, 1,020 motor-boats had left for invasion ports; three of these had been put out of action.

Flushing itself the number quickly fell from 140 to 45, but in late September practically all the missing barges were seen lying in a neighbouring canal. The number at Ostend decreased in the same proportion, and here some barges were actually photographed moving inland along the canal which connects Ostend with Bruges. At Dunkirk the number increased slightly towards the end of the month, only to fall sharply in October, while at Calais and Boulogne the fall was steady.

These facts were plain enough, but their interpretation was no easy task. Dispersal to avoid loss through bombing was an obvious motive, but the deeper implications of the move were hard to fathom, especially as much of the information given by reconnaissance seemed contradictory. Photographs taken in late September and October, while dispersal was in full swing, showed ramps apparently intended for rapid embarkation and disembarkation. They also revealed twin barges of mysterious pattern, presumably connected in some way with invasion. On the other hand, widespread evidence of constructional work on aerodromes, particularly in Holland but also as far afield as Brittany and Norway, might well mean that the enemy was discarding invasion in favour of an all-out air offensive. An added complication was the chance that, under cover of the bustle so plainly evident across the Channel, unseen preparations might be going on in Baltic ports beyond the range of air reconnaissance. A new long-range version of the Spitfire set that doubt at rest on 29th October, when photographs of Stettin, Swinemünde and other ports not previously covered were at last obtained and revealed nothing of great consequence.

Meanwhile a few barges which put to sea on exercises had been sunk by bombing or bad weather. Some thirty-six bodies of German soldiers were washed up at various points between Yarmouth and Cornwall. Hence arose a widespread belief that an invasion fleet had actually sailed and had been badly mauled by our defences. But naturally that belief was not shared by the British Government, the Chiefs of Staff or other authorities whose access to the reports of the Combined Intelligence Committee had enabled them to watch the tide of German preparations flow early in September and mysteriously ebb some three weeks later.

(iv)

Confusing in many ways as were the signs revealed by air reconnaissance after the third week in September, by the end of the following month—or, as some thought, earlier—they justified the inference that an expedition from the Channel ports was no longer imminent. With

Map 20



the coming of autumn the Admiralty withdrew instructions which had restricted the movements of the Home Fleet while the danger seemed acute. Soon afterwards they ruled, however, that the Auxiliary Patrol designed to give warning of approaching seaborne forces should be maintained throughout the winter. Thereafter a growing threat to merchant shipping on the Atlantic convoy-routes forced them to disperse a large part of the Home Fleet to distant ports for the greater safety of convoys and to divert to trade-protection more than half the light naval forces hitherto allotted to defence against invasion.¹

Whether, and at what time, the danger might be expected to recur were points not easily determined. If the threat of invasion were revived, light naval forces would again be badly needed, though it was hoped that those available for the purpose would be increased by some or all of the fifty American destroyers whose exchange for certain rights conceded by this country had now been sanctioned by the President of the United States. The Chiefs of Staff were confident, however, that if the enemy did decide to try again, his preparations would attract our notice at least some weeks before his fleet could sail. They considered, therefore, that the transfer of naval forces from trade-protection back to counter-invasion duties could safely be left until the threat declared itself. When the time came the necessary changes could be made in five to seven days. To lessen the risk of bombing and of mines laid by German aircraft in East Coast estuaries, counter-invasion forces which then came south would be based on the western half of the Channel, and a cruiser squadron on Rosyth. As the expected warning would not enable the Admiralty to gauge the exact time of invasion, a delay of twelve hours must be expected before the ships could reach the landing-area.

Army plans and dispositions for the winter were governed by broadly similar assumptions. Reviewing the chances of invasion before the spring, the Government concluded at the end of October that a major landing within the next five months could be discounted except in the south-east. Their view was that German troops might still be put ashore from self-propelled barges between the North Foreland and Dungeness and that landings from transports might be made in small harbours and on beaches from Orfordness to Poole. Elsewhere only small diversionary expeditions need be feared.

Calculating that two field divisions kept forward in the neighbourhood of Dover and one in Norfolk would suffice to meet this reduced threat, General Brooke proposed to withdraw the rest for training, leaving the defence of beaches elsewhere to troops of lower category. By November seven County Divisions, with an establishment of

¹ See Chapter XVIII.

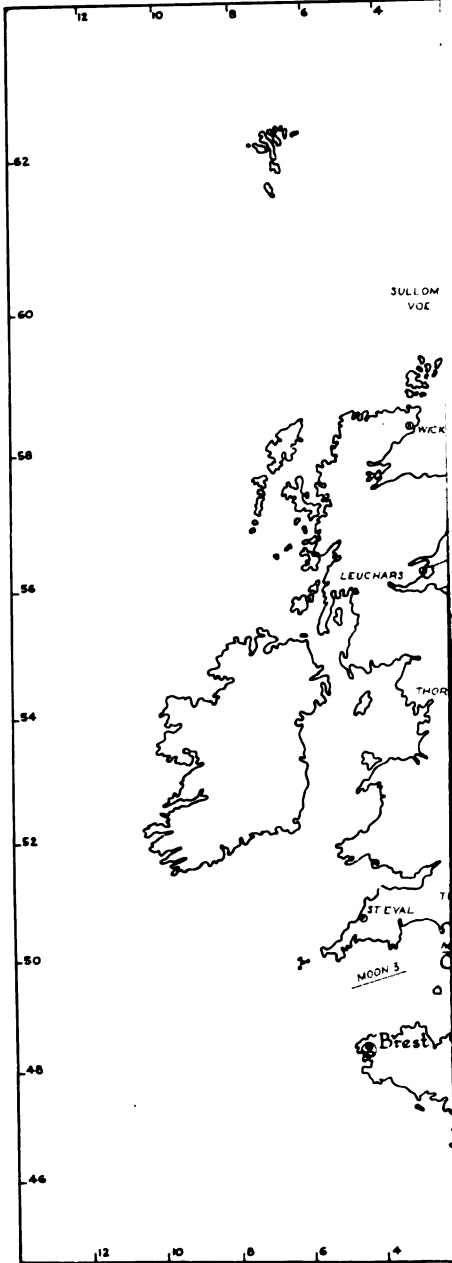
10,000 of all ranks apiece instead of the 15,500 allotted to the field divisions, and with little artillery or transport, were available for these duties. Plans had been made to build them up to full scale, but lack of manpower threatened postponement. Meanwhile withdrawals overseas had reduced the number of full-scale divisions at home to twenty-two, of which six were under orders to go abroad or earmarked for the purpose. In addition, one armoured division remained in the United Kingdom and three more were being formed. To ensure an adequate number of trained troops at home after the winter, the Government and the Chiefs of Staff therefore fixed the rate of overseas reinforcement for the period from January to June at one division a month, with the proviso that the strength at home must not be allowed to fall below twelve divisions in reserve, apart from troops on the beaches.

These arrangements at last gave Brooke a chance of putting the Field Force through a much-needed course of training in mobile warfare. The bulk of the troops spent the winter learning to go into action immediately after completing forced moves of up to two hundred miles in mechanised transport or forty miles on foot. Routes appropriate to every imaginable contingency were reconnoitred; comprehensive schemes for the control of military traffic and the movement of refugees were drawn up; and rehearsals for the hypothetical battles of 1941 included practice in rounding up parachutists who might be landed to block communications. On completing their training the divisions took up the positions shown in Map 20.

The winter also gave time for a further overhaul of arrangements for higher command and for co-operation between formations of different services. Eastern Command, which covered practically the whole of the probable invasion area from the Wash to the Channel coast, had too wide a commitment. Accordingly a new South-Eastern Command was formed to take care of the area south of the Thames and as far west as Western Command's new boundary just east of Portsmouth. Exercises designed to test plans for an all-out effort by the metropolitan air force against an invader provided some lessons whose interpretation gave the Air Staff much to think about. The defended ports were re-classified, the old categories appropriate to peacetime preparations giving place to a new division into 'major' and 'minor' ports.¹ In December, Coastal Command adopted a contingent plan of anti-invasion reconnaissance, to which effect would be given only when the danger reappeared; meanwhile anti-shipping and general reconnaissance patrols were continued in accordance with a scheme set out in Map 21. Finally, to ease the task of defending shipping in the North-West Approaches, in April the

¹ For details, see Appendix XIX.

COASTAL COMMAND SCHE
GENERAL RECONN
20th Decem



Admiralty assumed operational control of Coastal Command. The command remained under the Air Ministry for administration and training, its functions being substantially unchanged. Effect was thus given to an agreement between the Admiralty and the Air Ministry which had been reached in principle in the previous December.

On the approach of spring the Chiefs of Staff completed an exhaustive review of the possibilities of invasion in the coming season and of the resources available to meet the threat. They reasoned that the enemy would be eager to end the war in 1941, but would probably try all other means of doing so before he ventured on a gambler's throw. Nevertheless, they believed that full provision to resist a landing was indispensable. They estimated the strength of the German forces which might be used at six armoured, four airborne and twenty-six infantry divisions, supported by more than two thousand bombers and dive-bombers, fifteen hundred fighters and a thousand transport aircraft. They thought, however, that as many as fourteen thousand aircraft might conceivably be mustered if the enemy decided to stake all his capital on a colossal gamble.

The first part of this estimate was reasonable enough, but the second flattered the Luftwaffe considerably. Towards the end of March the German air force had on all fronts some nineteen hundred bombers and dive-bombers and seventeen hundred fighters, or with other categories a total of about five thousand machines, including transport aircraft. About two-thirds of these machines were serviceable. In the circumstances postulated by the Chiefs of Staff the total might have been substantially increased by squandering reserves and training units, but could scarcely have been raised to more than half the British estimate by even the most unbridled gambler. As for the air forces on the front immediately facing the United Kingdom, when the estimate was made removals to the Balkans and Sicily, with wastage incurred in recent night flying from wet aerodromes, had already weakened them considerably, and further transfers to distant theatres were in view. In the light of current knowledge the Chiefs of Staff were bound, however, to assume that units moved away from the Western Front might come back later in the year.

Meanwhile, as the Führer had predicted, the British Army was much better trained and equipped to resist invasion than in 1940, though the Chiefs of Staff would still have liked more armour. Hence they recommended that for the time being no armoured units should leave the country. In general, the Chiefs of Staff endorsed the measures already taken or contemplated by the fighting services. The bomber force, now some seven hundred aircraft strong and in process of re-equipment with heavier and faster bombers, seemed to them likely to do great damage to shipping which might reassemble in the nearer invasion harbours, and signs of readiness across the Channel

would, they thought, give reasonable time for the diversion of destroyers from trade-protection. Fearing a landing in Eire, which the navy and the air force might not be able to prevent, they recommended a strengthening of land forces in Northern Ireland; in other respects they could suggest no alteration of Brooke's dispositions, although their old fear that a force rushed across the Straits of Dover might escape our naval forces was still present. Finally, they summed up their opinion of the outlook by pointing out that, while invasion seemed to have grown less likely, 'the Germans, with their aerodromes already established in north-west Europe and with a highly-developed system of roads and railways, could always concentrate for invasion far more quickly than troops despatched overseas could be brought back to this country to meet the threat'. They concluded that, while their policy must be to avoid playing into the enemy's hands by keeping inordinately large forces mewed up in the United Kingdom, they must also avoid important overseas commitments other than those already existing in the Balkans and the Middle East. For in Europe a fresh phase in the struggle for control of the Balkans had just been opened by the decision of a new Yugoslav Government to resist the Axis powers; and in North Africa a critical stage had been reached with the arrival of German armoured formations and air forces to strengthen the discomfited Italians.

CHAPTER XV
THE BATTLE OF BRITAIN :
THE LAST PHASE¹

(7th September—31st October, 1940)

(i)

WE MUST now retrace our steps to the autumn of 1940 in order to consider the last phase of the daylight battle in the air.

The German plan for the final stage of the struggle for air superiority over southern England was promulgated by the Air Ministry in Berlin at the beginning of September, and confirmed a few days later by an order from the Führer. Not altogether without reason, Fighter Command were thought to have suffered severely during the phase now ending. Perhaps fortunately from the British point of view, instead of drawing the obvious conclusion—which would have led them to continue and intensify their damaging attacks on sector-stations—the leaders of the German air force seem to have decided that their best hope of victory lay in forcing Air Chief Marshal Dowding to commit his supposed reserve of relatively unscathed squadrons to the battle. This they hoped to do by seeking objectives further inland, and of such a kind that nothing was likely to be held back from their defence. To this argument the Germans may perhaps have joined the reflection that ruthless bombing of targets less obviously military than those they had hitherto assailed might so weaken the British will to fight as to bring surrender without the pains and risks of an opposed landing. Alternatively, the same process might make possible a landing in face of little more than token opposition.

Accordingly the German plan provided that, towards the end of the first week in September, a daylight raid on London should inaugurate a series of day and night attacks on the populations and defences of large cities. After the failure of Stumpff's venture on 15th

¹ The strength and location of Luftwaffe units at the beginning of the last phase are shown in Appendix XVII; for the equipment and location of the defences, see Appendices XX–XXII. A summary of operations is given in Appendix XXIV.

August, the German Air Staff had wisely concluded that day attacks by weakly-escorted bomber forces on targets at any considerable distance from the coast were inadvisable; but the new decision made observance of that rule impossible unless the bomber forces now to be used in daylight were limited to the numbers for which strong escort could be found.

Strategy apart, the new plan must be seen against a background of high policy whose influence is difficult to judge but cannot be ignored. On 25th August—the night after London had been unintentionally attacked by German bombers¹—aircraft of the British Bomber Command were sent to bomb military targets in Berlin. Three nights later the Germans made their first big raid on a British city by opening their series of attacks on Liverpool and Birkenhead.² The German Air Ministry issued their orders for the new phase of the battle on 2nd September, presumably after consultation with the Führer, whose directive authorising the measures then announced came three days later. In the meantime Hitler had stated publicly, on 4th September, that raids would be made on London as reprisals for British attacks on the German capital. That night a number of German bombers laid flares over London for purposes which can only be surmised; and on the next night a sharp attack was made on Rotherhithe and other dockland areas, although according to the German programme the new phase was not due to start until the 7th. Nevertheless, it would be rash to conclude that the change in German strategy was nothing more than the culminating move in an exchange of political discourtesies. If only for lack of evidence, it cannot be said that the leaders of the German air force were not genuinely moved by the hope that a change of targets would give them the air superiority which it was their task to win.

The new phase was heralded by signs and portents which did not escape observers in this country. The Luftwaffe had begun by attacking coastal convoys during the preliminary phase of their offensive; subsequently the bulk of their attention shifted first to forward aerodromes and then to sector-stations. We have seen that Luton was attacked in daylight at the end of August; and during the next week the enemy showed manifest interest in aircraft factories on the southern and western outskirts of London, and in the industrial and dockland areas between Tower Bridge and the Nore and on both banks of the Medway. Thus there was much, apart from Hitler's speech, to suggest that a change in German strategy was imminent, though not enough to show convincingly what form it might take. In any case continued attacks on sector-stations remained the biggest danger. Measures designed to speed repair of damaged aerodromes

¹ See pp. 207-8.

² See pp. 211-13.

and their communications included the establishment of twenty-seven Works Repair Depots in various parts of the country, the posting of detachments of Royal Engineers to more than twenty Royal Air Force stations south of the Thames, and provision for specially close co-operation between the air force and the War Group set up by the General Post Office on the outbreak of hostilities. On occasions in August when attacks like those made on Biggin Hill and Kenley threatened disruption of the fighter-control system, Post Office engineers assisted by the Royal Corps of Signals performed feats which earned the respect of every airman. But Dowding and Park feared that the system might nevertheless break down if continued bombing of sector-stations enforced undue recourse to standby operations rooms and other expedients designed to cope only with brief emergencies.

Accordingly, their plans still looked largely to the defence of aerodromes, though they also reflected increased concern for the security of certain other likely targets for the German bomber force. Since the end of August Park had been formally relieved of the obligation to provide close escort for Channel convoys; but his resources were certainly none too great for the heavy tasks which he still faced. After objectives near Brooklands aerodrome had been attacked on 4th September, the Commander-in-Chief instructed him to give 'maximum fighter cover' to factories in that neighbourhood during the next week; and the arrangements which he then made were so framed as to reconcile this new need with undiminished regard for the safety of his all-important sector-stations. Briefly, his intention was to offer the strongest opposition to incoming German forces after they had crossed the coast but before they reached the line of the sector-stations. The greatest number of squadrons which could safely be spared on a given occasion would therefore be sent forward of that line, in pairs if there was time to form them; and care would be taken that German bombers should not be missed through vain attempts to out-top the enemy's high cover. Adequate but not excessive numbers of squadrons would be held back to guard Kenley, Croydon and Biggin Hill; and the factories near Brooklands would look for their safety to reinforcements from No. 10 Group. Stations north of the Thames would be protected by Park's own squadrons until the arrival of reinforcements from No. 12 Group released them for the main battle.

(ii)

In accordance with the German plan, the new phase opened in daylight on 7th September with a raid on London and its eastern outskirts. Towards five o'clock that afternoon well over three hundred

bombers, escorted and covered by some six hundred single-engined and twin-engined fighters, were sent to attack docks and oil-installations along the lower reaches of the Thames. Some of these objectives had already suffered damage on the last two nights and in the course of daylight operations on the 5th.

When the blow fell Park was unavoidably absent from his headquarters, having been summoned to a conference at Stanmore. Whether in consequence of his absence, or because the threat developed with a gradualness which tended to obscure its gravity, or again because the picture given by radar was incomplete or because the enemy's objectives proved not to be the sector-stations round whose defence so much planning had revolved, the project which envisaged meeting the attacker in force at an early stage was not realised. The first arrival of the enemy in strength found a substantial part of No. 11 Group's resources deployed in single squadrons or smaller formations well back from the coast. (See Map 22.) Two squadrons from Northolt had formed a wing to patrol north-east of London, and one squadron, joined later by a flight from Croydon, had been sent to guard oil farms down-river, where fires kindled in earlier attacks had not yet been extinguished. In response to a request from Park's headquarters, a wing of three squadrons from No. 12 Group was on its way to protect No. 11 Group's stations north of the Thames. Meanwhile Hornchurch was guarded by one of Park's own squadrons, as was Gravesend on the south bank of the river; in addition half a squadron was just leaving to patrol North Weald, and elements of three more squadrons had been ordered to cover the line Hornchurch-Chelmsford. Other formations were over or near Canterbury, Maidstone, Beachy Head, and aerodromes just south of London.

How far these dispositions might have proved effective if the enemy had in fact attacked the sector-stations is a question which need not detain us; as it was, our forces were too weak, too widely dispersed and too far from his true line of approach to stand much chance of success in the early stages of the action. At the outset, combats were wholly or mainly with formations which had already reached their targets. The German vanguard would seem, however, to have been engaged on its inward course by the Thames and Medway guns, which opened fire at five o'clock on a formation flying westward; and not until some fifteen minutes later did bombs begin to fall at Woolwich, where the Royal Arsenal and two important factories were damaged. Thereafter the attackers, retiring to the north and east, were engaged by at least seven squadrons, including the pair from Northolt and the three-squadron wing from No. 12 Group. Its symmetry already broken by anti-aircraft fire, the German formation was then roughly handled by our squadrons; but the effects of the



Plate 17. German Bombers above the Thames near Woolwich, 7th September, 1940.

Plate 18. Polish Pilots of Fighter Command at Readiness in their Dispersal Hut.





Plate 19. A 25-pounder Field Gun in Action during a Practice Shoot.

Plate 20. An Anti-Aircraft Rocket Projector in Action (3-inch U.P. Single Projector).



bombing could not be undone. Moreover, while these engagements were in progress other German forces were bombing Thameshaven and dockland targets at West Ham, also without serious interference before they dropped their load.

Meanwhile yet other formations were converging on the capital from points between Beachy Head and the North Foreland. By this time there was no room for doubt that a major challenge had been offered and must be accepted; and on this occasion at least four squadrons engaged the enemy before he dropped his bombs or as he did so, including one which fought a running action over London. But for the most part German fighters were able to beat off our formations and conduct their charges in comparative safety to the dockland area on the eastern outskirts of the city. There a heavy rain of bombs not only damaged such legitimate objectives as the Millwall and Commercial docks, but also blasted dozens of thickly-populated streets. Further down the river there was heavy damage near Tilbury, and at Thameshaven new and vaster fires were added to those already burning. Other places hit included Crayford, Brentwood and districts of London as far afield as Tottenham and Croydon. As he retired towards half-past six the enemy was engaged by another four squadrons, including one from No. 10 Group.

Thus ended the first big daylight raid on London. On the whole it amounted to a victory for the German bombers, most of which had reached their targets without much difficulty, dropping more than three hundred tons of high-explosive and many thousands of incendiaries on and round the capital within an hour and a half. Their escort, though not as strong as the Germans would have liked to make it, had yet proved capable of clearing a way through the rather thin screen interposed by the defences. Admittedly twenty-one out of the twenty-three British squadrons ultimately used had joined action, two of them twice, but the plan of engaging the enemy well forward with pairs of squadrons had gone astray, excusably enough in view of the constant difficulty of deducing the enemy's movements from the inevitably imperfect picture furnished by radar and observation from the ground. Again, the Germans had lost more than forty aircraft; but Fighter Command's losses, amounting to twenty-eight aircraft shot down, sixteen badly damaged and seventeen pilots killed or seriously wounded, were disquieting at a time when the command was already suffering from the effects of recent onslaughts.

In face of such figures the Commander-in-Chief could no longer refuse Park the absolute priority he had been pressing for; and next day he reluctantly put into effect a 'stabilisation' scheme whereby pilots of proved ability throughout the command were mostly drafted into squadrons serving under Park or on his flanks. More distant sectors were forced to make do with squadrons manned

largely by unseasoned men. In addition a few squadrons assigned to an intermediate category and kept up to strength with well-qualified pilots were held ready in adjacent groups, as reliefs for No. 11 Group and its flanking sectors. The disadvantages of such a scheme, with its invidious distinctions, were obvious; and its adoption by a Commander-in-Chief who had long held out against it provides the best proof of the seriousness with which the outlook was viewed at his headquarters.

(iii)

On their retirement the German day-bombers left huge fires burning in the dockland area on both sides of the Thames below Tower Bridge, at Woolwich Arsenal, and among oil installations and factories further down the river. With only a few hours of daylight left, the fire services had no chance of extinguishing them before the onset of darkness made them into beacons for night-bombers.

From almost every point of view the outlook for Londoners on the first night of the new phase was therefore an unhappy one. The core of the great city was clearly marked out by the curving line of the Thames and the fires raging on its banks. To find so obvious a target the Germans would scarcely need their beams, so that interference with them would serve little purpose. The night air defences were ill equipped at best, and those assigned to London had been weakened earlier in the year by withdrawal of guns to newly-threatened targets. As compared with the 480 heavy anti-aircraft guns allotted to London and the Thames and Medway defences by the Committee of Imperial Defence before the war, only ninety-two were deployed in the inner artillery zone, another hundred and twenty on the Kent and Essex marshes and fifty-two on the western outskirts of the capital.¹ The total of 264 was thus well short of the pre-war figure, recently confirmed by a fresh examination of the problem. In the fighter sectors guarding London there were two squadrons of night-fighters equipped with Blenheims, but Hornchurch aerodrome was so thick with smoke from neighbouring fires that when the time

¹ These figures were made up as follows:

<i>1st A.A. Division</i>	
Inner artillery zone	92
Langley, Hounslow, Stanmore	36
<i>5th A.A. Division (part)</i>	
Brooklands	16
<i>6th A.A. Division (part)</i>	
Thames and Medway	120
	264

For further details, see Appendix XXII.

came the squadron based there could not get its aircraft off the ground. In addition, a section of single-seater fighters in each of No. 11 Group's seven sectors would normally have been available to supplement the Blenheims; but single-seater fighters were notoriously ineffective at night except when visibility was very good, while every available aircraft and pilot would almost certainly be needed for day fighting as soon as the sun rose again. In the circumstances Park took the responsibility of making practically no call on his day fighters once the afternoon's attacks were over. Thus the burden of defending London against its first big night raid fell mainly on the one remaining Blenheim squadron and on guns, balloons and searchlights.

The first of the night-bombers left France about eight o'clock and reached the English coast near Beachy Head some twenty minutes later, when darkness had not yet settled in. Two Hurricanes from Tangmere were in the air close by, but were not diverted from their routine task. The German vanguard flew unhindered to Battersea, where the first bombs fell soon after half-past eight, the guns of the inner artillery zone not opening fire until nine o'clock. Thereafter the guns were in action intermittently until three o'clock next morning, unfortunately to little purpose. A method of fire based on two lines of outmoded sound-locators east and west of London failed utterly, bombers from the south being able to outflank the system, while even those which did approach from the expected quarter were often missed or incorrectly tracked. Failing communications further increased the difficulties of the gunners, some parts of the front going out of action for long periods. The Thames and Medway guns were also called upon, but many of those on the south bank of the estuary were too far east to deal with bombers approaching from the south, while those north of the river necessarily fired mostly at aircraft which had already dropped their bombs. The Portsmouth and Southampton guns were likewise busy with incoming and outgoing bombers from twenty minutes past eleven until dawn, but were no more successful. Two aircraft of the only Blenheim squadron able to go into action patrolled north-east of London for three hours before midnight, and another went up later in the night, but their crews saw nothing of the enemy. A Blenheim and a Beaufighter of the experimental Fighter Interception Unit, both equipped with airborne radar, were also on patrol, but they too drew blank.

Thus for nearly seven hours German bombers were able to fly over London unimpeded by our fighters, though hindered by balloons and anti-aircraft fire which at least prevented them from closing to point-blank range. Between them *Luftflotten 2* and *3* despatched about two hundred and fifty aircraft, of which the vast majority bombed London, aiming some three hundred and thirty tons of high-explosive and four hundred and forty incendiary-canisters at Silvertown and at

districts on both banks of the Thames from Vauxhall Bridge to Putney Bridge. About nine-tenths of their load came down within ten miles of Charing Cross. The riverside boroughs east of the City, already sorely tried in daylight, suffered most, but almost every district was affected. Power stations at Battersea and West Ham sustained hits which forced them to close down, the London and North-Eastern Railway was cut at several places, Victoria Station was blocked so that only a few trains could get in or out of it, and traffic to London Bridge station had to be suspended. In dockland, and down-river where tidal waters lap the Kent and Essex marshes, the huge fires kindled in the last few days were still burning when dawn broke over the battered city, and indeed continued to burn for many days.¹ In the course of 7th September and the succeeding night about a thousand Londoners lost their lives.

(iv)

On 8th September bad weather, and probably also the strain of recent operations, limited the Luftwaffe to minor raids of little consequence. On the 9th the Germans returned to the attack in force, although the weather was still far from perfect. Again the blow fell almost wholly on London and south-east England, but this time the defences did much better. Whereas German crews returning from England on the 7th had commented on the weakness of the opposition, on the 9th they reported strong resistance by fighters south of London and spoke highly of Fighter Command's tactics.

Once more the main attack came late in the day, as if to pave the way for the night's bombing. At half-past four the growing strength of German patrols above the Straits led No. 11 Group to post a squadron over Canterbury; and by five o'clock nine squadrons of the group were airborne over Essex, Kent and Surrey, including a pair of Hurricane squadrons over Rochford. A quarter of an hour earlier Park had asked for reinforcements from Nos. 10 and 12 Groups to guard aircraft factories in the Thames Valley and sector-stations north of the Thames Estuary.

Meanwhile the leading German formation had crossed the coast near Dover. Coming east from Maidstone, the Spitfire squadron posted there engaged it over East Kent and was soon joined by another already in the neighbourhood. Abandoning their primary objective, most of the bombers thereupon dropped their load on Canterbury and the surrounding countryside before wheeling westwards over the Sussex border, where they were engaged by three

¹ For an account of the subsequent course of the night offensive against London, see Chapter XVI.

more squadrons. A second wave approaching over Beachy Head was likewise met well forward by two squadrons, but continued towards south-west London, where another squadron from No. 11 Group and a wing from No. 12 Group were in action shortly afterwards. Determined opposition and indifferent visibility gave the bombers little chance of taking careful aim, with the result that their bombs were widely scattered over districts as far apart as Epsom on the one hand and Lambeth on the other. Intermediate places which reported hits included Kingston, Richmond, Malden, Surbiton, Norbiton, Purley, Barnes, Wandsworth, Lambeth and Chelsea. Altogether about ninety bombers reached London and its outskirts, dropping about a hundred tons of bombs there, while another fifty or sixty were turned back and some seventy diverted to secondary targets of small value. Eighteen German aircraft crashed on land or within sight of the coast; but altogether twenty-eight were lost. With nineteen aircraft shot down and only fourteen pilots missing, killed or wounded, Fighter Command had much the best of the exchange. Admittedly lack of time to form two-squadron wings had again forced many of Park's squadrons to go into action singly; but their attacks were well-timed and generally effective. And if the unexpected move which brought the No. 12 Group wing so far south and west of the objectives they had been asked to guard was disconcerting to No. 11 Group, the practical value of their intervention seemed undeniable.

The strength and effectiveness of the British response on this day surprised the German High Command, but did not extinguish their hope of achieving air supremacy within the next few days. We have seen that on the 11th Hitler postponed announcement of his decision regarding 'Sealion' until 14th September.¹ The 10th was another quiet day; but on the afternoon of the 11th about a hundred bombers attacked London. They went chiefly for the City and the docks, though some of their bombs fell further north at Islington and Paddington. At the same time a smaller force attacked the outskirts of Southampton. In repelling these and other raids on the 11th Fighter Command lost twenty-nine aircraft, while German losses for the day were twenty-five. Over-estimating the losses inflicted on the enemy, the defences believed that the Luftwaffe had suffered a bad setback, but the impression received by the German High Command was very different. After yet another quiet day on the 12th, they concluded on the 13th that air supremacy was by no means out of reach. And indeed, in a very hopeful appreciation made on that day, Hitler went so far as to imply that victory in the air might soon relieve him of the disagreeable duty of deciding whether or not an opposed crossing of the Channel should be attempted.

¹ See Chapter XIV.

These hopes received apparent confirmation on the 14th, when further attacks on London were ineffectively opposed and both sides lost fourteen aircraft. They were, however, shattered on the morrow, when the air defences achieved their biggest triumph since mid-August.

In Great Britain 15th September is annually celebrated as 'Battle of Britain Day', the date having been chosen largely because about a hundred and eighty German aircraft were at one time thought to have been shot down on that day in 1940. In fact the number destroyed was only a third as large; but the day was nevertheless one of the most important of the whole battle. If 15th August showed the German High Command that air supremacy was not to be won within a brief space, 15th September went far to convince them that it would not be won at all.

At dawn on that memorable Sunday the weather over southern England was fine and visibility was good. But as the day wore on clouds gathered over Kent and Sussex, so that by the middle of the afternoon an opaque screen between four thousand and six thousand feet above the ground extended over a great part of both counties. Fighting began a little before midday. During its early stages, and later through occasional breaks in the clouds, spectators on the ground were able to watch as much of its progress as was revealed by brief glimpses of aircraft shining in the sun and by vapour-trails which their passage traced across the sky. Widespread awareness that the authorities had been expecting invasion for the last week, and that much hung on the issue of the combats daily fought four miles above the fields and houses of south-east England, gave special poignancy to events in which large forces were visibly at work.

The German plan of operations comprised a series of raids on London by about two hundred and twenty bombers of *Luftflotte 2*, and attacks on Portland and the Supermarine Aircraft Works outside Southampton by some thirty of *Luftflotte 3*. Supporting fighters flew some seven hundred sorties. *Luftflotte 3's* attack on Portland was timed to catch No. 10 Group at an awkward moment when the Middle Wallop sector was busy reinforcing No. 11 Group; but the main offensive was weakened by division into two distinct phases, separated by an interval which gave defending squadrons time to refuel and rearm before they made their second sorties.

A further weakness of the German plan was its neglect of the usual feints and false alarms. Formerly a gradual strengthening of patrols across the Straits had often preceded well-contrived diversions which threatened to catch Park or his deputy in two minds. This morning the massing of aircraft above the French coast left no doubt by eleven o'clock that a big attack was imminent. Half an hour then elapsed before the leading German aircraft reached the English coast, and

attempts to provoke No. 11 Group to a false move in the interim were too perfunctory to serve their purpose. The delay gave time for the deployment of seventeen British squadrons, including one from No. 10 Group and five from No. 12 Group, in good positions to meet threats from east or south. (See Map 23.) Ten of the eleven squadrons of No. 11 Group were despatched in pairs, while the three Hurricane and two Spitfire squadrons sent by No. 12 Group came south in a single tactical formation, impressive even by Teutonic standards.

By the time the German vanguard reached East Kent the cards were therefore stacked in favour of the defenders. A pair of Spitfire squadrons posted over Canterbury went into action within the first few minutes and were soon followed by the single squadron at Dover and a pair patrolling Maidstone. Almost at the same instant Park threw in six more squadrons which he had been holding in reserve, and shortly afterwards two of them came in contact with the enemy near the Medway towns. Continuing to the outskirts of London, the first wave of German bombers and their escort then fell foul of two pairs of Hurricane squadrons which had moved south after each pair had joined forces over Essex. Immediately afterwards the big wing from No. 12 Group took up the fighting, the three Hurricane squadrons engaging the bombers while the Spitfires took on German fighters. During the last two engagements the bombers dropped their load with little attempt at accuracy on London and its outskirts from Beckenham to Westminster. Houses were destroyed or damaged at Camberwell, Lewisham, Battersea and Lambeth; two bridges and a suburban electricity works were hit and damaged; and a bomb descended in the grounds of Buckingham Palace, but failed to explode. Thereafter four more squadrons engaged the enemy as he retired in two distinct formations over Kent and Sussex.

The second and heavier attack on London came about two hours later. The warning was shorter than in the forenoon, but gave time for six pairs of squadrons from No. 11 Group to take up positions over Chelmsford, Hornchurch, Sheerness, Northolt and Kenley while the leading German aircraft were still over the Channel. As the enemy approached the English coast No. 11 Group put up another seven and a half squadrons, four of them in pairs, while No. 12 Group again contributed five squadrons in a single tactical formation, and No. 10 Group one squadron. Originally posted over Middle Wallop, the last was later transferred, with a second squadron, to the Kenley-Brooklands line.

Crossing the coast between Dungeness and Dover a little before twenty minutes past two, the attackers flew towards the capital in three formations. One was intercepted near Canterbury by a pair of squadrons ordered south from Hornchurch and later by a flight of

Hurricanes posted over Maidstone; further west two squadrons moving north from Tangmere engaged another near Edenbridge and saw some of the bombers jettison their load and turn away while the majority continued towards London. Later Group Captain S. F. Vincent, commanding the Northolt sector, came in contact with the same force and had the satisfaction of seeing some of the bombers turn back in consequence of his single-handed attack delivered from head-on. The bulk of the fighting took place over London and its outskirts from Dartford westwards, where five pairs of squadrons from No. 11 Group and the wing from No. 12 Group were all in action between ten minutes to three and a quarter past, mainly with the third formation but probably also with survivors of the other two. In the course of the action the enemy distributed a big bomb-load over London and its outskirts, scoring several lucky hits on public utilities and railways. At East Ham a gas-holder and a telephone-exchange were wrecked; and considerable damage was done to a variety of targets on both banks of the river at West Ham and Erith. Many other riverside boroughs reported hits; but the harm done was nothing like as great as that sustained eight days before in the first of the big daylight raids on London. Again retiring by two distinct routes, the attackers were engaged on the way out by another four squadrons, including two from No. 10 Group. Guns of the inner artillery zone and the Thames and Medway defences were also in action and claimed a number of successes.

The fighting over London was at its height when a small force, apparently consisting of bombers without fighters, crossed the Channel to threaten Portland. The radar chain gave more than half-an-hour's warning, but underestimated the strength of the oncoming force. Moreover, luck or skill enabled the attackers to approach by such an unexpected route that only one gun-site at Portland was able to engage them. To make matters worse, reinforcement of No. 11 Group had reduced the available strength of the Middle Wallop sector to a single squadron, which succeeded in bringing the enemy to action only as he retired. Fortunately the bombing did little harm, the dockyard escaping with minor damage. About six o'clock another small bomber force, this time escorted by twin-engined fighters, approached the Hampshire coast. Twenty minutes' warning gave Nos. 10 and 11 Groups time to put four squadrons in the air before the enemy's arrival and follow with a fifth, but none succeeded in joining action until the attack was over. Engaged meanwhile by the Southampton guns, the bombers missed their target but damaged property close by.

In the course of the day Fighter Command lost twenty-six aircraft. Between them pilots and gunners claimed to have shot down a hundred and eighty-five German bombers and fighters. In fact the

Luftwaffe lost sixty aircraft, a number amply sufficient to strain a force already battered by nine weeks of unprofitable fighting.

(v)

A natural result of the setback suffered by the Luftwaffe on 15th September was to cast doubt on the methods and tactics adopted since the beginning of the current phase. Since the 7th the German air force had lost more than two hundred aircraft, including nine destroyed on the ground by British bombing. More than half of them were bombers. British accounts of the fighting suggest that many of these losses were due to insufficiently close fighter escort. German bomber-crews received the same impression. German fighter-pilots, on the other hand, protested that close escort of slowly-moving, heavily laden bombers flying very high was beyond their powers, and that the Messerschmitt 109, successful as it was in attack, was less suited to a purely defensive role than the 'slower but more manoeuvrable' British fighters.¹ In order to keep pace with their charges, escorts were forced to fly a devious course which removed them periodically from the bombers without conferring the freedom of action inherent in a less rigid system. Asked to adjudicate in the dispute, Göring gave his opinion in favour of the bombers.

Meanwhile, on 16th and 17th September, bad weather precluded daylight raids on London, and on the latter day the Führer ordered the indefinite postponement of 'Sealion'.² Whatever factors may have led to his decision, outwardly at least it signalled the failure of Göring and his men to live up to their reputation. Thereafter the German High Command, abandoning the hope of a rapid victory achieved in daylight raids, fell back on the combined effects of night bombing and maritime blockade to weaken British resistance while they made ready for more spectacular adventures in the east.

Even so the daylight battle was not over. Not until October brought declining weather was the German effort drastically reduced, and even then attacks on London were made whenever the skies were suitable. Throughout the rest of September small bomber-forces raided London daily when the weather was favourable, and during the same period several bold attacks were made on aircraft factories. Besides providing escort and cover for the larger raids, fighters made diversionary sweeps, and sometimes fighter-bombers were employed.

Fighter Command continued, therefore, to be well extended,

¹ When asked by Göring what he needed to improve his chances, the commander of *Jagdgeschwader 26* claims to have replied, 'I request that my *Geschwader* be equipped with Spitfires.' This demand is said to have left Göring speechless.

² See Chapter XIV.

though a lower scale of attack and diminished losses on most days during the latter half of September brought some relief. By the middle of the month gross wastage of Hurricanes and Spitfires had fallen below output, so that reserves began to increase again. On the other hand, the chronic shortage of fighter-pilots called once more for heroic measures on 18th September, when the Air Ministry agreed to a further combing of the Battle squadrons for Fighter Command's benefit. They also agreed to allot to the command more than two-thirds of the entire output of the Flying Training Schools in the four-week period ending in the middle of October.

Like his counterparts across the Channel, Park found occasion after the 15th to review the lessons of the last few days. Too often squadrons detailed to work in pairs had failed to join forces, sometimes because they had been given points of junction so far forward that they came upon the enemy before they met their partners. At times diversionary sweeps by German fighters had drawn up nearly the whole strength of the group, and sometimes pairs of squadrons had been so disposed as to invite a swoop by the enemy's high cover. He told his group and sector controllers, therefore, to make special arrangements in future for the engagement of high-flying German fighters by pairs of Spitfire squadrons, and to muster squadrons in such positions that they were not likely to be dived upon while still climbing. When high-flying German fighters were known to be approaching, ample Hurricane squadrons must be paired in the neighbourhood of sector aerodromes, and waiting squadrons in the outlying sectors must be warned for action against further enemy formations not yet in evidence. The lesson of the battle was that successful action against the kind of raid the enemy had learnt to make since August depended not merely on getting up enough squadrons in the early stages, but also on so adjusting the readiness of those left on the ground that a tactical reserve could be brought in at the crucial moment.

Here Park was met by the difficulty that, while the wing habitually sent south from Duxford and its neighbouring sectors by No. 12 Group was capable of providing such a reserve if its movements were concerted with those of his own squadrons, he had no means of bringing this about. Air Vice-Marshal Leigh-Mallory, commanding No. 12 Group, naturally wished the reinforcing squadrons to be controlled by one of his own sectors. Nevertheless he was unwilling to see them confined to the minor task of guarding sector-stations north of the Thames Estuary while major actions were going on elsewhere. Consequently No. 11 Group were more than once surprised to find the Duxford squadrons in the thick of the fighting when they were supposed to be well away on the left flank. Moreover, Park was worried lest his neighbour's preference for large formations should retard

the arrival of the reinforcing squadrons. Reminded that twice in August stations in No. 11 Group had been bombed when No. 12 Group had been asked to guard them,¹ Leigh-Mallory retorted, perhaps unfairly, that his squadrons were usually called in too late. Somewhat complex changes of procedure were needed to give No. 12 Group independent warning of raids approaching their neighbours' flank, and to enable Uxbridge to follow the movements of the Duxford wing. And amidst the preoccupations of the battle they were not made until October was three-parts over.

On the whole, No. 11 Group's arrangements for the second half of September worked well when the group found anything to bite on. German crews attacking London and other targets in south-east England paid frequent tribute to the strength of the defences. On the 18th, 27th and 30th, when the number of bombers which claimed to have reached the capital and its outskirts varied from twenty-seven to nearly seventy a day, the defences fought notably successful actions, German losses for the three days amounting to more than a hundred and twenty aircraft, while Fighter Command lost only sixty.

On the other hand, the Germans succeeded in making several damaging attacks on aircraft factories, sometimes using single aircraft and sometimes fairly large formations. On the 21st a single bomber made a daring raid on the Hawker factory at Weybridge from five hundred feet, though fortunately the damage done did not affect production. Three days later from fifteen to twenty aircraft attacked the Supermarine Works at Woolston near Southampton in two waves, doing little damage to the factory itself, but hitting an air-raid shelter and killing or wounding nearly a hundred of the staff. On the 25th a more ambitious effort against the Bristol Aeroplane Company's establishment at Filton was undertaken by nearly sixty bombers of *Luftflotte 3*, accompanied by fighters, while fighter-bombers made a diversionary attack on Portland. No. 10 Group put up three squadrons and a section as the enemy approached, but began by ordering them to Yeovil, where the Westland factory seemed a likely target. When the true objective became clearer, three of the squadrons set off in pursuit, but only a few aircraft caught up with the bombers before they reached their target. Dropping ninety tons of high-explosive and twenty-four oil-bombs, the attackers severely damaged the main assembly works and other buildings, with the result that production remained below normal for many weeks. Moreover the bombing killed or wounded more than two hundred and fifty people, blocked railways near the factory, and cut communications between Filton aerodrome and group headquarters.

¹ See pp. 209 and 214.

The German formation was further engaged after the bombing, and altogether lost five aircraft, including one shot down by anti-aircraft fire.

Although Filton was serving temporarily as a sector-station, no fighters were based there on the 25th, the squadrons allotted to the sector being at Exeter and Bibury. On the next day Dowding took the exceptional precaution of sending No. 504 (County of Nottingham) Squadron from Hendon to Filton for the express purpose of guarding the factory in future. The move was timely, for on the 27th ten twin-engined fighter-bombers with an escort flew to the neighbourhood to attack either Filton itself or some other target close to Bristol. No. 504 Squadron met them near the city and, as the German crews admitted, kept them from their target, so that they dropped their load unprofitably on the suburbs. The Bristol guns and pilots of three other squadrons helped to give the attackers an impression strongly at variance with current reports of British weakness.

Meanwhile, on the 26th another attack on the Supermarine factory at Woolston had been attempted, this time by some fifty escorted bombers and fighter-bombers. They dropped nearly seventy tons of bombs to such good purpose that for a short time production was completely stopped. In addition, more than thirty people were killed, and at Southampton a warehouse filled with grain was totally destroyed. Engaged on the way in by anti-aircraft fire only, the attackers were afterwards set upon by four squadrons from Nos. 10 and 11 Groups, losing three aircraft as compared with six aircraft and two pilots lost by the defenders. Finally, on the 30th about forty escorted bombers which sought to attack the Westland factory at Yeovil were engaged on their way in by at least four squadrons and by four more near their destination or after they had left it. They were also hampered by dense clouds which hid the target, forcing them to estimate its position by dead reckoning. Consequently they missed the factory, hitting instead the neighbouring town of Sherborne and the railway close by, so that traffic had to be temporarily diverted.

(vi)

As the autumn drew on, the Luftwaffe reduced the proportion of bombers to fighters used in daylight. They took to sending towards London small formations of fighters, either unaccompanied or escorting only modest striking forces often composed of single-engined fighter-bombers. Where bombers were used the German authorities favoured the Junkers 88, their fastest bomber, but one whose reputation when first introduced was summed up in a report by the

Inspector-General of the Luftwaffe that crews had no fear of the enemy but were afraid of the Junkers 88. Attacks on aircraft factories by unaccompanied single bombers or small formations continued in October, but sweeps by fighters and fighter-bombers were the dominant feature of the month.

These tactics were difficult to counter, first because of the height at which the German fighters flew. Above 25,000 feet the Messerschmitt 109 with two-stage supercharger had a better performance than the Mark I Hurricane or Spitfire. Mark II versions of both aircraft were coming into service, but at great heights the enemy still had the advantage. Moreover, raids approaching at 20,000 feet or more had a good chance of escaping radar observation and were difficult for the Observer Corps to track, especially when there were clouds about. Secondly, the speed at which formations unencumbered by long-range bombers flew was so great that at best the radar chain could not give much more than twenty minutes' warning before bombs carried by fighter-bombers fell on London. Thirdly, Park and his controllers had no means of telling which of several approaching formations contained bomb-carrying aircraft and should therefore be given preference.

A step towards the solution of the second and third problems was taken at the end of September, when No. 421 Flight (later No. 91 Squadron) was formed for the purpose of spotting approaching formations and reporting their height and strength to Uxbridge by radio-telephony. Although told to fly high and avoid combat, pilots so employed were sometimes taken at a disadvantage. After four had been shot down in the first ten days they began to work in pairs, a practice later generally adopted. But in any case their efforts were not a sufficient answer to the problem of intercepting raiders which flew too high for detection by the radar chain. At the end of the first week in October, Park was therefore forced to maintain patrols by at least one squadron when high-flying raids were likely. Beginning with a patrol at 15,000 feet between Biggin Hill, Maidstone and Gravesend by a single Spitfire squadron, he found himself obliged in the middle of the month to add a second patrol by one Hurricane squadron in the morning and early afternoon, and later to order continuous patrols by two squadrons whenever the weather favoured high-flying raiders. These measures were expensive in flying-time but were followed by a notable improvement in the ratio of interceptions to sorties when the enemy appeared.

The result was that, while a fairly high proportion of small bomb-carrying formations reached their targets without serious interference, the achievement of the defences in terms of casualties suffered and inflicted continued to be satisfactory. In the whole of October Fighter Command lost one hundred pilots killed and sixty-five

wounded, or altogether about half the total for September. German losses were swelled by growing wastage among night-bombers landing on indifferent aerodromes; but of the 328 aircraft of all types destroyed or irreparably damaged in October, probably about two hundred succumbed to the defences in daylight raids. A gradual weakening of the Luftwaffe as winter drew on was thus accompanied by a slight but perceptible strengthening of the British fighter force, unhappily offset by the growing demands of the night battle. At the end of the month the average number of pilots in Dowding's squadrons was just under twenty-three, a figure which included many not yet fit for active operations. Moreover, the unwelcome stabilisation scheme was still in force. On the other hand, the last week of October found the Aircraft Storage Units holding a bigger reserve of Hurricanes and Spitfires than at any time since August. But these figures scarcely justify the popular impression that the fighter force was stronger at the end of the battle than at the beginning. For when the battle ended Fighter Command's casualties, apart from wounded, included nearly four hundred and fifty officers and other ranks who had lost their lives in the fighting since July; and among that number were many whose skill would not easily be matched by their successors.¹ The battle had been won, but by a margin whose narrowness was apparent only to those who had studied its progress in all its aspects and through all its phases.

¹ For details, see Appendix XXV.

CHAPTER XVI
THE NIGHT OFFENSIVE
AGAINST LONDON¹

(7th September–13th November, 1940)

THE OPENING of the air offensive against London on 7th September, 1940, marked not only a change of target for the Luftwaffe, but also the beginning of a change in policy which ultimately transformed its operations against this country. Experience had taught the German Air Staff that mass attacks in daylight brought heavy losses, but that big night raids like those on Liverpool and Birkenhead in August could be made at little cost. They applied the lesson. Without altogether abandoning attacks in daylight—which continued into the winter on increasingly rare days of good weather—they soon reduced the scale of their day-bomber operations after trying a few mass attacks on London. Thereafter the bulk of their effort went into night attacks. Both *Luftflotten* in France and the Low Countries shared in the night raids, aiming about 5,300 tons of high-explosive at London and its outskirts on twenty-four nights in September, or more than four times the load dropped in daylight during the same period.

Although not primarily designed for a night offensive, the German bomber force was by no means ill equipped for such a task. Like the British Blenheim (but unlike the heavier bombers which the Royal Air Force was introducing in increasing numbers), its aircraft carried a modest load and owed their genesis to an exploded faith in their ability to outpace pursuing fighters. But in the aggregate their striking-power was considerable. Between them *Luftflotten 2* and *3* mustered in early September more than seven hundred serviceable bombers, each capable of carrying well over a ton of bombs across the Channel. Captured aerodromes in occupied countries provided a string of bases so widely distributed that all were scarcely likely to be weatherbound at once. Finally a lavish array of beacons, beam-transmitters and other aids to night-flying and target-finding made night-raiding possible in weather which greatly hampered the defences.

At best the resources available in the United Kingdom to meet the threat were meagre. After the first night raid on London, General

¹ For statistical summaries, see Appendices XXVI–XXVIII.

Pile received authority to raise the number of heavy anti-aircraft guns in the inner artillery zone from 92 to 199, largely by drawing on the Midlands and on South and East Coast ports; but lack of adequate equipment for directing 'unseen' fire made them capable of little more than wild shooting, comforting to the ears of Londoners and doubtless disturbing to some bomber-crews, but unlikely to bring down many aircraft. The removal, on 11th September, of restrictions which forbade the gunners to fire except at aircraft specifically seen or detected led to a system of barrage-fire which, however unlikely to bring a high proportion of successful engagements, nevertheless had certain merits. The radio counter-measures controlled by No. 80 Wing—which included by October fifteen equipments to counter *Knickebein*, besides the transmitters already installed to counter medium-frequency beacons¹—were a potent asset, but their value was partly discounted by the comparative ease with which so large a target as London could be found without recourse to artificial aids. Balloons, like barrage-fire, were useful chiefly as a means of keeping the enemy high and were seldom lethal. As for night-fighters, Dowding's resources in September comprised only some eight squadrons which could be properly so called.² Six Blenheim squadrons were divided between the four fighter groups, with two in No. 11 Group near London and two in No. 12 Group, while one Defiant squadron was in No. 12 Group and the other divided between Nos. 11 and 13 Groups. Elements of a large number of single-seater squadrons were nominally available each night to swell the total, but only half a Hurricane squadron in No. 10 Group claimed any special aptitude. Air Vice-Marshal Brand, commanding that group, had gained distinction in the First World War as a night-fighter pilot in single-engined aircraft, so that he had a special interest in the matter; elsewhere the prevailing opinion was that the slender chance of intercepting bombers in the dark with ordinary day-fighters scarcely justified their diversion from normal duties unless conditions were exceptional. In addition, one section of the specially-equipped Fighter Interception Unit—the pioneers of airborne radar—was available in Sussex.

At the beginning of the night-battle, therefore, success seemed likely to turn on the speed with which night-fighter squadrons proper could be given the tools to do their job. Modern equipment for the guns was also an urgent need, but the inherent difficulty of gunfire against unseen targets made the chances of the fighters seem more promising. The immediate outlook, however, was not good. The Blenheim, designed originally as a bomber, was too slow for the work; its successor the Beaufighter was only just coming into service and was abnormally beset by teething troubles. Airborne radar was

¹ See p. 158.

² For details, see Appendix XXIX.

now at an advanced stage of development; but its use and maintenance on active service raised many problems. Moreover, the equipment was valueless without some means of bringing aircraft which carried it within working distance of their quarry. In average conditions a fighter which relied on airborne radar had to get within about three miles of its objective to establish contact; thereafter the pilot and radar operator, working in partnership, used the apparatus to close the range until the bomber or its exhaust flames became visible. Information furnished by the Observer Corps was seldom accurate enough for the purpose, especially in regard to height; while fighters patrolling fixed lines had only a remote chance of success. A more promising method was to station fighters over landmarks known to be favoured by the enemy; but in practice even this proved disappointing. Over the sea the data furnished by ordinary radar stations could be used, but here too accuracy was not easily attained. Moreover, there were objections to the use of aircraft fitted with highly secret apparatus at any considerable distance from the coast. When the enemy was using beams, patrols along the beams by fighters equipped to receive their message seemed likely to be profitable; but German crews perceived the danger and grew wary. Searchlights could of course be used to point the way for fighters if they themselves could find the bombers; but without new equipment they stood little chance of doing so. What the fighters and the searchlights needed was assistance from some form of radar on the ground which would reveal, with much greater accuracy than sound-locators or similar devices, the course and height of bombers flying almost directly overhead.

As it happened, a radar set which satisfied these conditions already existed under the name of the G.L. set. For some time past the War Office had been developing a gun-laying equipment which was capable of accurate tracking within vertical or slant ranges of 40,000 feet and of estimating height to within a thousand feet or so of the true figure. At the cost of further retarding the progress of the guns—for the equipment was still scarce—Dowding borrowed a number of the sets and installed them experimentally at searchlight posts in the Kenley sector, on the path most commonly used by night-bombers flying towards London. Direct communication with Kenley enabled these searchlight posts to keep the sector controller informed of the course and height of bombers in their neighbourhood. The controller, who was made aware of the position of his own aircraft by the means used for daylight interception, then had the task of bringing a selected fighter within range of a selected bomber, partly by verbal orders given by radio-telephony and partly by ordering a 'master' searchlight to point towards the indicated position of the bomber. The method was ingenious and formed the basis of the more elaborate technique adopted later when special 'G.C.I.' equipment for the

ground control of interception at night came into service. But its application in the early stages proved very difficult. Working in an operations room designed with other needs in mind, and burdened with multiple responsibilities, the sector controller had an unenviable task. Redhill, the only aerodrome available for night-flying in the Kenley sector, was ill adapted for the purpose, especially in wet weather; damp and inexperience played havoc with delicate airborne radar sets which at best were apt to give capricious readings. Fighters were sometimes incorrectly tracked, or even confused with the bombers they were chasing; communication between pilots and radar operators was sometimes interrupted by untimely orders from the ground. And when the airborne radar did pick up the quarry the Blenheims were usually too slow to catch it, while the Beaufighters which were gradually replacing them gave much trouble until a variety of technical ills were remedied. The outcome was a tantalising series of missed chances in the form of radar contacts broken off before the quarry came in sight. Indeed, if German reports are to be believed, the crews of bombers saw our fighters far more often than their own machines were seen.

In any case the Kenley experiment was confined to a single sector. Even if it were successful, not enough G.L. sets existed or could be manufactured within a foreseeable time to make the system widely applicable. A simpler variant, expressly designed for the control of searchlights and known as S.L.C., was on the way, but suffered from defects which proved extremely hard to overcome. In the upshot only the special G.C.I. equipment designed from the outset to help fighters filled the bill, but the sets would not be available in substantial numbers before the end of 1940. By that time, too, the supply of G.L. sets might be expected to benefit the guns. The question was, what could be done to check the bomber effort in the meantime?

This problem, among other aspects of night air defence, was discussed in September by a committee set up by the Air Council under Marshal of the Royal Air Force Sir John Salmond, a veteran officer of great distinction. The committee's findings were largely concerned with the development of airborne radar on lines discussed in the foregoing paragraphs; but they also recommended that more attention should be paid to single-seater aircraft as night fighters. A little earlier Air Vice-Marshal W. S. Douglas, a member of the Air Staff whose duties were largely concerned with air defence, had urged that not only the two existing Defiant squadrons and a third Defiant squadron then in process of formation, but also a Hurricane squadron, should be devoted exclusively to night-fighting. Believing that fighters without airborne radar—which could not then be fitted in single-seater aircraft, though Douglas was given to understand that the difficulty might soon be overcome—could accomplish little

in the dark until the searchlights were better equipped, Dowding dissented from the last suggestion. The report of the Salmond Committee gave fresh support to the view expressed by Douglas; and early in October the Chief of the Air Staff, having discussed the matter with the Prime Minister, ordered Dowding to relegate no less than three Hurricane squadrons to night duty.¹ To Dowding this move seemed unwise. Convinced that the future of night interception lay with airborne radar and that 'haphazard methods' would never produce more than 'an occasional fortunate encounter', he obeyed the order with great reluctance, conveyed to his superiors in a trenchant protest. Douglas and other members of the Air Staff remained of the opinion that attempts to intercept at night with single-seater fighters were, at any rate, well worth making.

Another suggestion made by the committee and supported by the Air Staff was that separate Filter Rooms—already existing in Nos. 9 and 10 Groups—should be opened at each group headquarters in place of the Central Filter room at Stanmore.² Here too Dowding dissented, and here too he was overruled. Not all the arguments adduced by the Air Staff in favour of devolution were well founded; but the view that dangerous congestion at Stanmore would thereby be avoided was probably justly held to outweigh Dowding's objections, based largely on considerations of expense. For reasons too technical to be discussed here, devolution of filtering strengthened an existing case for a similar devolution of responsibility for initiating air-raid warnings, so that this too followed in due course. In 1941 separate Filter Rooms were opened at the headquarters of Nos. 12, 13 and 14 Groups and of the new No. 82 Group in Northern Ireland. Experimental devolution of responsibility for initiating air-raid warnings to Nos. 9 and 10 Groups was followed by devolution to Nos. 12, 13, 14 and 82 Groups. Filtering for No. 11 Group continued to be done at Stanmore (ultimately in a room outside command headquarters); and warnings to the area covered by that group were still issued and cancelled from the command operations room until, in 1944, the Ministry of Home Security assumed responsibility for initiating warnings to all parts of the country.³

These changes had little or no immediate effect on the performance of the night defences, though they served to emphasise important differences of outlook between Dowding and the Air Staff. Whatever the ultimate value of the Hurricane squadrons as night-fighters, they could scarcely hope to accomplish much in such conditions as must

¹ The squadrons chosen were Nos. 73, 85 and 151. In November, No. 73 Squadron was transferred to the Middle East and No. 87 Squadron took its place.

² Filtering was the term applied to the collation of information from radar stations so as to produce a continuous track for each aircraft identified as hostile.

³ For a further account of the development of the public warning system, see T. H. O'Brien, *Civil Defence* (1955), pp. 425 and 435 and *passim*.

be expected on many nights throughout the winter. As for devolution of the filtering and air-raid warning systems, they would take some time to put into effect, and in any case had little bearing on the immediate issue. By early November two twin-engined squadrons, in addition to the Fighter Interception Unit, had some Beaufighters to supplement their Blenheims, but air and ground crews were still not quite at home with them. In the middle of October the first of the new G.C.I. equipments was experimentally installed in Sussex, but further deliveries were not expected until Christmas. By October, too, a few G.L. sets had reached the gunners, who pronounced them far superior to anything within their previous experience. As early as September, No. 80 Wing had reported that their counter-measures were at least effective enough to make the Germans alter their call-signs at irregular intervals. But solid progress in the shape of a substantial number of bombers brought down was still lacking. On the other hand, as the year drew to its close the German bomber force suffered fairly heavy losses from accidents for which the night defences, whose efforts must certainly have increased the strain on pilots, can fairly claim some credit.

Meanwhile, from the end of the first week in September until the middle of November London was attacked nightly by an average of about a hundred and sixty German bombers.¹ The only respite came on the night of 3rd November, when prohibitive weather over England and a great part of the Continent confined the Luftwaffe to objectives in Scotland. For similar reasons only a handful of bombers attacked London on the night of 6th October, and on eight other nights the number attacking did not exceed a hundred. According to German records about 6,500 tons of high explosive were aimed at London and its outskirts by night in October and some 1,800 during the first half of November. Other places—notably Liverpool, Manchester, Birmingham and Coventry—received their share; but for ten weeks Greater London was the main objective.²

¹ For details, see Appendix XXVI. Italian bombers contributed to the offensive from October, making 16 night sorties in that month and 8 in the first half of November. The Italian contribution by day and night is set out in Appendix XXVIII.

² According to German sources the bomb-load for October (day and night together) was distributed as follows:

	<i>Tons of H.E.</i>	<i>Incendiary Canisters</i>
Greater London	7,160	4,735
Liverpool and Manchester	220	369
Birmingham (18th onwards)	217	591
Coventry (19th onwards)	17	332
Aerodromes	190	165
Ports and shipping	352	355
Aircraft industry (51 targets)	63	81

A British source puts the total tonnage dropped on the United Kingdom in October at 6,910, of which 5,854 tons were dropped at night. But there are grounds other than the German figures for thinking these estimates too low.

Damage extended to almost every borough, but was most severe in districts near the river. Docks, railways and public utilities suffered badly and many commercial and domestic buildings were destroyed. Interference with rail traffic was so great that at one stage the Great Northern section of the London and North-Eastern Railway could pass only four trains a day to the Southern Railway instead of the usual fifty or sixty; in September five or six thousand wagons stood idle because their passage was blocked by unexploded bombs. In dockland many warehouses were destroyed with their contents, and in numerous districts damage to gasworks and power-stations caused much inconvenience. Injuries to life and limb, though sufficiently distressing, were lighter than had been foretold before the war; but throughout the capital new dangers and difficulties shattered the orderly routine of millions. On one night in October—that of the 15th, when more than four hundred bombers aimed nearly 540 tons of high explosive at Greater London—damage to railways caused temporary stoppage of all services at St. Pancras, Marylebone, Broad Street, Waterloo and Victoria, while at Euston, Cannon Street, Charing Cross and London Bridge traffic was reduced to less than a third of the normal volume. The District Railway, which carries thousands of Londoners to and from their daily work, was cut at three widely-separated points; on the Metropolitan Railway Baker Street and Moorgate stations were put out of action. No trains ran between Edgware Road and South Kensington. A bomb on the outskirts of the City burst the Fleet sewer, whose waters poured into the tunnel between Farringdon Street and King's Cross. Tube railways were likewise severed at many places where they ran above ground; elsewhere access to them was barred at several points by damage to stations or the proximity of unexploded bombs or mines. Roads were blocked in whole or part at seven or eight places, from East Ham in the east to Fulham in the west, and as far north and south as Tottenham and Lewisham; for some hours Oxford Street was closed and London Bridge open only to southbound traffic. Damage to public utilities included the fracture of three large water-mains; in addition a reservoir, three gasworks, two power stations, three dock areas and the headquarters of the British Broadcasting Corporation in Portland Place all suffered hits. Altogether more than nine hundred fires were reported in the London Region, including six afterwards described as 'major' and nine as 'serious'. And during the night's bombing, which lasted from dusk until nearly five o'clock next morning, more than four hundred civilians were killed and nearly nine hundred seriously injured. About two hundred people perished while seeking asylum in shelters or rest-centres. Many Londoners were rendered homeless, some losing all or most of their possessions.

Nevertheless the two months' offensive against London failed to do

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mortal injury to the British capital. The blow struck at the docks, said the Ministry of Home Security in an objective study, was 'serious but not crippling'. In the main the basins, quays and gates, and the equipment and railway lines which served them, remained substantially intact; and in the long run the ability of the Port of London to handle the imports and exports needed to keep the capital and the country going was not much impaired. Wise dispersal of stocks of food to depots away from the docks reduced the effects of damage to dockland buildings; damage to communications, power stations and the like was seldom lasting. Under the direction of a Special Commissioner appointed for the purpose, roads and public utility undertakings were repaired with creditable speed, despite the hindrance of rubble and salvage often difficult to clear. Another Commissioner supervised the bestowal of the homeless and the needs of those not tied to London who sought a roof elsewhere. The menace of the delayed-action and the unexploded bomb was met by the formation of reconnaissance and disposal parties—among whose notable feats were the removal of a one-ton bomb which threatened St. Paul's Cathedral—and the establishment of 'bomb cemeteries' for the reception of their merchandise. Naval parties under the Admiralty dealt with land-mines dropped by parachute from German aircraft.

Concerning the attitude of Londoners the Ministry of Home Security 'had only good reports'. Criticism of the small volume of gunfire noticeable at the beginning of the night attacks was met by measures mentioned earlier in this chapter; for if the guns added to the inner artillery zone could accomplish little without new equipment, at least they made a joyful noise and served to mask the desolating drone of German engines. In frequent peril, deprived of many familiar comforts, often short of sleep and sometimes of hot food and water, compelled if they went out after dark to find their way with feeble torches through a gloom relieved at times by the glare of fires, the flash of bombs and guns or the pale gleam of an unwelcome moon, dwellers in London endured much during the long nights of the deepening winter. Yet the public temper, strengthened by the resolute but wisely cautious tone set by the Prime Minister in broadcast commentaries, remained firm. If conditions were hard—and by urban standards they were sometimes very hard indeed—life was still sweet to those who faced the nightly peril of maiming or extinction. Danger and discomfort left much room for dogged humour, for a new sense of fellowship between all classes, even for gaiety. Some months earlier, on the eve of Dunkirk, the Chiefs of Staff had said that, if the nation and the Empire were to endure, 'the gravity of the problem and the need for individual self-sacrifice' must be brought home to the people. For millions of

Londoners the night offensive of 1940, perhaps much more than the earlier peril of invasion, performed that function, steeling them for the long years of slogging war that lay ahead. And the turn of their neighbours in the provinces was close at hand.

CHAPTER XVII
THE NIGHT OFFENSIVE
AGAINST BRITISH INDUSTRY
AND COMMUNICATIONS¹

(14th November, 1940–16th May, 1941;
Summary 7th September, 1940–16th May, 1941)

(i)

BY THE late autumn of 1940 no visible ground remained for the belief that repeated night attacks on London might cause a swift collapse of the British will to fight. German estimates of damage to the docks and interference with business and domestic life were on the hopeful side, but did not justify the inference that disintegration of the capital and the country was imminent. Accordingly, in early November the Luftwaffe made ready for a new stage of the air offensive. If Great Britain could not be bludgeoned into swift surrender, she might have to be worn down by repeated hammering. In any case everything possible must be done to check the expansion of her war production and prevent her from repairing recent losses. Air attacks at night would therefore be extended to the chief industrial centres throughout the country, and to the great commercial ports through which both everyday supplies and special consignments of war material reached her from abroad. London, as both a port and a centre of industry, still qualified for the target-list.

Although the plan adopted by the Luftwaffe early in September had mentioned attacks on the populations of large cities, detailed records of the raids made during the autumn and winter of 1940–1941 do not suggest that indiscriminate bombing of civilians was intended. The points of aim selected were largely factories and docks. Other objectives specifically allotted to bomber-crews included the City of London and the government quarter round Whitehall.

The leaders of the German air force, recognising that *Knickebein* was not proof against interference, were inclined henceforth to favour

¹ For statistical summaries, see Appendices XXX–XXXII. The equipment and location of British night-fighter squadrons on various dates are given in Appendix XXXIII.

moonlight for their biggest raids. They had, however, two more radio devices suitable for attacks on unseen targets. Both, like *Knickebein* itself, were designed originally for daylight use in cloudy weather. But whereas *Knickebein* transmissions were receivable with the ordinary blind-landing equipment fitted to German bombers, the alternative systems called for special apparatus not generally available. Their use was confined, therefore, to selected units whose function was either to undertake special missions on their own account, or more frequently to act as 'pathfinders' and target-markers for larger forces.

One system, employing an apparatus called *X-Gerät* and known to British intelligence officers as 'Ruffians', depended on the laying across the target of a main beam or beams cut by two cross-beams at points separated from each other and from the target by fixed intervals. By following a main beam, the bomber was assured of a correct track, while the time taken to pass from the first to the second point of intersection gave its ground-speed, from which the proper moment to release bombs could be calculated with great accuracy. The calculation was in fact made automatically by an apparatus carried in the bomber. Certain allowances for the effects of wind were made, however, by the rough-and-ready method of displacing one or more of the beams from its calculated bearing. More precise than *Knickebein*, this elegant device nevertheless shared the susceptibility of its cruder partner to interference by a resourceful enemy. Moreover, the practice of laying the beams some hours before the beginning of an attack, presumably for the purpose of making final corrections, quite often enabled the Air Ministry to predict the target and warn the defences accordingly.

The other system, employing an apparatus called *Y-Gerät*, was known in the United Kingdom as 'Benito'. Essentially it consisted of a ground station emitting transmissions automatically re-radiated by a bomber. The time taken for re-radiated signals to return to the ground-station enabled a German controller there to gauge the exact range of the aircraft along a bearing determined by an auxiliary direction-finding system. He could thus direct the aircraft towards the target, make such corrections as errors of navigation or uncharted meteorological conditions might require, and order the dropping of its bombs at the proper moment. The method was potentially very accurate, but could be countered with some chance of success if the appropriate British station picked up the transmissions in sufficient strength.

By the second week in November the existence of German plans for a new series of night attacks became known in London. Counter-measures were thereupon concerted between the Air Ministry and appropriate formations. Where the blow would fall was not precisely

known, but everything pointed to heavy attacks on centres of industry about the middle of the month. *Kampfgeschwader 100*, a unit soon famous for its 'pathfinder' technique, was expected to lead the raids with the aid of beams. Features of the British counter-plan included a major attack by Bomber Command on a German city; patrols by aircraft of Bomber and Coastal Commands over German bomber bases in France and the Low Countries; and the biggest possible effort by the night defences. Aircraft of day-fighter squadrons would be expected to supplement the effort of regular night-fighter squadrons. In addition No. 420 Flight, a new unit training to trail mines in the path of German bombers, would take part if it were ready.

(ii)

The new phase opened on the night of November 14th with a memorable raid on Coventry. Out of about five hundred and fifty German aircraft despatched against the United Kingdom and adjacent waters about four hundred and fifty, duly led by *Kampfgeschwader 100*, attacked the city, dropping some five hundred tons of high-explosive and nearly nine hundred incendiary-canisters over a period of about ten hours. Bomber-crews were not told to make an indiscriminate attack on Coventry itself, but to cripple the aircraft industry and its ancillary services there by aiming at specified objectives such as the Standard Motor Car Company's factory and the like. 'Ruffians' were laid over the city, but seem to have been scarcely needed, for bright moonlight clearly revealed its main features. Fires kindled in the early stages, with flares dropped as markers, acted as further guides for the rank and file. Within an hour of the opening of the raid the centre of Coventry was a sea of fire, clearly visible for many miles.

In such circumstances the city's ordeal was bound to be severe. Telephone communications failed early in the raid; extensive damage to gas and water-mains increased the difficulty of controlling the two hundred or more fires raging by the early hours of the morning. Railway lines from Coventry to Birmingham, Leamington, Rugby and Nuneaton were all blocked; innumerable roads and streets within the city were made impassable by rubble, flames or unexploded bombs. Gravely hampered by these conditions, local Civil Defence workers, reinforced at dawn by parties brought to the outskirts of the city during the night, earned high praise for deeds done in a setting of horror and destruction which few could have imagined before the raid began. In the course of the night five hundred and fifty-four people are believed to have been killed, eight hundred and sixty-five seriously wounded; how many of the latter, and of those more lightly

injured, owed their lives to anonymous rescuers who carried them from wrecked or blazing buildings to places of relative safety is not recorded.

As usual, the attackers came to little harm at the hands of the defences. Good weather helped Fighter Command to put up a substantial effort, unhappily without success. On the approaches to Coventry and elsewhere the command flew thirty-five sorties by Blenheims, twelve by Beaufighters, thirty by Defiants, forty-three by Hurricanes and five by Gladiators of No. 247 Squadron at Roborough, these figures including sorties at dusk and dawn. Pilots or other aircrew reported seeing seven enemy machines between them; two Blenheims opened fire, but neither succeeded in bringing down its quarry. Anti-aircraft fire brought down a German bomber on its way to Coventry at Loughborough; at Birmingham gunners claimed to have seen an aircraft break up in mid-air. On the other hand, the deterrent effect of the defences, though it cannot be precisely estimated, may have been substantial, for some sixty aircraft out of about five hundred despatched with orders to bomb Coventry failed to do so, either attacking alternative targets or breaking off their mission. Minor operations, including minelaying and an attack on London by some twenty aircraft, completed the night's total of just over five hundred and fifty sorties.¹

By half-past six on the morning of the 15th the last German aircraft had left a city outwardly stricken almost past repair. Cherished locally as a provincial capital and much-valued religious and commercial centre, but also of wider importance by virtue of its aero-engine assembly works and machine-tool industry, Coventry had in fact sustained a fearful blow; but its wounds were far from mortal. Much of the centre of the city was a smoking ruin, where fresh fires continued to blaze up during the day amidst the broken fragments of fallen buildings. Yet by nightfall all fires had been brought under control. Between four hundred and five hundred retail shops were out of action; whole streets were rendered difficult of access by ruined masonry and unexploded bombs. By closing the city to all but essential traffic, and with the help of mobile canteens and field-kitchens, the authorities were nevertheless able to keep the wheels of life turning while troops and rescue-parties cleared the ways. Of the railway lines blocked during the night's bombing, all were repaired

¹ According to German sources the effort was distributed as follows:

	<i>Despatched</i>	<i>Reached Primary Target</i>
Coventry	509	449
London	21	18
Minelaying, etc.	22	...
	552	

by the evening of 18th November except that to Nuneaton, which reopened three days later. Meanwhile the main highways out of the city were found to have suffered no important damage. Transport needed to take people to their work, remove the homeless to places of shelter and shift valuable gear from damaged factories was, however, scarce for several days. Apart from residents transferred to new quarters under the official scheme, a number left Coventry on their own initiative. But by the evening of the 16th confidence had so far returned that means provided to convey ten thousand people from the centre of the city that night were used by only about three hundred. A visit by H.M. the King on that day did much to keep up the spirits of the inhabitants.

In some respects the industrial quarters of the city escaped more lightly. Hits were plentiful; but at Coventry as elsewhere factories and plant proved generally less combustible than serried rows of shops and houses, often with much timber in their construction and well stocked with inflammable materials. Twenty-one important factories, twelve of them directly concerned with aircraft production, were severely damaged by fire or direct hits. But perhaps a bigger obstacle to production was lack of services through damage to cables, pipes and water-mains. Shortages of gas and water in particular affected most undertakings to some extent. Such interruptions caused a complete stoppage at nine important factories not so severely damaged that they could not have carried on if services had been available. After a general suspension of production on the day after the raid, work was nevertheless resumed as means allowed. Half the staff of the Standard Motor Company were back at their usual tasks on the 16th, though one important building had been completely wrecked; and even the worst-hit factories estimated that production could be resumed in a few weeks.

The British verdict on the raid was therefore that, while the aircraft industry had suffered a bad setback, so far no irreparable damage had been done. On the other hand, two or three similar raids on Coventry within the next few nights might curtail output over a long period. That these opinions were held in England did not escape the notice of the German Air Staff; yet they failed unaccountably to profit by their knowledge. Apparently satisfied that one night's bombing had achieved its object, they turned their attention to other targets. On the night of the 15th London was the main target and only sixteen bombers were ordered to Coventry. In unfavourable weather less than half of them reached the city, dropping seven tons of high-explosive and thirty-two incendiary-canisters there as compared with some four hundred tons of high-explosive and more than a thousand incendiary-canisters aimed at London—a far bigger and less rewarding target, though doubtless easier to hit in conditions

which forced crews to rely on artificial aids. Similar conditions on the next three nights brought further attacks on London and a fairly big raid on Southampton, where targets included both aircraft factories and the docks. On the 19th, when weather over the Midlands was once more favourable, the opportunity for another devastating raid on Coventry was neglected in favour of an attack on Birmingham.¹ This raid, with two others on the 20th and 22nd, did much damage; but a similar effort against Coventry would almost certainly have paid the Germans better. Visits to Bristol, Plymouth and the Mersey, with two more to Southampton and one more big raid on London, brought the effort for the last seventeen nights of November to a total of thirteen 'major' raids.²

Meanwhile the British bomber-force had embarked on a series of 'area-attacks' designed to damage German economy and wear down the spirits of her people by devastating centres of industry and population. Raids in November on Berlin, Essen, Munich, Hamburg and Cologne were the sequel to decisions made by the British Government in October, rather than reprisals for the new series of German attacks which began at Coventry. The experience of Coventry did, however, play its part in influencing British estimates of the probable effectiveness of the new policy.

(iii)

On 25th November Air Marshal Douglas succeeded Air Chief Marshal Dowding as Air Officer Commanding-in-Chief, Fighter Command. For four years Dowding had headed a command which hitherto had known no other leader, and which bore at almost every point some imprint of his shrewd mind and well-marked personality. Throughout those years he had defended his conception of sound strategy, and had upheld the interests of his command and of all those who served in it, with a pertinacity and vehemence which had brought him often into conflict with the Air Staff. Not many men in British history have shouldered such a burden of responsibility as he had borne in recent months, and few have been privileged to shield their fellow-citizens from so grave a danger. Whether posterity numbers him among the great commanders of all time, or assigns to

¹ The night was notable for what seems to have been the first successful interception by an aircraft belonging to a Regular first-line squadron using airborne radar. A German bomber was brought down in Oxfordshire after engagement by a Blenheim of No. 604 Squadron whose crew were directed by their sector controller and by searchlight indications. There were no more successes with airborne radar for several months. Aircraft of the Fighter Interception Unit had, however, claimed some successes with airborne radar at an earlier stage.

² A 'major' raid by German reckoning was one where a hundred tons or more were aimed at a given target-area.

him a lower place, he will surely be remembered as one of whom it can be truly said that he deserved well of his country.

Three weeks after Douglas moved to Stanmore, Leigh-Mallory, the exponent of large formations for defensive fighting, took Park's place at Uxbridge. Park had borne the brunt of the fighting in the daylight battle, and that battle had been won; but victory did not silence criticism. Some contemporary observers thought that heavier losses would have been inflicted on the enemy if he had massed his squadrons in greater strength; and while later commentators have generally endorsed his policy of early engagement with single squadrons or pairs of squadrons during the first and second phases of the battle, some have continued to think that in the last phase, when the enemy's objectives lay further from the coast, a more whole-hearted acceptance of the 'big-wing' principle would have paid him better. It is certain, at any rate, that the contribution made by large wings on the few occasions in September when they did come into play, though over-estimated at the time, was not to be despised.

While still a member of the Air Staff, the new Commander-in-Chief had shown where his sympathies lay in this controversy by declaring that 'it does not matter where the enemy is shot down, as long as he is shot down in large numbers'. Soon after assuming his new post he made his attitude still clearer by announcing that he had 'never been very much in favour of the idea of trying to interpose fighter squadrons between enemy bombers and their objective'. He would rather, he said, shoot down fifty of the enemy when they had bombed their target than ten forward of it. Adopting a suggestion made by the Deputy Director of Air Tactics at a conference held in the closing stages of the Battle of Britain, he made arrangements to re-dispose his day-fighter squadrons in the south-east so that wings could be more readily assembled there in future. A few months later, establishments were created for an officer of Wing Commander rank, immediately subordinate to the Sector Commander and capable of leading a wing in action, at each of fifteen sector-stations in all parts of the country.¹ Another and less controversial reform which arose out of the recent battle was the reorganisation of fighter squadrons in sections of two aircraft instead of three, to facilitate division into pairs for mutual defence when the need arose.

But for the moment, at least, the enemy had suspended the big daylight attacks which alone could justify the use of large wings for defensive fighting. The task immediately confronting the new Commander-in-Chief was to deal with the night offensive. Like his predecessor (and like his successors throughout the war), he had under

¹ The stations were Speke (a new sector-station in No. 9 Group.), Colerne (replacing Filton), Middle Wallop, Northolt, Tangmere, Kenley, Biggin Hill, Hornchurch, North Weald, Duxford, Wittering, Digby, Kirton-in-Lindsey, Catterick and Turnhouse. The new arrangement of sectors is shown in Map 24.

his operational control the guns and searchlights commanded by General Pile. General Pile's command was reorganised soon afterwards, when the number of anti-aircraft divisions was raised from seven to twelve and three corps headquarters were interposed between command headquarters and the divisions. These changes lightened the burden borne by command and divisional headquarters and eased co-operation with the fighter groups. But the gunners were still much handicapped by shortages of weapons and ancillary equipment. About the same time Pile and Douglas decided in consultation that searchlights should be redispersed in clusters of three to give more powerful illumination and save manpower. For the rest, the resources at Douglas's disposal when he assumed command comprised the balloons of Balloon Command (from the beginning of December under Air Vice-Marshal Sir E. L. Gossage, succeeding Air Vice-Marshal Boyd); the various radar devices whose development and shortcomings have been outlined in Chapter XVI; and eleven squadrons of night-fighters. Six of these were the twin-engined squadrons earmarked for re-equipment with Beaufighters instead of Blenheims; the other five consisted of the two Defiant and three Hurricane squadrons whose relegation to night duty was due partly to his advocacy. In addition, elements of the Fighter Interception Unit at Tangmere could still be counted on for active operations; the nucleus of the new aerial mining unit was in being; and a third Defiant squadron was working up. Moreover, a special unit—No. 422 Flight—had been formed recently to study methods of night interception with single-engined fighters, while orders had been given for the creation of an additional Operational Training Unit to specialise in training pilots and other aircrew for night fighting. Measures not under Douglas's control included the devices worked by No. 80 Wing and various decoys and dummies intended to attract bombs. Smoke-screens for the purpose of obscuring vital targets were organised by the Ministry of Home Security with the assistance of up to eight thousand men of the Pioneer Corps provided by the War Office.¹ In addition, industrial haze was deliberately increased in certain districts by inciting factories to emit more smoke than was allowed by peace-time regulations.²

For the time being General Pile's guns were perhaps the most effective of these weapons; for if their tangible achievements were strictly limited, at least they often succeeded in impressing German bomber-crews with the volume and accuracy of their fire. The future seemed to lie, however, with the fighter force; and Douglas lost no

¹ In April, 1943, responsibility for smoke-screens was transferred to the War Office and Air Ministry. The work then fell mainly on Anti-Aircraft Command.

² This measure was discontinued in September, 1943, in view of the reduced risk of bombing.

time in stating his view of the measures needed to make that force effective. Like his predecessor, he soon saw that the main obstacle to interception was lack of accurate information about the course and height of German bombers flying to and from their targets. Although worth trying, the Kenley experiment had not brought good results, and in any case its scope was limited. Concluding that concentration of his relatively few G.L. sets in a single sector was uneconomical, he decided to disperse them so as to form a 'carpet' of sets in the southern counties. But this was only a beginning. In his opinion at least twenty squadrons of night fighters were needed to form a strong defensive belt from Newcastle to Devonshire, with a squadron each near Birmingham and Coventry. Later an additional squadron might be based near Glasgow. Aerodromes with special equipment for night-flying, including blind-landing devices and homing beacons to which airborne radar would respond, were urgently needed, as was an organisation which would relieve sector controllers of direct responsibility for bringing fighters down in safety, thus freeing them for more important tasks. Finally, pilots and other aircrew earmarked for night-flying must be chosen for their eyesight and specially trained to fly and fight in darkness.

Steps already taken to meet these requirements included the formation of the new Night Fighter Operational Training Unit, the posting to twin-engined night-fighter squadrons of experts to look after airborne radar, and the provision of meteorological officers at night-fighter bases. On 9th December the Secretary of State for Air promised Douglas that from twelve to fourteen aerodromes should be fully equipped for night-flying 'on the highest priority'. Compliance with his request for a minimum of twenty night-fighter squadrons was more difficult. To make up the number, six new twin-engined squadrons must be formed; but aircraft and pilots were both difficult to find. On the one hand, deliveries of Beaufighters and of the American D.B.7 (the basis of the Havoc and the Boston) were disappointing; on the other, the training organisation was still hard-put to meet demands. By early February the strength of the twin-engined fighter force had risen to seven squadrons, with eighty-seven pilots between them instead of nearly twice that number.¹ Towards a deficiency of seventy-four pilots, twenty-two were due shortly from the new Operational Training Unit and twelve 'veterans' with civilian experience would be added to them. The rest would have to be found by combing other commands or waiting for more recruits to come out of the mill.

On the other hand, new prospects of success were opened about the

¹ The standard establishment of a fighter squadron had been reduced in December from 26 to 23 pilots, the filling of vacancies on the old basis being clearly impossible at a time when new squadrons had also to be manned.

end of 1940 by delivery of a few of the G.C.I. sets already briefly mentioned.¹ Designed expressly for the ground control of interception, the new equipment had the advantage of showing the progress of both bomber and intercepting fighter on a fluorescent screen. In their original form the sets failed to read height as accurately as was desirable; until they could be improved the obvious solution was to use them in combination with G.L. sets, whose performance in that respect had been brought to a high pitch. Accordingly, Douglas deployed the first six sets in an area corresponding roughly with that assigned to the G.L. carpet, though his ultimate intention was to cover the whole country.

The coming of the sets not only simplified the mechanics of night interception, but also helped sector controllers by shifting part of their burden to other shoulders. In appropriate conditions the detailed work of interception was now done by special G.C.I. controllers stationed where the apparatus was installed. Again, special aerodrome control officers were henceforth made responsible for landing fighters safely. In these conditions the sector controller's task, apart from his general responsibility for the smooth working of the system, was to order fighters to their patrol lines, hand them over to the G.C.I. controller when the time was ripe, and order them to make for home or return to their patrol lines when the G.C.I. controller had done with them. Originally intended purely for use at night, the system of G.C.I. control was soon extended to daylight operations in cloudy weather, and later to a variety of circumstances calling for close control of fighters not necessarily equipped with airborne radar.

Meanwhile Douglas had not relinquished his intention of using substantial numbers of single-seater fighters for night fighting when circumstances were propitious. The G.C.I. system could, of course, be used to guide such aircraft towards their targets in precisely the same way as it guided Beaufighters and Blenheims. But in practice G.C.I. stations were usually fully occupied with twin-engined fighters. A method which relied on G.L. sets to track bombers on behalf of single-seater fighters was tried, but soon abandoned. There remained the time-honoured method which relied on searchlights alone; or rather a new version of it modified by re-deployment of the lights and gradual substitution of special radar sets for sound-locators. The S.L.C. sets whose development we have noted on p. 254 were, however, still scarce, and the system was handicapped by inadequate communications. Douglas believed that single-seater fighters nevertheless had a good chance of success when visibility was good. Should it prove possible to equip them with airborne radar—as then

¹ See pp. 253-4 and 256.

seemed likely—their chances would become better still. Applying a method used in the spring of 1940 for the defence of Scapa Flow, he ordered that on certain occasions Hurricanes should patrol at various heights over places chosen by the Germans for attack. To give them a free hand, twin-engined fighters (which they might mistake for bombers) would not be allowed within ten miles, while guns in the vicinity would be either forbidden to fire or restricted to a ceiling two thousand feet below the lowest Hurricane. In the second case, if all went well the bombers would be caught between the upper millstone of the Hurricanes and the nether millstone of the guns. The best conditions for a 'fighter night', as it was called, were such as might be expected in good weather when the moon was high and full.

Such were the more straightforward of the measures devised at the end of 1940 and the beginning of 1941 to cope with the night bomber. In addition the gravity of the threat and the absence of quick results engendered a number of less orthodox remedies. The formation of a unit for the purpose of trailing mines in the path of the elusive enemy has already been recorded.¹ A suggestion made by the Admiralty was more comprehensive. Advocating a much bigger minefield than could be sown by a few aircraft, they proposed that balloons carrying explosive charges should be allowed to drift towards the oncoming bomber stream.² Clearly the number of balloons required for a barrage of useful size and density would be very great, while an organisation of some complexity would be needed to secure their release at the most auspicious moment. Moreover, the risk that an uncharted wind might carry them away from the predicted course was far from negligible. Yet the prospect of doing lethal damage to the enemy without so much as firing a single gun or sending up a single fighter was undeniably attractive, especially as the scheme might possibly be workable in weather which put more orthodox measures out of court. Accordingly the Air Ministry decided, after a sub-committee of the War Cabinet had drawn attention to the point last mentioned, that the measure was worth trying. A meteorologist was attached to headquarters, Fighter Command, expressly to advise the Commander-in-Chief when conditions were most promising; and No. 30 (Balloon Barrage) Group, Balloon Command, took steps to release a drifting barrage fifty-five miles long, seven miles wide and four thousand feet deep from sites on the outskirts of London when the moment came. On 14th December Douglas was able to tell the Air Ministry that by the 16th preparations would be complete.

¹ See pp. 263 and 268.

² A similar suggestion had reached the Air Ministry some years before from a private source.

(iv)

In spite of radio beacons, beams, blind-landing devices and a multiplicity of aerodromes, German plans for the night offensive were balked in December by rain, snow, fog, ice and thick clouds. On fifteen nights Great Britain was left almost undisturbed. On the other sixteen, eleven major and five moderately heavy attacks were made on British cities. London was the favourite target, with three major attacks and visits by small forces on twelve other nights. Of the seven other places which drew attacks of some weight, the Mersey ports, Manchester, Sheffield and Birmingham attracted most bombs, but Bristol, Southampton and Portsmouth also suffered fairly heavily in relation to their size.¹

The most notable of the December raids, though not the largest, was that made on London on the 29th. (See Map 25.) As no bombers operated on the next two nights, it was also the last raid of the year. As in many previous raids on the capital, the principal areas chosen for attack were the City and the government quarter round Whitehall. The night was dark, the weather indifferent before midnight and worse later. Expecting such a change, the Germans arranged to deliver the bulk of their attack in the early hours of the night. Fresh winds, rising to a velocity of fifty miles an hour or more six thousand feet above the ground, blew from the west and south-west across London.

Before the raid the Germans laid the main beams of the *X-Gerät* from south-west to north-east along a line from Battersea Reach to Bloomsbury. At the last moment they made a correction, presumably for wind, which placed at least one beam on a roughly parallel course about five-eighths of a mile to the west. Ten aircraft of *Kampfgeschwader 100*, the unit which specialised in *X-Gerät*, took part in the raid and were almost certainly the leaders. They carried incendiary bombs only, presumably to kindle marker-fires. The bulk of the several

¹ According to German sources the bomb-load for December was distributed as follows:

Target	Major Attacks	Other large Attacks	Tons of H.E.	Incendiary Canisters
London	3	—	625	4,129
Liverpool-Birkenhead	2	—	485	1,701
Manchester	2	—	467	1,925
Sheffield	1	1	435	1,057
Birmingham	1	2	409	1,317
Bristol	1	1	198	773
Southampton	1	—	147	586
Portsmouth	—	1	88	148

'Major attacks' are those in which 100 tons or more of high-explosive were aimed; 'other large attacks' those involving a load of 50 to 99 tons. Smaller attacks are ignored throughout the table. For further details, see Appendix XXX.



Plate 21. The City of London on the morrow of 29th December, 1940.

hundred incendiary-canisters dropped throughout the raid fell east of the displaced beam, largely within a circle of about two-and-a-half miles in diameter centred near St. Paul's Cathedral. High-explosive bombs were thickest in the riverside boroughs from Poplar to Westminster, but many fell further south in Lewisham and Camberwell. In commercial quarters of the City, crowded with warehouses and dotted with fine churches, and also in Bermondsey and Southwark, fearful harm was done by fires which quickly became uncontrollable. Of nearly fifteen hundred fires reported from various parts of London, fifty-two were afterwards classed as 'serious', twenty-eight as 'major', and six as 'conflagrations'. The two largest covered areas of about a half and a quarter of a square mile respectively. By an evil chance, the raid reached its peak when the Thames was at its lowest ebb and therefore of least use to firemen. Outside the City heavy damage was done at many places; but the devastation wrought there, the scars inflicted on treasures of architecture cherished in the imagination of thousands throughout the English-speaking world, were by far the most impressive features of a night which Londoners will long remember. Apart from churches, well-known buildings damaged on that night of terror included the Guildhall and the County Hall, the Tower of London and nine hospitals.

As in several earlier raids on London, Birmingham and Sheffield, damage done by fire was far heavier than that done by high explosive. The moral was clear. In many cases incendiary bombs and minor fires could be quickly rendered harmless if tackled at once by someone on the spot. Firemen, whether professional or auxiliary, could not be on the spot for the simple reason that they could not be everywhere at once. Their business was with fires of some size which had already gained a hold. As the Air Staff urged, what was wanted was a person in every building—and especially every building otherwise left unoccupied at night—to keep watch for incendiary bombs and scotch them and their immediate consequences without delay. Accordingly the Government instituted a system of 'fire-watching' whereby members of the public were made responsible for dealing with incendiary bombs which fell on their dwellings or places of work. Though introduced too late to offset the consequences of some of the worst raids, the system saved much damage to property in the later stages of the night offensive.

Meanwhile the air defences continued to struggle with tasks beyond their strength. On many occasions anti-aircraft fire was sufficiently well-placed to draw tributes from German bomber-crews, but not quite accurate enough to hit their aircraft. In December the guns claimed ten victims, fighters four—an almost negligible fraction of the German effort.

On the 11th an oddly-conceived experiment was tried, when

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twenty-four Hampden bombers patrolled Birmingham in layers separated by intervals of five hundred feet while the city was being raided. Crews report seeing aircraft—supposedly German bombers—on twenty-six occasions, but the Hampdens were too slow and unwieldy to catch them. As a rehearsal for a 'fighter night' the test was inconclusive, for lone pilots of faster single-seater aircraft might not have seen anything.

The first trial of the balloon-borne aerial minefield on the 27th was still more disappointing. Communications were so unsatisfactory that the order for release was followed by a delay of more than half an hour before the first balloons went up. About a third of the nine-hundred-odd balloons inflated proved defective; others exploded early in their flight or descended prematurely in unexpected places. Observation of two special test-balloons suggested that those which continued on their course were flying much too high. About two hours after the first release an apparent scarcity of German bombers led to the suspension of the operation; but again some forty minutes elapsed before the last release was made. The German report of the night's events refers to numerous 'parachute-grenades' (*Fallschirmgranaten*), but there is no evidence that the barrage achieved anything of value. The project was not, however, to be condemned on the strength of a single experiment, and arrangements were made for a further trial in due course.

December saw another new departure in the shape of the first 'intruder' patrols flown by British fighters. For some time past aircraft of a German long-range night-fighter unit had been visiting British aerodromes at night for the purpose of hampering our bomber effort.¹ With a similar end in view, aircraft of Bomber and Coastal Commands had made many attacks on aerodromes in France and the Low Countries since the summer. Quite often their crews had seen German aircraft apparently awaiting their turn to land. The inference was that British long-range fighters armed with guns, flares and light bombs would find good opportunities of damaging or destroying German bombers returning from raids on the United Kingdom. Accordingly, when the Air Ministry suggested that Fighter Command should relieve the bomber force of at least part of its responsibility for patrolling aerodromes in German hands, the way seemed open for a valuable extension of the defensive to the enemy's camp. Good intelligence and a flexible system of control would, however, be needed to ensure that fighters went to the right aerodromes and reached them at the proper moment. As a first step No. 23 Squadron, one of the original twin-engined night-fighter squadrons, parted with

¹ Between 1st October, 1940, and 31st March, 1941, some fifty attacks were made on aircraft of Bomber Command over the United Kingdom. Seven bombers were destroyed and twenty damaged.

its airborne radar—which could not be risked on the far side of the Channel—and went through a short period of special training at a Bomber Command station. On the night of 21st December six of the squadron's Blenheims made the first 'intruder' sorties over France. Crews saw four aircraft, presumably all German, but were unable to engage them. Bombs aimed at six aerodromes in Normandy and Artois did negligible damage. Further patrols were made on the next night and that of the 29th, with much the same results.

(v)

At the beginning of the New Year the long-range bomber strength of *Luftflotten 2* and *3* stood at 1,214 aircraft, as compared with 1,291 in September. The strain imposed by recent operations was, however, reflected in the large number of aircraft undergoing or awaiting minor repair or overhaul. On 4th January the two *Luftflotten* mustered only 551 serviceable bombers—about 250 fewer than the corresponding figure for September. Thus in four months the ratio of serviceable bombers to total bomber strength had fallen from 61 to 45 per cent.

Throughout the first two months of 1941 bad weather continued to limit the scale of attack. In January, major raids were confined to two on London and one each on Avonmouth, Bristol, Portsmouth, Cardiff and Manchester. London and Avonmouth, with Swansea, Derby and Southampton, also drew substantial raids of smaller scope. In addition, Plymouth and Devonport suffered a sharp attack, mainly with incendiary-canisters.¹ The majority of these places are in the western half of England and nearly all of them are ports. As early as January events thus foreshadowed changes in German strategy to which full effect was to be given later.²

In February no major raids were made, but London and Swansea

¹ According to German sources the bomb-load for January was distributed as follows:

Target	Major Attacks	Other large Attacks	Tons of H.E.	Incend. Canisters
London	2	3	490	1,987
Avonmouth	1	1	206	2,232
Bristol	1	—	154	1,488
Portsmouth	1	—	148	1,409
Cardiff	1	—	115	392
Manchester	1	—	111	735
Swansea	—	1	89	901
Derby	—	1	59	41
Southampton	—	1	57	325

For definitions of 'major attacks' and 'other large attacks', see p. 272. The foregoing figures ignore raids in which less than 50 tons of high-explosive were aimed at a single area. Further details are given in Appendix XXX.

² See Chapter XVIII.

suffered fairly heavily in attacks of lesser weight. Between them the two places attracted roughly one-third of a bomb-load totalling about a thousand tons. Among many places which drew minor raids were Chatham, Cardiff and Great Yarmouth.

Major bombing was resumed in March with the return of better weather. During the moonlit period in the second and third weeks of the month twelve major attacks were made on ports and centres of industry. London was again the favourite target, suffering three major raids which totalled seven hundred tons; but Glasgow with its outskirts, drawing about five hundred tons in two raids on successive nights, was close behind. Other sufferers were Plymouth, Hull and Liverpool-Birkenhead, each with more than three hundred tons; Portsmouth with about two hundred; and Bristol-Avonmouth and Birmingham with about a hundred and seventy and a hundred and twenty tons respectively. In several cases major raids were preceded or followed by smaller raids on the same target so as to produce a cumulative effort.

February and March were also notable for several attempts by small numbers of bombers to score precise hits on aircraft factories and the like with the help of *T-Gerät*. Although technical difficulties hindered counter-measures, the usual result was a spectacular 'near-miss' which left the factory untouched.

The first three months of 1941 saw modest but appreciable progress by the night defences. 'Fighter nights' brought claims to the destruction of three bombers—admittedly an almost negligible number. New trials of the airborne minefield in January and March went more smoothly than the first, but yielded no material return.¹ On the other hand, twin-engined fighters gave convincing evidence that G.C.I. control could yield practical results. On ninety-five occasions in March (as compared with forty-four in January and twenty-five in February) crews detected aircraft with their airborne radar; on another twenty they saw aircraft which they had not previously detected.² Combats followed on only thirty-one of these occasions; but the main point was that the ability of G.C.I. control to bring twin-engined fighters near enough to the enemy for crews to detect him or even see him was conclusively established. There was thus a good chance that before long growing experience, additional equipment and possibly better weather might enable the night defences to declare a handsome dividend on the work and skill invested in them.

At the same time a great deal was being done in other fields to rob

¹ Thereafter trials were confined to an experiment at Liverpool in May and a few tentative releases from ordinary balloon-sites in the London area. The scheme was finally abandoned towards the end of 1942.

² For further details, see Appendix XXXIV.

the night offensive of its sting. Balloons and anti-aircraft fire, always valuable deterrents to low-level bombing, sometimes scored more tangible successes. In February and March at least seven German aircraft crashed after striking balloon-cables in various parts of the United Kingdom. Anti-aircraft gunners claimed the destruction of thirty-seven night-bombers in January–March (and a share in the destruction of a thirty-eighth), as compared with twenty-nine claimed by fighters. Altogether the Luftwaffe lost ninety bombers during the three months in raids by day and night on the United Kingdom and on shipping. Other methods of defence included radio counter-measures cunningly reinforced by decoy-fires designed to simulate the effects of incendiary-bombs dropped as markers. In February such fires twice drew bombs intended for delivery elsewhere, though only four were lit; next month, out of seventeen kindled, sixteen scored some success, two at Cardiff and Bristol in particular drawing upwards of a hundred and seventy high-explosive bombs between them. Finally the new fire-watching system, backed by the growing experience of Civil Defence workers, tended to make even well-directed bombing less destructive than heretofore. As spring drew on much, therefore, fostered the impression that, while the menace of the night-offensive had not yet been overcome, at least its measure had been taken.

(vi)

In April the German bomber force confronting the United Kingdom was reduced by the withdrawal of about a hundred and fifty bombers, with other units, to support the campaign in the Balkans. In May still further withdrawals were made in preparation for the offensive against Russia. Steps were taken to conceal them by means of dummy signals traffic; perhaps to the same end, units which remained behind were exceptionally active.

Accordingly the last weeks of the night-offensive against British industry and communications saw an undiminished effort by diminished forces. In April some very heavy raids were made on London; in the same month familiar targets on the coast and in the Midlands were revisited, and major attacks were extended to some places hitherto little troubled by night bombing. The next month opened with big raids on Liverpool–Birkenhead, Clydeside and Belfast. The last phase of the night offensive culminated on 10th May in a big attack on London, and six nights later closed with a raid on Birmingham. During the raid on London Rudolf Hess, Deputy Führer of the Third Reich, landed by parachute near Glasgow from an aircraft in which he had flown alone from Germany. Announcing that he had

come on a private peace mission, he asked to see the Duke of Hamilton and Lord Simon.

The last three major raids on London were the heaviest yet suffered by any British city. To swell the effort some crews made double and even triple sorties. Inevitably, great damage was done, especially to riverside boroughs. Belfast, too, was sorely tried by two raids in which some four hundred tons of high explosive and many thousands of incendiaries were dropped on a city that had hitherto seen little of the enemy. Heavy loss of life and damage to property in the first raid caused many inhabitants to seek a roof elsewhere, and convinced others of the wisdom of taking shelter at once when the sirens sounded. The result was that, though the consequent demand for accommodation outside Belfast cut across the official plan of dispersal, casualties in the second raid were only about a quarter of those suffered in the first. Damage to Harland and Wolff's shipyard was, however, so great that production was cut by nine-tenths for about ten days and did not fully recover until more than six months later.

Meanwhile the strength of the defences was increasing, though much less rapidly than the defenders could have wished. By May, General Pile had 1,691 heavy and 940 light anti-aircraft guns. These figures compared with pre-war approved scales of 2,232 heavy and 1,860 light guns, increased in August, 1940, to 3,744 and 4,410 respectively. Under the new scheme he was entitled also to some 8,000 rocket-projectors, and in fact well over 7,000 were available. Unhappily, output of the rockets themselves had fallen so far short of expectations that only a few of the projectors could be used. By the end of March 18,600 rockets had been delivered, of which Pile's share was 8,400. This allotment enabled him to deploy only 840 projectors with ten rounds apiece. At the same time future supplies were threatened by a decision to give preference to the Admiralty, who sorely needed weapons for the defence of merchant shipping.¹ Demands from the Admiralty contributed likewise to his other shortcomings, for in recent months he had not only been compelled to hasten the return of over a hundred 3-inch guns lent to him in 1939, but had also been asked to find for the defence of shipping three hundred Bofors guns from his existing resources and from new production on which he had previously counted. His allotment of searchlights had risen earlier in the year to the substantial total of 4,532, but shortage of men had since obliged him to reduce the number in commission. As a remedy for his chronic shortage of manpower in other spheres he proposed in April that women of the Auxiliary Territorial Service should serve with men on gunsites. The

¹ See Chapter XVIII.



suggestion was adopted, but the first Mixed Battery was not ready until four months later. It was then deployed in Richmond Park, south-west of London. Ultimately the employment of women in Mixed Batteries manned in the proportion of two women to one man freed some 28,000 soldiers for other duties and was thus a valuable contribution to home defence.

Air Marshal Douglas was better off than General Pile, with some fifteen night-fighter squadrons by mid-May towards the twenty he required.¹ Of seven twin-engined squadrons designed for pure defence by orthodox means, one had Havocs, while re-equipment of all the rest with Beaufighters was next door to completion. His eight single-engined squadrons were equipped with Hurricanes and Defiants in varying proportions. In addition, No. 23 Squadron was still engaged on its 'intruder' duties, the aerial minelaying unit had now achieved the status of a full squadron, and elements of the Fighter Interception Unit remained at his disposal for occasional active operations. Eleven G.C.I. stations were in position by the end of April and in May two more were added.

Thus equipped, and favoured by more frequent opportunities, the fighter force began to find its feet. April, with its big raids on a variety of targets, brought fifty-five engagements by twin-engined fighters, all but five of them resulting from the use of airborne radar.² In the same month pilots and gunners of single-engined fighters saw their quarry on forty-five occasions and had thirty-nine engagements. These combats were not all successful—in the whole of April the Germans lost seventy-five bombers over or near the United Kingdom as compared with nearly ninety claimed at night by guns and fighters—but at least the trend was upward. In May the same tendency continued; and during the last big raid on London single-engined fighters seemed at last to come into their own. In bright moonlight sixty Hurricanes and Defiants patrolling over London, with another twenty over Beachy Head and smaller numbers elsewhere, met many bombers and claimed excellent results. When claims were reckoned up next morning, nineteen victories were credited to single-engined fighters, four each to twin-engined fighters and anti-aircraft gunners (the latter hampered by 'fighter night' restrictions) and one to an 'intruder' aircraft. In fact, the Germans lost only eight aircraft destroyed (including one which crashed on take-off) and three damaged; but at least there was some foundation for the belief that the tide was turning.

In a sense the subsequent falling-off of the night offensive came, therefore, as a disappointment to Douglas and his subordinates, who saw their adversary elude their grasp at the very moment when they

¹ For details, see Appendix XXIX.

² For further details, see Appendix XXXIV.

seemed on the point of overthrowing him. 'We were confident', wrote Douglas later, 'that if the enemy had not chosen that moment to pull out, we should soon have been inflicting such casualties on his night-bombers that the continuance of his night-offensive on a similar scale would have been impossible.' On the other hand, the general run of results achieved so far had admittedly been disappointing. In retrospect, at least, the struggle between the night-bomber and the air defences appears at best as a drawn battle, at worst as a victory for the enemy, who must be admitted to have come off very lightly. But in another sense the night-offensive had clearly failed. Eight months' bombing had caused much hardship and raised many problems, but British industry and communications had survived to feed the long war so inimical to German interests. Aircraft factories and aero-engine works had suffered setbacks but escaped disaster; heavy industry had sustained wounds which appeared of small importance when viewed on the national scale. Stocks of oil were virtually unaffected by losses trifling in proportion to their total bulk, while tankage written off could be replaced without much difficulty from reserves. Reserves of food, especially animal feeding-stuffs and sugar, had been rather heavily depleted by certain raids on London and Liverpool, but such losses were not disastrous while external communications remained open. Traffic on the railways had suffered many interruptions, but none had been sufficiently prolonged or widespread to hold up war production to any serious extent. And troubles arising from damage to public utility undertakings and their distribution systems, though they caused much inconvenience and some loss of output, had come well short of calamity. Despite a lengthy catalogue of 'incidents', each with its overtones of pathos, humour, miraculous escape or domestic tragedy, the night-offensive had failed to halt the machinery of production and distribution in these islands or to break the national will to fight.

To sum up the effects of the night-offensive more precisely is difficult without prolixity on the one hand or misleading brevity on the other. Statistical comparisons are tempting but lead readily to false conclusions. German documents record the weight and number of bombs supposedly dropped on various objectives night by night throughout the whole course of the offensive, but necessarily ignore the effects of unsuspected errors in aim or navigation. On the night of 8th May, for example, crews instructed to bomb Derby believed that they had done so when in fact they had bombed Nottingham, with the result that other crews who *were* instructed to bomb Nottingham dropped their load unprofitably in open country as far east of their objective as Nottingham lies east of Derby. And British records of the bombing, while remarkably informative in some respects, are incomplete, particularly with respect to the first few

months of the offensive.¹ But even with all the data a comparative assessment of the bombing would be hard to make. Besides area, population, weight and frequency of big and small attacks, number of killed and seriously injured and of buildings damaged past repair, a recalcitrant array of imponderable factors would claim consideration.

By rough-and-ready standards first place goes unquestionably to London, most heavily and frequently attacked of British cities. Admittedly its big bomb-tonnage—according to German reports amounting to some 18,000 tons in major raids alone during the eight months of the whole offensive—was distributed over nearly a hundred boroughs and districts, ranging in size from about four hundred to more than twenty thousand acres.² Among them Holborn, the City and Westminster reported the largest numbers of hits in proportion to their size, the first apparently receiving many bombs intended for its neighbours. Shoreditch, Southwark and Stepney, all dockland areas, also suffered heavily, as did Finsbury, Chelsea and Bethnal Green, with the riverside boroughs of Lambeth, Bermondsey and Deptford. Outside London, Liverpool (with Birkenhead) was probably the biggest sufferer, especially if earlier raids in August are brought into the reckoning; but Birmingham, with eight big raids, was close behind, while Coventry and Plymouth were probably as heavily attacked in proportion to their size as any British city. And any list of claimants to the melancholy honour of having suffered most in the night offensive must mention also Glasgow, Bristol, Portsmouth, Southampton, Hull and Belfast. Manchester, with only three big raids, may be thought to have come off lightly in view of its great size and importance. Sheffield, Newcastle, Nottingham and Cardiff complete the tally of cities considered worthy by the enemy of major raids. (See Map 26.) In all sixteen of these cities, as in countless other places from the Scottish Highlands to quiet villages in rural England, bombing caused incalculable distress and hardship. Yet it can be claimed without exaggeration that, while these experiences led occasionally to passing discontents—habitually expressed in criticism of the air defences—in the long run they left the people everywhere not only with spirits undismayed, but more than ever determined to see the war through to the end.

¹ A detailed 'bomb census' was inaugurated in September, 1940, and began to function about a month after the beginning of the German night offensive against London. 'Bomb diaries' for Birmingham, Liverpool and London were kept from early October, but trained staff was scarce and for some time the London diary recorded only numbers and positions of bombs, without reference to their tonnage. The system was extended in November to Coventry; afterwards to Manchester, Leeds and Hull; and ultimately (by employment of mobile census parties) to all parts of the country.

² The figures include outlying places such as Enfield, Chingford, Orpington and Esher, reckoned for this purpose as part of Greater London.

CHAPTER XVIII

BLOCKADE: PART ONE

(October, 1940–June, 1941)

(i)

WE HAVE seen in earlier chapters that the problem of defending coastal shipping against air attack, so prominent in the preliminary phase of the Battle of Britain, was later masked by more pressing needs, so that in August No. 11 Group was formally absolved from the duty of providing close escort for Channel convoys.¹ Hence in September and October, 1940, the fighter force made only a few hundred sorties for the direct protection of shipping, as compared with about 3,200 and 2,900 respectively in the previous two months.

Nevertheless the place of coastal traffic in the national economy had not diminished since the days when raids on shipping in the Straits had led the Air Staff to comment on Dowding's disposition of his forces.² On the contrary, the diversion of ocean convoys from the south-western to the north-western approaches gave new importance to coastal traffic moving northabout; and in areas threatened by invasion increasing numbers of minesweepers and other adjuncts to home defence all helped to swell the volume of shipping afloat where fighters might be expected to escort it. If in the autumn the Admiralty accepted a lower standard of security than had been contemplated earlier, the reason was not that they were willing to see coastal shipping relegated to the background, but that for the moment other claims were irresistible. At the first sign of a lull, if not before, their demands were bound to be renewed on an ascending scale.

In the outcome the end of the daylight battle was still some weeks distant when the fighter force received the first hint that more attention to shipping would be expected in the future. Early in October the Admiralty were confronted with the task of building up supplies of coal in London against the coming winter, perhaps with little assistance from railways threatened by the night-offensive. They warned Dowding that they must increase the flow of traffic down the East Coast, where attacks by bombers based in Norway and Holland

¹ See pp. 164 and 235.

² See p. 173.

were a constant threat. Thereafter requests from naval home commands came in so fast that in the third week of the month the number of convoys or other shipping units for which assistance was asked reached an average of twenty-three a day.

At that time the daylight battle had reached a stage of peculiar difficulty for the defenders. Approaching London at great heights and high speeds, German formations which might or might not drop bombs proved hard to intercept and often hard to track. Casualties among the fighter force, though lighter than in the summer, were still serious enough to prevent the recovery of squadrons stripped to the bare bone in September. Meanwhile, Dowding was in the thick of the night battle. His twin-engined and Defiant squadrons were committed to night-duty, and he had just been ordered to relegate to the same task three Hurricane squadrons which he would have preferred to keep for daylight fighting. He was therefore in no position to devote some hundreds of sorties a day to standing escort. The Merchant Navy's need was indisputable, but had been recognised at so late a stage of pre-war planning that nothing effective had been done to enable Fighter Command to meet it while a major battle was in progress. As the Air Staff tacitly admitted, Dowding could do no more in many cases than promise what was technically called 'protection', in the hope that soon a lull would enable him to give the standing escort which would doubtless be preferred.¹

In fact, the lull came fairly soon, though not before a new series of attacks on shipping, somewhat similar to those with which the battle had begun, had raised fresh alarms. On 1st November German bombers and dive-bombers sank four ships, including the East Oaze light-vessel, when attacking drifters off Dover and a convoy entering the Thames. Repeated attacks of the same sort during the next few days threatened to make life intolerable for seamen in the searched channels leading to and from the Port of London. So seriously did the Commander-in-Chief, The Nore, regard the danger that on the 8th he asked that a standing patrol should be flown over one of the principal channels whenever a convoy was entering or leaving it.

Fortunately the menace dwindled to small proportions after the middle of November. Thereupon the daylight battle could be reckoned at an end, though occasional sweeps by fighter and fighter-bombers were still made until the middle of December.

Accordingly Douglas, succeeding Dowding on 25th November, confronted issues disquieting enough, but in some ways less complex than those which had faced his predecessor. Renewal of mass attacks in daylight was unlikely before the spring. He calculated that he would then need eighty day-squadrons to fight a second daylight

¹ For definitions of 'escort', 'protection' and 'cover', see pp. 91-2.

battle against larger forces than the Germans had used in 1940. Meanwhile he had some fifty-five and the promise of nine more within the next few months. As he would still be sixteen squadrons short of the number he deemed necessary, and could expect no further additions by the time the Germans were expected to attack, clearly he must make the most of what he had by building up existing units. Apart from his concern with the night battle, he had also to consider means of countering 'pirate' raids on aircraft factories by single bombers or small formations which cleverly exploited every circumstance of topography and weather. Successfully resisting demands for dispersal of his resources to factory aerodromes throughout the country, he assented to a scheme which gave workers in eleven factories the moral support of a fighter apiece in charge of their own test-pilots; arranged that night-fighters with airborne radar should stand by in cloudy weather; and reviewed arrangements governing the operation of balloon barrages in order to ensure that excessive precautions against accidental loss should not result in their being close-hauled when they were most needed.

For some months, therefore, Douglas was scarcely better placed than Dowding to escort convoys lavishly. Throughout the early winter he followed his predecessor's policy of giving 'protection' rather than standing escort. Instead of rising sharply when the daylight battle ended, the number of sorties flown directly to aid shipping remained from November until February almost stationary at rather more than four hundred a month.

Towards the end of February the problem again came to the fore in consequence of the attention focussed on what was soon called the Battle of the Atlantic. Since the autumn, attacks on ocean convoys by submarines assisted by long-range reconnaissance aircraft of *Kampfgeschwader 40* had caused the Admiralty and the Government much anxiety. Meanwhile the West Coast ports were attracting growing attention from night bombers; and while mass attacks on coastal shipping had ceased in the middle of November, raids by single bombers or small formations were becoming perceptibly more frequent. At the same time the Luftwaffe was said to be about to strengthen its anti-shipping arm and was in fact about to overhaul it. Signs from many quarters thus pointed to the danger that submarine blockade, assisted by long-range air reconnaissance and backed by an offensive against ports and coastal traffic, might cut the country's lifeline.

The likelihood of such a threat had been foreseen at least as early as the fall of France, and measures had then been put in hand to meet it. Besides the diversion of ocean traffic to the north-western approaches, they included important changes in the naval organisation for convoy-escort and anti-submarine patrols. In consequence a

new Western Approaches Command, assisted by No. 15 Group, Coastal Command, had recently assumed responsibility for safeguarding Atlantic convoys approaching or leaving the United Kingdom by the new route north of Ireland. Its headquarters were at Liverpool, to which place No. 15 Group had accordingly moved from Plymouth. At Plymouth another new naval command with different responsibilities replaced the old and was assisted by No. 19 Group, created for that purpose. If these reforms were to be effective in face of the bigger scale of attack on convoys now expected, clearly the resources of the commands and groups concerned must be adjusted to their needs. Recognising that the time had come for such a change, the Prime Minister ruled towards the end of February that the problem should be studied on the understanding that defeat of German submarines and of *Kampfgeschwader 40's* long-range aircraft must rank above all other tasks.

On 27th February the Chiefs of Staff agreed, therefore, to strengthen surface and air escorts for Atlantic convoys at the expense of other claimants. Additional safeguards for the north-western approaches must be sought not only by countermanding reinforcement of distant theatres, but also by moving ships and aircraft from the East Coast to the West. The air defences and coastal shipping must help, too, by surrendering anti-aircraft weapons needed to safeguard ocean-going vessels. To minimise the consequent weakening of safeguards off the East Coast, the bomber force must take on certain duties hitherto performed by coastal aircraft, and the fighter force do more for coastal convoys. At the same time West Coast ports must also have increased protection. Moreover a directive issued by the Prime Minister on 6th March called on Bomber Command to make a special effort against yards and bases which built or harboured German submarines and long-range aircraft.

The impact of these changes on the air defences was widespread and substantial. Henceforth the Admiralty had first call on a variety of anti-aircraft weapons, including rocket-projectors and parachute-and-cable sets as well as light guns and machine-guns. Additional defences for West Coast ports were demanded at the very moment when a number of light anti-aircraft guns had perforce to be removed from some of them for the benefit of ocean trade. Within a few days Douglas received instructions to provide additional 'watch and ward' for East Coast shipping and to give such reinforcement to West Coast ports as might seem necessary; on 9th March the Air Ministry notified him formally that henceforward his primary task was no longer the defence of the aircraft industry but that of the Clyde, the Mersey and the Bristol Channel.

He responded by taking three steps, followed later by a fourth. In the first place he told his group commanders to pay special attention

to the needs of shipping, not only off the East Coast but also in other areas favoured by German bombers. Standing escort must, he said, be given more generously than in the past; and where 'protection' seemed sufficient, fighters earmarked for the purpose must be kept airborne as long as attacks were likely to be made without good warning. Secondly, he made some minor changes in the disposition of his fighters and in local arrangements for reinforcement between sectors. Thirdly, after consulting General Pile and on the recommendation of the appropriate committee, he sanctioned a scheme whereby the heavy anti-aircraft gun defences of the Mersey were brought up to about nine-tenths of their approved scale and those of other major West Coast ports to about three-quarters. The eighty-one additional guns required were found by moving fifty-eight from other areas and bringing in another twenty-three from new production. Soon afterwards visits by inspecting officers led to the conclusion that at the Mersey and the Clyde planned scales must be increased and that at the other places in question the existing scales must be made good without delay. On 21st March he therefore sanctioned further additions amounting to more than a hundred guns, of which about a third were to be found from other areas and the rest from accessions due in April.¹ Consequent reductions at such important centres as Birmingham and Sheffield were accepted with reluctance, but were broadly justified in the outcome by the trend of the offensive.²

Of all these measures, the most productive of tangible results were the orders given to group commanders to do more for coastal shipping. Whether the strengthening of heavy gun defences on the West Coast and minor changes in the disposition of fighter squadrons had much effect on the enemy no-one can say with certainty; the impact of more generous escort to coastal convoys on his air offensive against shipping, on the other hand, was profound and striking.³ Whereas

¹ The effects at the principal West Coast ports were as follows:

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Port	1939 Scale	1940 Scale	Strength 27.2.41	Additions 28.2-12.3	New Scale 21.3.41	Strength 21.3.41	Additions Sanctioned 21.3.41
Clyde . . .	80	120	67	19	144	88	56
Mersey . . .	104	104	84	12	112	96	16
Bristol	} 56	80	36	28	80	68	12
Avonmouth							
Swansea	} 32	48	18	18	48	36	12
Port Talbot							
Llanelly							
Barry	} 48	64	52	4	64	56	8
Cardiff							
Newport							

The figures in column 7 include guns moved or ordered to move since 12.3.41 and hence exceed in some cases the totals of columns 4 and 5.

² See Chapter XVII.

³ See Appendix XXXV.

between December, 1940, and February, 1941, the number of sorties counted by the fighter groups as directly devoted to the defence of shipping had amounted to about one-twelfth of their total defensive effort in daylight, in March the proportion rose to about one-fifth and from April onwards to about one-half. As compared with a monthly average of well under five hundred sorties so defined at the end of 1940, the groups flew more than two thousand in March and an average of over seven thousand a month in April, May and June. In the first three months of 1941 convoys and other shipping units reported a hundred and sixty-one daylight attacks, or threats amounting to imminent attack, in waters within forty miles of a fighter aerodrome, and thirty ships were sunk in daylight; in April alone a hundred and twenty-four such incidents were reported but the number of sinkings in daylight was only ten. In May and June reported incidents fell to forty-one and forty respectively, sinkings to seven in May and only three in June.

A growing volume of fire from ships' guns probably contributed to the trend, but a big share of the credit goes undoubtedly to fighter escort. The outcome was not, however, an unmixed benefit, for one result was to drive the enemy to make more attacks at night, when fighter escort was difficult and of questionable value. The number of ships sunk at night in coastal waters rose from three a month to eleven and then to twenty, so that total sinkings by day and night were higher in June than in any previous month except March. A number of remedies were tried, but were not very effective. No comprehensive answer to the problem could be found while in general the night-bomber had the upper hand of guns and fighters.

All this time the struggle against submarines and *Kampfgeschwader 40's* long-range aircraft was in progress far to seaward. Atlantic convoys were menaced, too, by ordinary long-range bombers based conveniently in France and Norway. The business of *Kampfgeschwader 40's* aircraft was not so much to attack ships—although at first direct attacks were a potent menace—as to shadow convoys and report their movements for the benefit of submarines. So doing, they ran little risk from ships' guns or from flying-boats and aircraft of bomber type appointed as spotters of submarines and surface craft. Long-range fighters of Coastal Command working from Northern Ireland or the Hebrides stood a better chance of closing with them; but some forty squadrons would have been needed to guard the four convoys usually in the danger area throughout the long hours of summer daylight, and nothing like that number was available. A possible alternative existed in the shape of single-engined fighters which might be sent to sea with every convoy and be launched by catapult from ships adapted for the purpose. Sir Charles Portal, who had recently succeeded Sir Cyril Newall as Chief of the Air Staff, was much struck by

the merits of the plan at a time when direct attacks by aircraft seemed more dangerous than the shadowing which later proved the bigger risk. Observing that 'neither shore-based aircraft in the numbers that we can hope to provide in the next six to nine months nor gun armament can secure our shipping in the Atlantic against the scale and type of long-range air attack that we must now expect', he urged on 3rd March that the scheme should be put into effect as rapidly as possible.

Accordingly the fighter force, whose realm had already been extended from the coast to five and then to forty miles beyond it, soon found their sphere of influence stretching right over the Atlantic. Besides an auxiliary aircraft carrier and four modified Ocean Boarding Vessels equipped to work continuously in the danger zone, fifty merchant ships of about nine thousand tons were modified so that each could carry a single Hurricane and launching-gear without prejudice to its normal trade. The carrier and Ocean Boarding Vessels carried naval fighters, the merchant vessels air force fighters, pilots and maintenance crews and naval 'fighter directing officers'. On completing his patrol a pilot launched from any of the modified ships could either make for land (if it was near) or wait to be picked up after descending on the water with his aircraft or by parachute. If he achieved his object the loss of his aircraft was no great price to pay for the safety of the convoy, especially as obsolescent Mark I Hurricanes could do all that was required.

Provision for the 'Catapult Aircraft Merchant Ships', as they were called, added one more to the many novel tasks imposed on the fighter force in recent years. Known as the Merchant Ship Fighter Unit and administered by No. 9 Group, the appropriate unit was formed in May with headquarters at Speke, near Liverpool, and later with outposts in Nova Scotia and at Archangel and Gibraltar. Besides the headquarters organisation and a practice flight, its resources at the outset comprised two erection parties, fifty seagoing detachments and sixty Hurricanes, or roughly the equivalent of two normal squadrons. The first detachments went to sea in early June, but contact with the enemy was not made until November. On the 1st of that month a pilot launched from the steamship *Empire Foam* about six hundred and fifty miles west of the Irish coast gave chase to an aircraft of *Kampfgeschwader 40* but lost touch with it in cloud.¹ But first blood had already gone to a naval fighter, for on 3rd August a Hurricane of No. 804 Squadron, launched from the converted Ocean Boarding Vessel *Maplin*, had destroyed an aircraft of the same German unit about four hundred miles south-west of Cape Clear.

¹ No further interceptions by the Merchant Ship Fighter Unit were recorded in 1941, but some success was scored on various convoy routes in the next two years. The unit was disbanded in September, 1943.

(ii)

At the end of 1940 the fighter force was by no means comfortably strong. The German night-offensive was at its height; the daylight battle, with its heavy losses, only a few months behind. The proportion of pilots in Fighter Command whose abilities had been proved in battle was not so high as Douglas could have wished, for many experienced officers had been killed and others were due for posting overseas or to expanding training units where their knowledge was at a premium. Their successors were largely untried, and in many cases the last stages of their training had been curtailed owing to the urgency prevailing in the autumn, or hampered by subsequent bad weather. Numbers, too, were short, the average strength throughout the command amounting to about twenty-one pilots a squadron as compared with the original establishment of twenty-six and the new figure of twenty-three.

Thus, outwardly at least, the fighter force was in no position to seek new commitments. Indeed, we have seen that until the end of February only meagre escort was available for shipping. Yet such was the value placed on the initiative that before the year was out Fighter Command embarked on a limited offensive.

A warrant for such operations had existed since the time of the French collapse, when the Air Ministry told all home commands to 'take every opportunity of destroying enemy aircraft wherever met'. More recently the Air Staff had sanctioned night-intruder sorties, but these were essentially defensive in everything but tactics. The same was perhaps (though more doubtfully) true of daylight sweeps by three-squadron wings, proposed by Park as early as October in order to surprise the weak patrols maintained by German fighters over the Straits of Dover. A step towards a more explicitly offensive policy was taken about the time of Douglas's appointment, when the Air Staff sanctioned the principle that in the New Year the fighter force should, if conditions allowed, 'lean forward into France'. At his first meeting with his group commanders Douglas followed up the suggestion by urging them to 'get away from the purely defensive outlook'. He recommended sweeps as far afield as Calais, and told Park to look into the possibility of combining them with operations by the bomber force. Accordingly, fresh orders for 'sector offensive sweeps' by wing formations flying high above the Straits were issued from Park's headquarters early in December.

Ten days later Leigh-Mallory succeeded Park at Uxbridge. A firm believer in the efficacy of 'big battalions', he soon drew up a more ambitious programme. His plan included frequent sorties over

France by single fighters or small formations which would hop from cloud to cloud, and also occasional sweeps by much larger numbers of fighters sometimes accompanied by bombers. The avowed object in both cases was to shoot down German aircraft and so force the enemy on to the defensive; but a weakness not stressed in Leigh-Mallory's proposals was that, unless objectives worth bombing could be found within the limited range attainable by fighters, operations of the second class would have little appeal for bomber crews, who might not welcome the suggestion that they should act as bait. There were in fact a number of military objectives within reach—the docks at Calais, Boulogne and Dunkirk were examples—but neither their value as targets nor the readiness of the Germans to lose fighters in defending them could be defined in terms convincing to all schools of thought. In the outcome the response of German fighter units at first proved satisfactory, but later the enemy was sometimes tiresomely quiescent.

Operations of the first class began on 20th December, when two Spitfires left Biggin Hill in the afternoon and flew below a bank of cloud to Dieppe, where they turned inland for a short distance before emerging near Le Touquet. Both pilots fired at buildings on an aerodrome and elsewhere, but saw no German aircraft in the air. Patrols continued at irregular intervals on subsequent days, but no German fighters were seen until 12th January, when a Messerschmitt 109 was inconclusively engaged and two of our aircraft failed to return. Altogether 149 patrols were ordered between December and the middle of June, but 45 of them were frustrated by unsuitable conditions, so that just over 100 (involving 233 sorties) were completed. German aircraft were seen in flight on only twenty-six occasions and in ensuing combats the enemy's losses were smaller than our own. The operations failed, therefore, to achieve their primary object, though the part they played in developing qualities which stood our pilots in good stead on other occasions deserves to be remembered.

The first of the more ambitious operations in which whole wings were used was carried out on 9th January. The day was fine and clear. Snow lay thick on the ground near Calais, but visibility was good. Five squadrons in two formations swept over the French coast, one formation going as far as Saint-Omer. Our pilots saw no German fighters and were not engaged by anti-aircraft fire. Next day six Blenheim bombers of No. 2 Group, Bomber Command, escorted and covered by six fighter squadrons, attacked aircraft dispersal pens and stores in wooded country south of Calais, while three supporting squadrons swept from Dungeness to Cap Gris Nez, Calais and Dunkirk. Our pilots saw a few German fighters and engaged them, but combat losses on both sides were confined to a single Hurricane and its pilot, who was forced to leave his aircraft and was picked up with

a broken leg. In addition, two Spitfires made premature landings and the pilot of one died later from injuries received in consequence.

During the next five months aircraft of Bomber and Coastal Commands co-operated with fighters in ten more raids of a similar character, fourteen attacks on shipping and two special raids on docks at Cherbourg and Le Havre. Fighters without bombers made a further eighty-five sweeps at strengths ranging from fourteen aircraft to more than twenty squadrons, besides a few reconnaissance patrols and the like. From their commencement on 9th January until 13th June these operations involved 190 bomber sorties and some 2,700 sorties by fighters with or without bombers. In all types of daylight offensive operation up to the latter date, including the minor raids described on page 291, Fighter Command lost fifty-one pilots and claimed the destruction of forty-four German aircraft, all but one of them fighters. In addition, one or two were claimed by bomber crews. Recorded German losses of fighter aircraft over France or the Low Countries totalled forty, and a further twenty-five aircraft of that category were described as lost over the United Kingdom; but only eighteen and twenty-two of these respective losses were attributed by the Germans to British action. On the evidence of the German figures, then, the number of fighters shot down by our aircraft during offensive operations was probably not more than a score or so. In addition, about twenty German fighters suffered substantial damage in contact with our forces and some fifty on other occasions. On any reckoning the operations cannot, therefore, be judged more than moderately successful if a quantitative standard is to be applied to them. On the other hand, their moral value is generally held to have been substantial. Yet at least one German commentator claimed—for what his views were worth—that the raids were welcomed by his colleagues, who saw in them no real threat to the German war machine and were glad of the opportunity to join battle in more favourable conditions than could be expected over England.



CHAPTER XIX

BLOCKADE: PART TWO

(June, 1941–October, 1943)

(i)

AS THE SPRING of 1941 drew on without the expected renewal of daylight mass attacks on the United Kingdom, an accumulation of evidence suggested that the enemy's next move might be the eastward thrust so frankly proclaimed in Hitler's published work as the proper end and aim of German policy.¹ Meanwhile, operations in the Balkans culminated in a descent on Crete. Matured in secret since the autumn of 1940, the threat to Russia was made manifest during the third week in June, when reports from Eastern Europe described German troops as massed along the frontier from Petsamo to the Black Sea.

At dawn on 22nd June Germany opened the campaign against Russia with immense land forces backed by two-thirds of the Luftwaffe's total first-line strength. Six days later a mere 299 bombers remained on the Western Front, including those concerned with shipping, and of that number only about half were serviceable. Meanwhile the whole of *Luftflotte 2* and its headquarters had moved to the Eastern Front.

German estimates of the duration of the campaign ranged from six weeks upwards, but all save the minority who feared the worst seem to have supposed that victory could be achieved before the winter. In Britain, too, successful opposition by Soviet armed forces was thought unlikely, especially in view of their poor showing against Finland in 1939 and 1940. But clearly major assaults on the United Kingdom were improbable while the bulk of the German army and air force were engaged elsewhere. The national interest, soon seconded by powerful evidence of popular sympathy for Russia, demanded therefore that the respite should be prolonged as far as possible by extending all practicable aid to Germany's new victim.

The British Army had no troops to spare for an adventure on the Continent. But Bomber Command was growing stronger, and Fighter Command had sixty operational day squadrons at least temporarily

¹ *Mein Kampf*, Eng. Edn. (1939), p. 533.

delivered from the prospect of a big defensive battle. On 17th June—five days before the Germans opened their campaign—the Air Ministry therefore instructed the Commanders-in-Chief of the metropolitan air force to consider means of compelling the Germans to reverse the existing flow of Luftwaffe formations from west to east, ‘particularly in the event of operations developing against Russia’.

Two days later the Commanders-in-Chief—assisted in their deliberations by Leigh-Mallory—came to the conclusion that the most promising method was to continue on a larger scale the recent day offensive against objectives within reach of fighters. Attacks by bombers with fighter escort on well-chosen targets in the neighbourhood of Lille and Lens, coupled with night attacks on the Ruhr and an offensive against shipping in the Straits, would, they thought, so threaten communications between Germany and France that the enemy might well recall some of his fighters to defend them.

On 14th June the offensive by bombers with fighter escort had been resumed after an interval of bad weather. It was now intensified in accordance with the opinion just recorded. In the rest of 1941 some ninety daylight raids by escorted bombers on objectives in the French departments of the Pas-de-Calais and the Nord and at or near Rouen were undertaken, besides more than a hundred attacks on shipping or dockyards and raids by fighter-bombers on a variety of targets. In addition, fighters without bombers made some hundreds of offensive patrols, including sweeps and minor raids of the kind described in the last chapter.

The full story of these operations, no longer defensive in any sense but undertaken from June onwards for an uncompromisingly offensive purpose, falls outside the context of this volume. It is enough to note here that for the rest of the year they were the main task of the fighter force after the defence of shipping; that German losses in aircraft and pilots were much lighter than our own; and that in the whole of 1941 the day offensive cost Fighter Command more pilots than they had lost in the defensive battle from July to October, 1940.¹

The extravagance of an offensive which kept at most some two or three hundred German fighter-pilots from joining their comrades on the Eastern Front or in the Mediterranean theatre was partly hidden by enormously exaggerated estimates of German losses.² Even so

¹ Namely, 426 pilots killed, missing or taken prisoner, against 414 pilots (and 35 other aircrew) killed outright or mortally wounded in combat between 10th July and 31st October, 1940.

² From 14th June to the end of the year pilots of Fighter Command on day offensive operations claimed the destruction of 731 German aircraft (practically all fighters). The number of first-line fighters in fact lost by the Germans over France and the Low Countries from all causes was 154, including 51 whose loss was not attributed to British action. Another eleven were reported lost over the United Kingdom. These figures do not, of course, reflect the moral value of the operations. Many British fighter pilots gained from the raids experience which served them well in later years.

considerable misgivings were felt in London and at Stanmore. An investigation in July showed that Fighter Command's losses were not too heavy to be made good, but such calculations ignored the difference between the experienced pilot who might be forced down over France and the death-prone tyro who might replace him. Moreover, Bomber Command's losses were sometimes uncomfortably heavy. At the end of August—by which time Bomber Command had long ceased to regard the day offensive as a profitable venture—Douglas and the Air Staff agreed that the scale of attack must be reduced. Subsequently Douglas, observing that demands from other theatres threatened him with a serious shortage of aircraft in future months, progressively curbed Leigh-Mallory's investment in the more ambitious class of operation. Further motives for economy were provided by heavy losses incurred by Bomber Command in a night raid on Berlin in November, and by the extension of the war to the Pacific theatre. In practice no more big escorted raids were made in 1941, after errors in navigation and timing, accentuated by a high wind, had led to the failure of an elaborately planned complex of operations early in November, when fourteen pilots of Fighter Command were lost in a single day at no cost to the Germans save two aircraft damaged.

(ii)

By the end of July Germany was clearly committed to a major campaign in Russia on a front of 1,500 miles. More than two-thirds of her fighting troops, with their transport and supplies, were engaged on that front and were meeting strenuous resistance. The large air forces already deployed from East Prussia and the Baltic States to Southern Poland and Rumania had been reinforced since June by further units from the Western Front, where only a handful of bombers and reconnaissance aircraft and a few hundred fighters now faced the United Kingdom. In the middle sector Army Group Centre, after advancing rapidly from Poland into White Russia, had been checked before Smolensk. According to the Joint Intelligence Committee Germany was so deeply committed on the Eastern Front that she could be reckoned incapable of disengaging before September the large land and air forces needed for invasion of the United Kingdom.

The Chiefs of Staff agreed that the prospect of invasion had receded and that Russian resistance would probably extend the respite until the spring of 1942. But the danger might then recur in no negligible fashion. The Joint Intelligence Committee estimated the forces which might try to land at nine armoured and twenty-three infantry divisions (with some 2,000 to 3,600 tanks), supported by another

AT THIS TIME
THE WEHRMACHT ONLY
HAD 3 PANZER DIVISIONS
ANYWHERE OUTSIDE USSR --
AND 3 OF THEM WERE
STAGING TO AFRICA!

eleven divisions employed to make diversionary landings; but naval and air action and losses on the beaches would, they thought, reduce the main body to the equivalent of four or five armoured and eleven or twelve infantry divisions. On the other hand, the Admiralty foresaw that, while good warning of the transfer of troops from east to west could be expected, confirmation that invasion had been launched would have to be awaited before light naval forces and cruisers were redispensed to meet the threat. According to the somewhat pessimistic view which was widely accepted at the time, from five to seven days might then elapse before they were fully ready to go into action.

Within that period, according to the Commander-in-Chief, Home Forces, 'it would be perfectly possible to lose this country and the war'. Nor did he think that defeat of Fighter Command was a necessary preliminary to the landing of German troops, or that the air campaign of 1940 would be repeated. In his view the biggest danger was a sudden swift descent, unheralded by preliminary air bombardment, by an enemy prepared to take big risks and relying on speed, mass and surprise.

In his opinion the remedy was to have ready in the United Kingdom enough armoured formations to defeat the greatest volume of armour which the Germans could get ashore by a rapid stroke designed to outpace British naval and air action. He calculated that to crush the largest German force capable of being transported to this country he would need eight armoured and fourteen full-scale infantry divisions, besides twelve County divisions, ten Army tank brigades, five independent infantry brigades, three infantry brigade-groups and an airborne brigade. In addition he required 43,224 men (of whom 38,110 were available) for coast defence, and three hundred light tank troops and two hundred and fifty-six Young Soldier and other battalions for the local defence of aerodromes, vital points and vulnerable places. Briefly the method of defence he favoured was to hold the coast as an outpost line, retaining the bulk of his troops in local and G.H.Q. reserves as fully mobile counter-attack formations capable of acting swiftly where they were most needed.

General Brooke's proposals and assumptions met some criticism. An Inter-Service Committee on Invasion, set up to consider the matter from the German viewpoint, favoured a frontal attack through Kent and Sussex rather than the pincers movement he expected. Again, some critics thought the provision suggested by the Commander-in-Chief too generous; others feared that his dispositions might prove inadequate in view of British inexperience of lightning warfare. And while the Vice-Chiefs of Staff agreed with him that a pincers movement was more likely to succeed (and therefore, presumably, more likely to be made) than a frontal attack, the Prime Minister believed, despite his arguments, that more benefit could

THIS IS THE
SAME ALAN BROOKE
WHO IS SO CRITICAL
OF EISENHOWER!

be expected from naval and air action than many were willing to allow.

In any case, demands from overseas soon scotched the hope of mustering so large a force as Brooke thought necessary. When the spring of 1942 arrived Eastern, Northern and Southern Commands were each a County division and an Army tank brigade below his figures, their reserves were limited to armoured formations, and G.H.Q. Reserve had one armoured division (with two due in the summer) instead of four.¹ South-Eastern Command, responsible for the most vulnerable stretch of coastline, alone remained unshorn. Even so the strength of Home Forces stood at roughly 850,000 of all ranks, while the total number of troops at home, including Anti-Aircraft Command and forces in Northern Ireland, was more than a million and a half. In addition, the Home Guard numbered nearly 1,600,000 men, of whom about three-quarters had been issued with a personal weapon. Apart from these defensive forces an Expeditionary Force was being formed in Scotland; its one armoured and two full-scale infantry divisions would be available to swell Home Forces if the Germans landed.

Meanwhile much progress had been made with the formation of Auxiliary units designed to act behind an invader's lines. The first of them, comprising only a handful of army officers, Local Defence Volunteers (as the Home Guard was first called) and civilians, had been formed about the time of the withdrawal from Dunkirk.² By 1942 the units had grown into a powerful and elaborate organisation, numbering many thousands of men and women drawn from a variety of sources and covering the coastal belt from John o' Groats to Pembrokeshire, with offshoots as far afield as the Hebrides. Thus an enemy who landed would find himself opposed, not only by a Field Army supported by substantial bomber and fighter forces and backed by the Home Guard, but also by patrols emerging from hidden centres to check his advance and strike at his communications.

General Brooke had in the meantime been succeeded as Commander-in-Chief, Home Forces, by Lieutenant-General Sir Bernard Paget.³ General Paget believed that many of those under his command were not fully alive to the possibilities of modern fire-power and mobile tactics. There was, he thought, a tendency to forget that infantry were still the major factor in winning battles, and that their schooling for the changed conditions they would have to meet was of paramount importance. Early in 1942 he established a G.H.Q. Battle School near Barnard Castle, in County Durham. There instructors were trained for the further schools set up in each Command

¹ See Map 27. The map includes the two armoured divisions added in the summer.

² See p. 130.

³ Appointed 25th December, 1941.

to give troops a thorough grounding in modern warfare. Live ammunition and live bombs dropped from aircraft conferred on the proceedings a realism never achieved in peace-time exercises. Lessons learned with alacrity in such conditions exacted their price in immediate casualties, but unquestionably saved many lives in battles not destined to be fought on English soil. To discuss at length the effects of the new attitude to training would take us far outside our province, since they were felt in every theatre where British troops went into action; but the great importance of Paget's contribution should not be forgotten.

Meanwhile the entry of the United States as an active partner in the war, and unexpectedly tenacious resistance by Soviet forces, had done much to transform the strategic outlook. Early in 1942 United States troops arrived in Northern Ireland. Briefly the Anglo-American policy was to use the United Kingdom as a base for the accommodation and supply of British and American troops ultimately to be landed on the Continent, and in the meantime to give priority to the despatch of war-material to Russia. During the winter the German Army and the Luftwaffe, having failed to achieve their promised victory in 1941, had suffered heavily amidst hardships which they were ill-prepared to meet; in the next few months Russian counter-offensives scotched their new hope of a swift advance to the Caucasus in the late spring and early summer. By June, 1942, the British Chiefs of Staff were satisfied that Germany would be fully occupied on the Eastern Front until August or later, and that invasion need not be feared while the Russian armies were undefeated or for three months afterwards.

On the other hand, raids on the United Kingdom by up to 100,000 seaborne and airborne troops were still a possibility with which they thought it wise to reckon. To deal with such raids Paget relied on a 'defence screen' of local garrisons and local mobile reserves provided by lower-establishment divisions, independent brigades, Young Soldier and Home Defence battalions and Home Guard formations, backed by a limited number of Field Army formations north of London and in Scotland. Field Army formations training for offensive tasks could always be switched back to a defensive role if the outlook grew more threatening. He believed there was also some risk that in the spring of 1943 the Germans might undertake invasion as a 'desperate final gamble' if they beat the Russians in the meantime. To repel an attempt by ten armoured and twenty-one infantry divisions he would need at least six armoured and twenty-two infantry divisions in the Field Army; but reinforcement of the Middle East and the forthcoming departure of the First Army for French North Africa (Operation 'Torch') would prevent him from finding more than five and nineteen respectively.

The Chiefs of Staff were much more hopeful. New production and American assistance had greatly strengthened our light naval forces during the past year, so that large numbers of such units could be quickly concentrated against German transports. The period which might elapse before arrival of reinforcements from the Western Approaches they now put at four days instead of five to seven. Moreover, the combined British and American bomber forces would be able to drop 47,000 tons of bombs on assembly areas and embarkation ports in seven days. Finally, the Chiefs of Staff thought that Germany would be quite unable to 'attain the requisite degree of air superiority for an invasion to be practicable before 1944, if ever'. Hence they concluded that the risk foreseen by Paget need not be feared in 1943, and that our forces in the United Kingdom could safely be reorganised 'to form the largest possible balanced offensive force'.

From the beginning of 1943 the main task of the authorities at home was, therefore, to build up forces for service in other theatres without denuding the base so much as to expose it wantonly to such dangers as still existed and to those which might arise in future. Even though invasion in the current year was ruled out, a new threat coming hard on the heels of a German victory in Russia might subsequently revive the perils of 1940 if the basic structure of home defence were too drastically uprooted. If only as a precaution against minor seaborne and airborne raids, the Home Guard must be kept in a high state of efficiency; as long as the possibility of air attack existed, the air defences must remain strong. The coast defences, too, elaborated with such pains during the past three years, would take at least nine months to restore if swept away, and nine months might not be available. Accordingly, the Chiefs of Staff advised the Government that where coast defence was concerned wholesale economies must be deferred until the Expeditionary Force was firmly established on the Continent and not likely to be dislodged by German armies released from the Eastern Front. Meanwhile, they agreed that seventy-one batteries out of the two hundred and sixty existing in the autumn of 1943 could be sacrificed.

In practice, economies in coast defence had begun as early as 1942, when fifty batteries not directly guarding ports or harbours were declared redundant. But at that time additions were still being made elsewhere in the form of modern batteries for the defence of places deemed more important. The guns and searchlights were not removed from redundant sites but were put in the hands of small 'care and maintenance' parties, the bulk of the troops being posted elsewhere. Other savings were made by replacing all but a few of the serving soldiers at certain batteries by members of the Home Guard, while one battery was manned by Norwegian troops. Thus, of the

two hundred and sixty batteries existing when the Chiefs of Staff decided that seventy-one could be dispensed with, seventy-five—including thirty-two of the seventy-one—were 'Home Guard' batteries.

(iii)

Early in July, 1941, the Germans abandoned the fighter and fighter-bomber sweeps over south-east England which they had resumed on a small scale in February after a lull lasting since the middle of December. Doubtless, if their object was to meet our fighters, they now met enough on their own side of the Channel. For the rest of the year daylight operations by the Luftwaffe, apart from defensive sorties, consisted almost entirely of regular reconnaissance and weather flights, some extending far over the Atlantic, interspersed with occasional attacks on shipping or places on or near the east coasts of England and Scotland. Perhaps the sole exception until late December was the dropping of some bombs near Downpatrick, in Northern Ireland, on 29th November by an aircraft which had just escaped from two pursuing fighters. Conversely, Fighter Command's main task in daylight, besides the offensive operations mentioned earlier, was the defence of shipping. During the latter half of 1941 some 28,000 sorties, or roughly seven-tenths of the whole defensive effort of the fighter force in daylight, were devoted to that task.¹ Only eleven daylight attacks or attempted attacks on shipping within forty miles of a fighter aerodrome were reported in July; the figures were higher in August, September and November, but did not rise again to the level of earlier months. Moreover, only five ships were sunk in daylight, as compared with fifty between January and June, while even at night sinkings totalled only twenty-nine as compared with forty-eight. By December, direct attacks on ships in coastal waters had lost much of their attractiveness for the German High Command; and further to seaward British counter-measures had shifted the focus of submarine warfare to areas which *Kampfgeschwader 40's* aircraft could barely reach.

Even so the defensive duties of the air defences were no sinecure. German aircraft which roamed daily over the face of the waters and sometimes over the United Kingdom were bent more often on getting news of shipping and the weather than on bombing; yet they could not be ignored when they ventured within range. Their interception, particularly in cloudy weather, was an ever-present problem. Well-founded reports that the enemy was developing bomber-reconnaissance machines capable of flying at 30,000 to 40,000 feet or more also

¹ See Appendix XXXV.

caused some anxiety. Means of coping with such aircraft were devised the best part of a year in advance of their appearance. At night the end of the main offensive in May was followed in June by a notable attack on Chatham and occasional raids on other places, especially Hull, which now became a favourite target. In the July moon-period Southampton, Plymouth, Yarmouth and Birmingham were attacked in the course of two successive nights; early on the 28th of that month London had its worst attack for many weeks, when fifty to sixty German aircraft retaliated at short notice for a raid by British bombers on Berlin. By the standards of the main offensive, night bombing for the rest of the year was very slight, though German minelaying and 'intruder' raids continued with other minor operations to make work for the defences.¹ Special methods of intercepting minelaying aircraft were devised towards the end of the year and were applied in 1942. The unwelcome distinction which attached to Hull as an objective easily reached by German prentice crews was recognised by installation of a special 'dazzle barrage' of massed searchlights—an innovation almost certainly responsible for the failure of at least one raid in August.

Too late for the main offensive, the performance of the night air defences during the latter part of 1941 showed a marked gain over earlier achievements. Night-fighters destroyed nearly one-tenth of the bombers which set out for Chatham on the night of 13th June; between June and December the Luftwaffe lost 114 bombers in operations against the United Kingdom (mainly at night) and 33 in operations against shipping. These were heavy casualties for the small force of about two hundred bombers remaining in the west. There was thus some ground for Fighter Command's claim that the main offensive ended at the very moment when they had put a good edge on their weapons.²

Nevertheless, some changes were found necessary. The most important was concerned with searchlights. Deployment in clusters, introduced about the end of 1940, was found unsatisfactory. A new system, devised in the autumn of 1941 and substantially unchanged thereafter, recognised the principle that heavy anti-aircraft guns no longer depended on searchlights, whose primary function was now to assist night-fighters. Illuminated areas were therefore divided into rectangular 'boxes' designed to give the optimum elbow-room to a single fighter. The fighter circled round a stationary vertical beam in the centre of the box until a hostile aircraft entered it. Thereupon other searchlights, disposed at intervals of three-and-a-half miles near the centre of the rectangle and more widely towards its edges,

¹ In December alone minesweepers detonated 99 mines in the Humber and its south-eastern approaches.

² See pp. 279-80.

converged on the newcomer in order to assist the fighter to close with it in the central 'killer zone'. Calculation and experiment showed that a rectangle forty-four miles wide and fourteen miles long gave the best chance to the fighter, and accordingly those dimensions were adopted.

About the end of 1941 the reduced scale of attack, and technical advances, made possible a change of policy with respect to balloon barrages, now a potent source of danger to a growing volume of legitimate air traffic. Improved communications and equipment having increased the speed with which close-hauled balloons could be put up in an emergency, a large number of provincial barrages were henceforth grounded throughout the day and night except when hostile aircraft were known to be about.

Of new weapons of air defence developed in 1941 the most notable was the night-fighter fitted with an airborne searchlight, or 'Turbinlite'. The project had always been attractive, but hitherto the weight and bulk of the equipment needed to produce a sufficiently powerful beam had hampered its adoption. A practical solution of the problem was due largely to the skill and ingenuity of Air Commodore W. Helmore. In the course of the year ten 'Turbinlite' flights, equipped with Havocs, were formed and by December eight—the equivalent of four full squadrons—were active in Nos. 10, 11 and 12 Groups. Their performance during exercises was extremely promising. But a paucity of raids in the latter part of 1941 gave them little scope, while later, when their chance came, they could no longer compete on level terms with orthodox night-fighters against the faster German bombers then in service.

CHAPTER XX

THE DWINDLING THREAT

(The German Air Offensive 1942–1943)¹

(i)

IN THE last two chapters we have watched the effect on the home defences of the attacks on sea communications near the British Isles which overlapped and followed the main air offensive against United Kingdom cities. We have seen that the number of ships sunk by air attack in coastal waters rose alarmingly in the spring and early summer of 1941, but afterwards declined as counter-measures took effect. We have seen, too, how the fear of invasion persisted for about two years after the crisis of 1940, but by the autumn of 1942 was so far overcome that the Chiefs of Staff discounted a landing in the following year; and how by the autumn of 1943 the danger seemed so slight that they then agreed to a substantial reduction of the coast defences. The story of German air operations against the United Kingdom was, however, carried only to the end of 1941 and must now be continued from that point.

Within six months of the opening of the campaign in Russia the few German bomber units remaining in the west had fallen on hard times. Their aircraft were far from numerous and—like the German bomber force in general—were no longer in the forefront of design. Attacks on coastal shipping had paid well for a time, but ultimately heavy losses in daylight made even night attacks seem less attractive, especially as the bomber was plainly losing its former immunity from interference by the night defences. Perceiving perhaps more clearly than their superiors that Britain's weak spot was her dependence on sea communications, the officers immediately responsible were still eager to continue minelaying and attacks on ports and shipping; but only meagre support could be expected from a High Command preoccupied with other theatres. For Hitler, whose energies were largely absorbed by the campaign in Russia, the Western Front had become a sideshow. Moreover, while the British Bomber Command remained outwardly content with relatively light attacks and while *Luflotte 3* was incapable of striking crippling blows, he was reluctant to provoke reprisals by ordering resumption of major raids.

¹ For statistical summaries, see Appendices XXXVII–XXXIX.

On the other hand, the fighter force in France and the Low Countries was fairly strong. Recovering quickly from losses sustained at the height of the British day offensive, by the autumn of 1941 it had a higher proportion of serviceable aircraft to actual strength than in the early summer. Its pilots knew or guessed that British claims were far too sanguine; for the most part its leaders were undismayed by minor damage done to French factories and power-stations in daylight raids. Moreover the new Focke-Wulf 190, although not entirely satisfactory or outstandingly successful when it first appeared, was in many ways a better fighter than anything the British Fighter Command could yet put into the air. New versions of the Messerschmitt 109, considered by some German critics superior to the Focke-Wulf 190, were also in production or on the way.

On Christmas Day two German fighters flew low across the Channel to the neighbourhood of Hastings, opened fire on some buildings a few miles to the east, and then made off. Much the same thing happened on Boxing Day, on the first day of the New Year and on several other occasions in January. These operations foreshadowed a growing tendency to call in the fighter to atone for the absence of the fast, self-sufficient bomber towards which German strategic thought had always leaned. In the early months of 1942 a fighter-bomber unit—soon expanded to two squadrons—was added to *Luftflotte 3's* resources. Unlike the occasional fighter-bomber pilots of 1940 and 1941, who had dropped their bombs from great heights with little attempt at accuracy, its men were trained to fly low so as to baffle the defences and to bomb specific targets with some care. A few months earlier the Royal Air Force had adopted the fighter-bomber as an anti-shipping weapon; both sides were exploring its effectiveness against armoured fighting vehicles and other battle-field targets. Meanwhile, for the German air force in the west it proved a useful weapon against seaside towns, where well-defined objectives like gasometers, rather than purely residential districts, were the usual points of aim in 1942.

From the end of March the sudden appearance of small formations of fast-moving aircraft which dropped a few bombs before retreating became a familiar hazard in such places as Brighton, Worthing and Torquay. In late March and early April raids by fighter-bombers were made at the rate of two or three a week. At night, minelaying expeditions to the Thames and Humber were interspersed with small attacks by the depleted bomber force on Dover, Portland and Weymouth. To the defences the day raids were a nuisance, the night attacks in no way remarkable. Indeed such night attacks, coupled with armed reconnaissance of shipping, had been a commonplace occurrence for months past. Neither by day nor at night did the bombing do much damage, and in March not more than about a

score of civilians were killed by air raids in the whole of the United Kingdom. Similarly the British air force had barely got into its stride, so that to many people both in England and in Germany the war in the air appeared to have settled down to an exchange of minor blows.

These illusions were shattered on the night of 28th March, when Bomber Command sent 234 aircraft to the Hanseatic port of Lübeck to try out a new system of fire-raising. The beautiful old city, almost undefended, burned like matchwood. The incident caused much resentment in Germany and seems to have made a deep impression on the Führer. Abandoning his policy of non-provocation, he ordered that air warfare against England should be given a more aggressive stamp. On 14th April he sanctioned raids on targets where attacks were likely to have the greatest possible effect on civilian life and called them frankly 'terror-attacks (*Terrorangriffe*) of a retaliatory nature'.¹ At the request of the German Naval Staff the original plan of substituting such raids for attacks on ports and shipping was modified and minelaying was sacrificed instead. Later Hitler conceded that minelaying might continue when it did not conflict with the main programme. But as raids of any size could be undertaken only if both anti-shipping and minelaying units took part in them, neither concession was worth much in practice.

When the new order was promulgated the fighter-bomber force mustered rather more than thirty aircraft, of which about five-sixths were serviceable. The bomber force, with the help of anti-shipping, minelaying and reserve training units and by dint of double sorties, succeeded on one night towards the end of April in carrying more than two hundred tons of bombs across the Channel. Reinforced a few days later by two *Gruppen* withdrawn from Sicily—a significant move at the height of the attack on Malta—it was able in May and June to aim some 1,500 tons at places chosen largely for their aesthetic interest and their lack of strong local defences.

The 'Baedeker' raids, as both sides soon learned to call them, began on the night of 23rd April with a modest effort by units diverted, as the Führer had decreed, from their usual task of laying mines. The primary target was Exeter, but few crews found their way to it and only one stick of bombs fell within the bounds of the city. A second attack the next night was rather more successful; but only about a sixth of the tonnage which German crews supposed they had aimed at Exeter on the two nights found its mark. The moon was up and there was no balloon barrage to hamper low flying, although guns

¹ The German text of the order is given with a translation in Appendix XXXVI. Contrary to the general belief, the term *Terrorangriffe* seems not to have been applied, at any rate officially, to earlier raids on Warsaw and Rotterdam, which were at least ostensibly regarded by the Germans as operations in support of troops.

and fighters were in action; yet most crews bombed cautiously from heights between 5,000 and 15,000 feet.

Attacks on the next two nights were notably heavier and far more destructive. Bath was the primary target on both occasions, although on the first night about ten tons of bombs hit Bristol. The German effort—about two hundred and fifty sorties all told—was small by the standards of 1940–1941, but no inconsiderable achievement in the circumstances. Unprotected by balloons or heavy anti-aircraft batteries and lying in a hollow which aggravated the effects of blast, the place made an easy and rewarding target. Crews came low in the bright moonlight, sometimes to 600 feet or so, and dropped their bombs at leisure. According to eye-witnesses, some crews hampered Civil Defence workers by opening fire with machine-guns. Early on the first night a direct hit set fire to the gasworks; to add to the difficulties of the defenders, the Civil Defence Control Room was also hit. On the second night a high wind and low water-pressure created a grave problem. In the outcome damage by fire was less severe than at one time seemed likely, mainly because few incendiaries struck the most vulnerable part of the old town; but high-explosive bombs and the blast they caused blew many gaps in rows of Regency houses, agreeable to the eye but not very solidly constructed. Authorities in London drew attention to an apparent improvement in the German aim since 1941, but pointed out that the success of the two raids was manifestly due largely, if not entirely, to the choice of target.

Similar methods at Norwich, York and again at Norwich on the next three nights brought even better results (from the German viewpoint) in terms of the proportion of the tonnage aimed which hit the target. At both places, but especially at York, incendiaries played a more effective part than at Bath. In the first raid on Norwich an acute shortage of water followed early hits on mains: thereafter twenty factories and many other buildings were destroyed or seriously damaged. At York dense clusters of incendiaries fell north and south of the Minster and straddled railway lines to north and north-west; high-explosive bombs, of which about fifty tons were counted within the city, were closely concentrated in the central and northern quarters.

Statistically the attack on York was the most accurate of the whole 'Baedeker' series; the first attack on Norwich was a close second. But the most devastating of the raids had yet to come. On the night of 3rd May the Luftwaffe returned to finish the job half done at Exeter; and this time no mistake was made. (See Map 28.) The night was fine and almost cloudless; in clear moonlight visibility was excellent. Arriving over their objective about two hours after midnight, the leading bombers marked the target with flares and a shower of incendiaries, all dropped in the space of about ten minutes. In the next

three-quarters of an hour further waves dropped on the city some fifty tons of high-explosive and many thousands of incendiaries, weighing about twelve tons. Other crews, more cautious or less skilful, released a substantial load outside its borders. For forty minutes, beginning about half an hour after the arrival of the leading bombers, aircraft of No. 10 Group patrolled in layers over Exeter, but neither they nor the guns which opened fire earlier could prevent the enemy from coming low to bomb at point-blank range. The outcome was bound to be disastrous to a city whose layout made it particularly vulnerable. With its core of mediaeval buildings, its narrow streets of shops stocked with highly combustible materials, the centre of Exeter was regarded by experts as more susceptible to fire than any other urban area in the country, except possibly Chester and a small part of the City of London which had succumbed in 1940. Within a short time a great part of it was gutted by a conflagration with which the fire services could not cope. The cathedral, with many other buildings, was seriously damaged.

Fortunately the Germans did not repeat the success achieved in April and on Exeter's unhappy night in early May. On 4th May an attack on Cowes—apparently chosen for its factories and shipyards rather than its appeal to the tourist—was reasonably successful; thereafter almost everything went wrong for the attackers. An ill-advised attempt to complete the discomfiture of Norwich on the 8th without the aid of moonlight failed badly. At the beginning of the raid a flare dropped near a decoy-site well outside the city kindled a fire which acted as a beacon for many crews, so that roughly half the load intended for Norwich fell in that neighbourhood, fortunately without disaster to a radar-station close by. Less than two tons fell inside the boundary and none in the built-up portion of the city. A balloon-barrage installed since the end of April had little chance to prove its worth, although probably at least one bomber collided with it.

The next few raids were only slightly more successful. Hull was saved on 19th May by a fire kindled by incendiaries on an anti-aircraft site outside the city boundary; at Poole a few nights later a decoy-fire lit by the defences was notably successful. Indeed, so well did it play its part that many crews came low to bomb it without detecting the imposture. And at Grimsby on the 29th rain and thick clouds so confused the enemy that not one bomb hit the target.

The month closed with an attack on Canterbury, intended as a reply to Bomber Command's big raid on Cologne the night before. But whereas more than a thousand British aircraft had been sent to bomb Cologne, the Luftwaffe mustered only some eighty or ninety crews for their reprisal. German reports of a later raid on Canterbury, when crews claimed 'two direct hits on the cathedral and

one near miss', suggest that on this occasion, too, some crews may have aimed deliberately at a building wholly unconnected with Canterbury's position as the 'strong garrison town and grain-marketing centre' of the German communiqué. Some windows of the cathedral were damaged by blast; eight small incendiary-bombs went through the roof but burned out harmlessly on the floor below. The old quarter of the city with its mediaeval buildings suffered heavily, though less disastrously than its counterpart at Exeter, in a conflagration covering about six acres.

The 'Baedeker' offensive was now almost over. By choosing easy targets and making the best use of a few experienced crews to blaze the trail for the rest, the Luftwaffe had achieved on six or seven nights a relatively better concentration of bombs than in the summer of 1941. The attackers had, however, lost some forty aircraft in the fourteen notable operations undertaken since the first raid on Exeter. Many of their losses were due to inexperience; in particular, reserve training units had suffered heavily. Göring and his staff may well have wondered whether the price was not too great for an offensive which served no clear strategic purpose. At any rate, *Luftflotte 3* soon modified the scale and direction of its attack, devoting more of its effort to places of some industrial or maritime value and less to those of purely aesthetic interest. Ipswich, Poole, Southampton, Birmingham and Middlesbrough were the chief targets for the next eight weeks; Canterbury, attacked twice in June, and Norwich, also attacked again although the Germans claimed to have reduced it to an 'enormous heap of ruins' in their unsuccessful May attack, drew much smaller forces than those used earlier.

By this change of emphasis the Luftwaffe may have satisfied its critics, but clearly did nothing to improve its chances. Southampton and Birmingham were well-defended targets; and a Midland city was not as easily found as Bath or Exeter. Hampered by bad weather, the crews despatched to Birmingham on 24th June went far astray, so that not one bomb hit the city; Southampton received about one-fifth of the load intended for it. Poole was saved largely by heath fires kindled by flares and incendiaries, which drew much of the attack; at Norwich the recently-installed balloon-barrage helped to spread the bombing by limiting the enemy to a safe height of about 8,000 feet. At Canterbury a barrage had been installed immediately after the first raid; the Germans seem not to have known that it was there, but even so their two attacks in early June were not very well concentrated. Ipswich, like Poole, was much helped by heath fires, while at Weston-super-Mare, where balloons guarded the premises of the Bristol Aeroplane Company, no very serious damage was done by the thirty to forty tons of high-explosive and incendiaries which went home on two successive nights.



Plate 22. The Guildhall, York, during the 'Baedeker' Raid on the night of 28th April, 1942.



Plate 23. Air Marshal R. M. (later Sir Roderic) Hill, Air Marshal Commanding, Air Defence of Great Britain, 1943-1944, and Air Officer Commanding-in-Chief, Fighter Command, 1944-1945.



Plate 24. Lieutenant-General (later General) Sir Frederick Pile, Bt., General Officer Commanding-in-Chief, Anti-Aircraft Command, 1939-1945.

As if seduced by their own communiqués, which claimed a spectacular success at Poole and good results elsewhere, the Germans were not deterred by substantial losses in June from assailing fairly well defended targets in July. A series of minor raids on Middlesbrough was followed at the end of the month by three attacks on Birmingham and one on Hull. The last four raids accomplished little—only three tons fell on Hull and thirty-four on Birmingham—and cost the attackers twenty-seven aircraft. Thereafter, with one exception soon to be discussed, the Luftwaffe made no more night raids of any consequence in 1942.¹

The fighter-bomber force continued its day raids throughout the spring and summer, but never mustered more than about thirty serviceable aircraft and seldom more than twenty. In July its Messerschmitt 109's were replaced by Focke-Wulf 190's. By flying just above the sea, fighter-bomber pilots succeeded as often as not in eluding the radar chain, thus setting a difficult problem for the defences; but their limited numbers and small bomb-load—each aircraft carried about half a ton—kept the menace within bounds. The loss of only five fighter-bombers in May and two in August, despite almost daily operations in both months, shows, however, that the Luftwaffe had found at least one way of conducting a continuous offensive at small cost. At first the aircraft flew mostly in twos or fours, but formations of eight were sometimes used in later months.

'Pirate' raids by single bombers or small formations on aircraft factories and similar targets—a form of daylight attack which had caused the Ministry of Aircraft Production and the air defences some anxiety in 1941—had also much to commend them to a force with limited resources. Picked crews who had carefully rehearsed their roles with the help of maps, models, photographs and sketches could reasonably expect, by taking advantage of cloud-cover and of natural features likely to hamper observation from the ground, to reach well-chosen objectives with little risk of interception and, having bombed them, to reap the reward of their daring by escaping before effective fire could be brought to bear on them. Skies often veiled by dense clouds interspersed with ample breaks which helped the attackers to check their whereabouts were a perfect setting for such tactics. On one day in July when the clouds were low and there was much rain about, as many as thirty 'pirate' raiders visited the country with scarcely any interference from guns or fighters, bombing and damaging four factories, two aerodromes and four railway targets of some importance. Fortunately a scarcity of crews experienced enough to undertake such ventures limited an effort which might otherwise have done much harm.

¹ See pp. 310-11.

Towards the end of August the German high-altitude bomber-reconnaissance machine expected since 1941 (and already seen in the Mediterranean theatre) appeared at last. Despite the elaborate preparations made for its reception it proved extremely hard to catch. But a climate which favoured 'pirate' bombers gave little scope for reconnaissance at great heights, so that the six high-altitude machines which figured in the establishment of the German Air Staff's strategic reconnaissance unit found little employment over England. About a dozen flights at heights in the neighbourhood of 30,000 to 40,000 feet were made before the innovation ceased to trouble the defences. About the same time another new reconnaissance machine—the Messerschmitt 210, designed to function also as a fast bomber and twin-engined fighter—was introduced, but proved a failure. On 6th September Typhoons—a type developed from the Hurricane—met two of the new machines at a great height over Yorkshire and destroyed them both. After two more had been shot down, Göring told representatives of the German aircraft industry that the words 'He would have lived longer if the Messerschmitt 210 had not been produced' would be his epitaph.

False.
↖

In October the Luftwaffe, encouraged by the success of recent fighter-bomber operations, planned a bigger raid by fighter-bombers than any they had yet attempted. The target was Canterbury, the time chosen the afternoon of the last day in the month. The two regular fighter-bomber squadrons mustered only nineteen serviceable aircraft, but machines from ordinary fighter units brought the number equipped with bomb-racks to sixty-eight. Another sixty-two fighters were detailed to escort the striking force and six more to make a diversionary sweep. The leaders crossed the coast near Deal and flew to their target with disconcerting swiftness. Consequently the balloons installed at Canterbury five months earlier had risen to only 700 feet when the attack began. Nevertheless they took the Germans by surprise and caused some pilots to drop their bombs too soon. Of forty-eight bombs aimed at Canterbury, thirty-one struck various parts of the city. One straddled the infantry and artillery barracks three-quarters of a mile from the cathedral, two fell close to the power-station; the cathedral itself and the railway station escaped unharmed. Engaged at first by light anti-aircraft guns and afterwards by fighters, the attackers lost two aircraft to the defences and a third in an accidental crash.

That night the enemy made a further attack on Canterbury. The raid was in two phases separated by an interval of about four hours. The first blow was notably unsuccessful, perhaps partly because of cloudy weather, still more because a haystack ignited by a chance hit attracted a good many crews to a neighbourhood about five miles

from the city. The second, delivered when the weather was improving, was rather more effective. The haystack was still alight and drew some bombs, as did a decoy fire kindled for the purpose; but eleven tons of high-explosive and incendiaries fell on Canterbury. Nevertheless the bombing was not well concentrated, so that on the whole it brought the Germans little to set against the loss of seven bombers. In a somewhat highly-coloured account of the day's and night's events the Germans claimed, with equal pride in their intelligence service and their marksmanship, that a bomb had fallen 'only a few yards away from a house which was visited by Mrs. Roosevelt last Friday'.

On that note of modest triumph the 1942 offensive came virtually to a close. A few days later Anglo-American landings in North Africa caused such apprehensions that German troops entered the former Unoccupied Zone of France and half the fighter-bombers recently employed against the United Kingdom were temporarily absorbed into a special unit posted to Provence. And although they afterwards moved north again, their operations and those of the bomber force remained for the rest of the year too inconsiderable to call for notice.

In the context of the whole war the 1942 offensive scarcely seems important. The bomb-load dropped in the course of the year—about 6,500 tons, of which a sixth was dropped by day—was only the equivalent of one month's bombing in the winter of 1940-1941. But the experience was not without its lessons for both sides. According to a naval liaison officer attached to the German Air Staff, it suggested that the bomber force on the Western Front, manned largely by men whose previous experience had been gained solely in Russia, where objectives were near and fighters few, was scarcely fit for operations against England; according to the Air Warfare Analysis Section of our own Ministry of Aircraft Production, that the results of German night attacks had come to be governed largely by the extent to which local conditions left crews free to fly low over their objectives. The German critic might perhaps have added that the bombers had in fact done quite well while they remained content with easy targets, reasonably accessible and not too well protected. And certainly the moral justly drawn in London and at Stanmore was that, notwithstanding the great progress made by night-fighters since 1940, balloons and guns were still essential, not so much to bring the enemy down as to keep him up so that point-blank bombing was impossible and the task of the Civil Defences was not made too difficult.

(ii)

In the spring of 1942 the Air Ministry, not without misgivings, had authorised resumption of the day offensive which had cost Fighter Command such heavy casualties in 1941. In 1943 day raids on targets within reach of the fighter force continued as a minor contribution to the 'round-the-clock' offensive against Germany. At the same time Fighter Command became the pool from which the fighter squadrons needed to support a landing in France would come in 1944. Thus Air Marshal Leigh-Mallory, who had succeeded Air Marshal Douglas at Stanmore towards the end of 1942, was able to retain much larger forces than were needed for home defence alone. The air defences also profited in 1942 and 1943 by the introduction of fast day-fighters like the Typhoon and new versions of the Spitfire, of new night-fighters like the fighter version of the Mosquito, and of improved radar equipment and more efficient methods of control. Controllers, once recruited from grounded or superannuated pilots, were now a corps of experts highly trained in the use of ingenious devices moulded by several years of practical experience. Necessity may be the mother of invention; but its period of gestation is a long one and its scientific offspring do not quickly reach maturity. Thus the air defences were able to meet the relatively light attacks of 1943 not only with more and better weapons than those of 1940-1941, but with accessories infinitely superior to the crude G.L. sets and immature airborne radar of that era.

No comparable progress had been made in the German bomber force. The German bombers of early 1943 were modified versions of those used in 1940, somewhat faster and offering a little more protection to their crews, but still incapable of carrying big bomb-loads on long journeys. The Luftwaffe had no heavy bomber like the Lancaster, no fast light bomber like the Mosquito, no bomber designed expressly for use at night. In the summer of 1942 a number of new bombs—the 40-kilogram phosphorus bomb, the thermite 'fire-pot' and a combined incendiary and high-explosive bomb—had made their appearance, but they were no substitute for an aircraft capable of reaching distant targets with a heavy load. Deploring his lack of such a weapon, Göring said frankly that it was 'enough to make him scream' and that the four-engined British and American bombers, which he regarded with 'terrific envy', were 'far, far ahead' of anything at his disposal.

Göring blamed the aircraft industry for these deficiencies, but the weakness of the bomber force extended to spheres with which makers of aeroplanes were not concerned. The facts were that German policy after the Spanish Civil War had put the emphasis on

army-support bombers and that the triumphs of the French campaign had created an atmosphere in which foresight did not flourish. For those reasons, and perhaps also because conditions on the Eastern Front did not encourage a high standard of ability, the training of crews for long-range bomber sorties had been neglected quite as much as the provision of new aircraft. Confronted with an unfamiliar task, the crews of 1940-1941 had acquitted themselves well; but since that time the training organisation had proved incapable of replacing by newcomers of like ability men killed or transferred to other duties. Apart from a few veterans, the pilots and navigators serving on the Western Front in 1943 were not, and doubtless would not have claimed to be, the equals of those who had made life precarious for Londoners and Midlanders two years before. Finally, by the early part of 1943 the threat of a fuel shortage had already begun to cause concern and even to curtail flying by units based in Norway. An actual shortage would involve more widespread economies which would certainly affect the general level of experience.

On the night of 17th January, 1943, the Luftwaffe replied to an attack on Berlin by making the first major raid on London since 1941. Double sorties and contributions from reserve training units brought the night's effort—which included minelaying in the Thames Estuary and Humber—to well over a hundred sorties. According to prisoners of war a unit on the point of leaving for the Eastern Front was held back to take part in the raid. The night was cloudy, especially before midnight, when the first stage of the attack was made, and many crews, perhaps deceived by searchlights, dropped their bombs well short of the target. Less than two-fifths of the load intended for the capital fell on the huge expanse of the London Civil Defence Region; the attackers lost six aircraft. Nearly sixty fires were reported, but none was large, and the only serious incident occurred at Greenwich, where a power station suffered rather heavy damage.

The offensive continued on the 20th with a daylight raid on London by twenty-eight fighter-bombers escorted by single-engined fighters. Diversionary forces made demonstrations off the Kent coast and over the Isle of Wight. The London balloon-barrage was grounded immediately before the raid, but was ordered to 6,500 feet about six minutes after the time when the fighter-bombers were reported as having crossed the coast in the neighbourhood of Beachy Head. When in fact they reached the inner suburbs only a minute or so after the order had been given, some balloons had risen to five hundred feet while others were still grounded. The time was half-past twelve, and the busy quarter south of the Thames near Greenwich Reach was thronged with people. Approaching 'at roof-top height' according to eyewitnesses, and certainly below a thousand

feet, the fast-flying Focke-Wulf 190's arrived at their target so swiftly that light anti-aircraft gunners at outlying sites had little chance of engaging them on their inward course. Eight bombs at Lewisham, two at Poplar and twelve at Deptford, Bermondsey and Greenwich caused heavy civilian casualties and seriously damaged a large warehouse at Surrey Docks. The suddenness of the attack gave some members of the public a disagreeable sense of insecurity. But if the defences incurred reproaches which no excuses could quite repel, they did much to atone; for the enemy paid for his success with the loss of three fighter-bombers and six fighters.

After two small and remarkably unsuccessful raids on Plymouth and Swansea in February, the Luftwaffe plumbed new depths of inefficiency in early March. On the third night of the month about a hundred tons of high-explosive were carried by aircraft sent to London, but only twelve tons hit the mark. Again the attackers lost six aircraft. Although few crews admitted that they had failed to find so huge a target, the German High Command were sufficiently well informed to know, or at least suspect, that the attack had failed. On 5th March the Führer complained that the offensive against England was being mishandled; when told that the Japanese believed that Europe would be the main theatre of war throughout the year he said significantly that the prospect was 'not very pleasing'. Later he drew a number of scathing contrasts between British attacks on German cities and the feeble attempts of the German air force to retaliate. He pointed out that, whereas apparently British bombers with new navigational equipment could fly hundreds of miles and then hit a target measuring about five hundred by two hundred and fifty yards, the Luftwaffe was unable to find London, an objective thirty miles across and only ninety miles from the French coast. Unless that state of things was remedied, the German people would 'go mad' when they learned, as finally they must, that their confidence had been misplaced. Remarking on one occasion that the poor performance of the bomber crews was 'scandalous' and that he would tell Göring so, he asked repeatedly, 'Why isn't the Reichsmarschall here?' But if the Reichsmarschall had been there, what could he have said except that he felt like screaming?

The remedy proposed by Hitler recalls Admiral Fisher's dictum, 'We need one man!' He ordered the Luftwaffe to charge a suitable officer with the sole task of directing air warfare against England. After several names had been put forward the choice fell on Dietrich Peltz, a young and energetic regular officer who had commanded dive-bomber and bomber units in the Polish campaign and in the offensive against the United Kingdom in 1940-1941. After organising dive-bombing courses in Italy and commanding a bomber unit at the time of the Allied invasion of North Africa, he had held since

the end of 1942 a staff appointment concerned with the inspection of bombers and the organisation of the bomber arm. A major in the summer of 1942, he had since been promoted lieutenant-colonel, was now made a colonel and a few months later, at the age of 29, became a major-general.

Peltz took up his new appointment as *Angriffsführer England* towards the end of March. The Führer's intention was soon partially defeated, for in the summer a crisis in the Mediterranean theatre caused Peltz to be charged with an additional role. His influence on the subsequent conduct of the offensive is difficult to trace, but at least part of the task he set himself seems to have been the preparation of a substantial bomber force for use in the early part of 1944. A month after his appointment his resources comprised sixteen reconnaissance aircraft (of which six were serviceable), a hundred and thirty-five bombers (one hundred and seven serviceable), and a substantial force of fighter-bombers, now called fast bombers and organised as a *Geschwader* of four *Gruppen*, one of which was in the Mediterranean theatre. Ninety-seven of the one hundred and twenty-three fighter-bombers in France were serviceable at the end of April.¹ An important addition which took effect in May was a special 'pathfinder' unit (*I/KG. 66*) whose crews were trained—not very successfully—to find a given target and guide others to it by means of flares.

Raids on Southampton and Newcastle on 7th and 11th March, for which Peltz was not responsible, were both utter failures, no bombs falling on either target; the attackers lost eight aircraft out of less than ninety. Norwich was attacked on two nights later in the month, but on the first occasion only a few bombs hit the city, on the second none. In daylight fighter-bombers attacked Eastbourne, Hastings and Ashford (Kent) with some success and made a further raid on London. This time the barrage was at 1,500 feet when the enemy appeared, and was ordered to 5,000 feet. Sixteen bombs fell at Ilford and Barking, but no important objectives were affected.

In the first half of April another fighter-bomber raid on Eastbourne was followed on the night of the 14th by an attack on Chelmsford. Of the seventy-seven tons which crews claimed to have carried to the target, nine fell within the borough boundary, fifteen near two wheat-stacks ignited by incendiaries early in the raid. The attackers lost six aircraft, but succeeded in hitting an important ball-bearing factory and damaging about 25,000 bearings stored in readiness for delivery to service users.

An innovation with which Peltz is popularly (but perhaps unjustly) debited came two nights later, when fighter-bombers fitted

¹ For details, see Appendix XL.

with supplementary fuel tanks were sent to London after dark. Thirty sorties were flown and twenty-seven pilots were believed by the Germans to have attacked the target. In reality their navigation was so hopelessly at fault that only two bombs fell within the London Civil Defence Region. Three pilots landed at West Malling aerodrome, near Maidstone, under the impression that they had reached France, and a fourth crashed near it. Altogether the enemy lost six aircraft. Similar and almost equally ineffective raids were made on many nights thereafter.

Unusual tactics paid much better a few nights later, when some thirty bombers sent to a forward base in Norway for the purpose made a dusk attack on Aberdeen. Flying low over the sea and avoiding the harbour on their inward route by crossing the coast some little distance from the town, they turned south over the target and escaped with scarcely any interference and no losses. Substantially the whole of their load came down on land, although only about two-thirds of it hit Aberdeen itself.

In May the results of night attacks on Norwich, Chelmsford, Sunderland and Cardiff showed only a small improvement over those achieved in March and April, despite a lavish use of marker-flares. Losses continued to be heavy. Constrained to tortuous courses by fear of Fighter Command's night-fighters, deceived by decoys and other counter-measures and harried by General Pile's guns whenever they approached a target of importance, the German bomber crews led a precarious existence. According to a lecturer at the Luftwaffe Staff College, their average life was somewhere between thirteen and eighteen sorties. Moreover, they could not be reckoned experienced until at least a third of it was spent.

Day attacks by fighter-bombers, on the other hand, were reasonably successful, largely because they often took the defences by surprise. On several occasions bombs were aimed expressly at residential districts; sometimes German pilots admitted opening fire on pedestrians. In the early part of the year the attackers were seldom engaged before they had dropped their bombs, and sometimes arrived unheralded by the 'warbling note' of the air-raid sirens. On 7th May twelve aircraft bound for Lowestoft were turned back by fighters; but such occurrences were rare. Strenuous efforts by the defences to improve matters included a careful watch by radar stations with recently-installed equipment capable, at least in theory, of detecting aircraft flying only just above the water; the greatest possible vigilance by anti-aircraft gunners; and standing patrols by fighters in areas where attacks were frequent. Success came on 25th May, when the radar chain detected a formation of fighter-bombers bound for Folkestone when it was on the far side of the Straits. Pilots about to land after a standing patrol were warned

accordingly, met the attackers over the Channel, forced fifteen of them to turn away and harassed the remaining four so much that three of them dropped their bombs in the sea and the other in a swimming-pool. Five days later light anti-aircraft and anti-aircraft machine-gun crews at Torquay saw twenty-two fighter-bombers flying towards them just as independent warning of an impending raid arrived. All but four of the attackers managed to reach and bomb the town, but the whole batch were so warmly received by the gunners, and by fighters which joined in, that five of them failed to get back to their base. A week later the threat to southern Europe arising from the Allied conquest of Tunisia led to the withdrawal to the Southern Front of the fighter-bomber units responsible for day attacks.

Thereafter the Luftwaffe found any kind of daylight sortie over the United Kingdom increasingly difficult and was ultimately forced to do essential reconnaissance at night. In the last three months of 1943 probably not more than a dozen German aircraft flew over the United Kingdom by day; and the High Command was soon at its wits' end to get photographic cover of the ports, assembly areas and aerodromes from which an Allied invasion of the European mainland might be launched. Night attacks continued on a small scale and generally with poor results. In the summer a new fast bomber, the Messerschmitt 410, made its appearance; in the autumn the Junkers 188, an improved version of the Junkers 88. These accessions, coupled with a careful timing of raids to coincide with the return of British bombers from Germany, helped crews to escape interception on the way to their targets and sometimes to reach them before the alert had sounded, but did nothing to improve their marksmanship or navigation. On the night of 25th July, when some fifty crews were sent with seventy tons of bombs to Hull, not one bomb hit the target; much the same thing happened in later months at the same place and at Lincoln, Norwich and Chelmsford. In the autumn the Germans, having noticed in July that aircraft of Bomber Command were dropping strips of metal foil to confuse their radar system, began to use a similar device themselves. But by that time their general performance was so poor that the additional burden placed on the defences—a drawback foreseen when the British decision to use the strips was taken—could have no decisive influence.

Meanwhile conflicting opinions had arisen among the Germans about the aims and conduct of the air offensive. Hitler, declaring that 'Terror is broken with terror, and by no other means', insisted that Bomber Command's onslaught could be countered only by smashing British cities. The German Air Staff, knowing only too well that they had insufficient forces in the west for such a programme, were more inclined to put their effort into 'intruder' sorties against

returning British bombers and their bases. Their case was strong, but not strong enough to withstand the Führer, although even he could not make five hundred aircraft out of fifty. They pointed out, quite rightly, that 'intruder' raids were cheap and difficult to counter, and were at least potentially capable of causing Bomber Command a good deal of embarrassment.

Yet another opinion, warmly championed by anti-shipping experts within the Luftwaffe and somewhat half-heartedly endorsed by the Naval Staff, was that any course of action, including reprisal raids, which did not directly advance the campaign against Britain's sea-communications was *ipso facto* a mistake. General Kessler, who had for some time commanded the force mainly responsible for air operations against shipping in United Kingdom waters with only grudging support from his superiors, put the matter very strongly in a letter written early in September. Addressing General Jeschonnek, the Chief of Air Staff—who incidentally had expressed his own opinion of the outlook by committing suicide a few days earlier—he pointed out that attacks on United Kingdom cities, backed by all the resources of the Luftwaffe, had failed to shake the British in 1940–1941, and were not likely to succeed now that only meagre forces were available. Describing shipping as the Achilles' heel of the British Empire and shipping-space as 'the deciding factor in the war', he declared that if Germany could sink 100,000 gross registered tons of shipping a month 'we should not need to worry about the industrial potential of England and America'. His conclusion was that the campaign against shipping should be 'the sole task' of the Luftwaffe's striking forces in the west.

In the outcome these objections failed to turn the Führer from his purpose, and perhaps their only effect was to ensure that whatever the Luftwaffe did in the west would be done with less than its full might. A few 'intruder' operations in the autumn and early winter caused British authorities some anxiety, but left them amazed that efforts which might well have gone to swell such operations should be wasted on scattered 'nuisance' and reprisal raids. Similarly, the meagre contribution of the Luftwaffe to the war at sea in the Atlantic theatre served chiefly to remind the Allies of the dangers they were escaping. And night attacks on towns and cities failed, as we have seen, because the attackers were too few, too inexperienced, too weakly led and too poorly equipped to get the better of defences which had drawn strength from their early setbacks and assurance from a mounting tally of success accumulated since the turning of the tide in 1941.

By the end of the year the authorities responsible for home defence could thus contemplate a prospect utterly transformed since the perilous days of 1940. The spectre of invasion had retreated before the

reality of German failure in Russia and Anglo-American success in Africa. Within the last nine months new methods and weapons, coupled since September with the use of bases in the Azores, had cleared a path across the sea for a mighty flow of men and material from North America to the United Kingdom. In British coastal waters, and wherever convoy-routes came within reach of the vast array of German bases extending from the North Cape to the Pyrenees, shipping which served the Allied cause was still open to direct attack by airmen now trained to use torpedoes and other missiles of ingenious design; but units capable of such attacks were few, while technical squabbles and administrative blunders had combined to keep them short of the aircraft and weapons which would have extended their range and striking-power. At home the air war had followed the undulating course which we have traced. The air defences, after their triumph in the summer of 1940, had suffered the frustrations of the following winter before achieving some degree of control over the night-bomber. Meanwhile an air offensive at first British and later Anglo-American had carried the struggle forward over Europe. By the closing months of 1943 air supremacy over the United Kingdom seemed clearly within reach; and the further task that faced the Western Allies in the European theatre was to extend it to the Continent.

CHAPTER XXI
THE WATCH ON THE BASE
(1943-1944)

(i)

IN 1943 and the early part of 1944 the business of 'reorganising our forces in the United Kingdom to form the largest possible balanced offensive force' went on steadily.¹ After the departure of the First Army for North Africa in the autumn of 1942, Allied troops continued to make ready in the United Kingdom for a landing in north-west Europe. Six 'holding' divisions, to which United Kingdom troops were posted for the last part of their training, eased the problem of providing a stout guard for the base by furnishing a nucleus of home defence formations whose continuity was not destroyed by the frequent changes of personnel which necessarily occurred. Lower Establishment Divisions, Young Soldier Battalions and, above all, the Home Guard, took a growing share in home defence. As we have already noted, in 1943 the Chiefs of Staff agreed that the coast defences should be reduced only by gradual stages, lest a German victory in Russia should revive the threat of invasion within nine months or a year.² Rather more than a quarter of the existing batteries were then declared redundant. At that time no further changes were contemplated until the Anglo-American armies were safely lodged across the Channel; but by the spring of 1944 the outlook on the Eastern Front had grown so favourable as to justify a scheme for the relegation to 'care and maintenance' of more than half the batteries remaining.

Reduction of the anti-aircraft defences posed more difficult problems while the German bomber force remained in being and while it retained the mobility of which it had shown itself possessed. Moreover, rumours that the Germans were developing weapons which would set new tasks for the air defences grew increasingly circumstantial as time went on. We shall see in later chapters that they proved well founded. Meanwhile the 'Baedeker' raids of 1942 enforced the move of 252 heavy guns to 28 hitherto undefended targets; in that year and the next, attacks on seaside towns by

¹ See p. 299.

² See p. 299.

fighter-bombers called for substantial defences against low-flying aircraft almost everywhere along the coast from Aldeburgh in Suffolk to St. Ives in Cornwall. By the early spring of 1943, 917 40-millimetre guns, 192 20-millimetre guns and 674 light machine-guns were deployed for low-altitude defence at places held to be likely targets for 'tip-and-run' attacks. To counter minelaying aircraft and to close a gap in the London defences a number of sea-forts, each capable of mounting four 3·7-inch guns, two 40-millimetre guns, a searchlight and a radar set, were installed in the estuaries of the Thames and Mersey.¹ The departure of the First Army for North Africa created another special task for General Pile, calling for the rapid deployment of more than a hundred additional heavy guns and nearly twice that number of light guns to protect the ports of embarkation and neighbouring anchorages. Finally, in preparation for the landing in Normandy which was to take place in 1944, the anti-aircraft defences of the southern ports, with their supply lines and assembly areas from Yarmouth to South Wales, were raised by the spring of that year to a total of 1,318 heavy and 932 light guns, 535 balloons and 17 smoke-screens—these figures including substantial contributions from field formations of the British Army and from Anti-Aircraft Artillery formations of the United States Army.²

It would be tedious to recount at length the manifold expedients by which these changes were made possible at a time when heavy demands arose from foreign theatres, and when the surrender of gunners for training in a mobile role with the Field Force imposed a constant sacrifice on home air defence formations. Mention has already been made of the employment of women in Mixed Batteries.³ Rocket batteries manned by the Home Guard—each member being expected to report for duty on one night in eight—had been formed in 1941. In 1942 members of the Home Guard were introduced to heavy anti-aircraft gunnery, manning one or more guns in certain batteries situated near their homes and thus deriving benefit from the proximity of more experienced companions. A system of 'over-gunning'—whereby batteries in some thickly-defended areas

¹ They were known as Maunsell Forts, after their designer, Mr. G. A. Maunsell. Four were installed in the Thames Estuary by October, 1942.

² The numbers were made up as follows:

	<i>H.A.A.</i>	<i>L.A.A.</i>	<i>Balloons</i>	<i>Smoke Screens</i>
Present before special deployment	842	332	342	4
Additions from A.D.G.B.	252	244	193	13
Additions from Field Force	248	360	—	—
Additions from U.S. Army	32	184	—	—
	<hr/>	<hr/>	<hr/>	<hr/>
Less 'Diver' Reserve (see p. 363)	1,374	1,120	535	17
	56	188	—	—
	<hr/>	<hr/>	<hr/>	<hr/>
	1,318	932	535	17

³ See pp. 278–279

took charge of more than the normal number of pieces—also helped Pile to grapple with difficulties of manning which caused him constant worry. In addition, the light anti-aircraft defence of certain factories and railways became the task of the Home Guard units recruited from among men who worked there, while the newly-raised Royal Air Force Regiment assumed a corresponding responsibility for air force stations.

The supply of light anti-aircraft weapons remained unequal to demands until the autumn of 1942, when a marked improvement in production permitted the reinforcement called for by the 'tip-and-run' offensive of the preceding spring and summer. Deliveries of the 3·7-inch heavy gun also improved as time went on. In the spring of 1943 a new 5·25-inch heavy gun was introduced, and later in the year conversion of 4·5-inch pieces by substitution of a special 3·7-inch barrel was put in hand. The 5·25-inch gun was based on a twin-barrel naval gun of that calibre which had been used in small quantities for air defence at home since the early part of 1942. By the end of 1943 no unconverted 4·5-inch pieces remained in the London area, though a diminishing number continued to be employed elsewhere to supplement the converted guns, the original 3·7-inch pieces and the 5·25-inch guns which were now the standard heavy anti-aircraft weapons.¹

The fighter force was reorganised in November 1943, when the fighter, tactical reconnaissance and tactical bomber squadrons needed to support the coming landing in France were assembled under Leigh-Mallory's command. Ten day-fighter and eleven night-fighter squadrons under Air Marshal R. M. (later Sir Roderic) Hill were assigned to home defence. In addition, six night-fighter squadrons intended for the defence of the 'lodgement area' across the Channel were put temporarily under Hill, who would be responsible for the night defence of the cross-Channel area during the early stages of the landing; and six day-fighter squadrons also intended for ultimate despatch to France were likewise placed at Hill's disposal to enable him to keep German reconnaissance aircraft at bay and to perform other tasks arising more or less directly from the assault on 'Fortress Europe'. A further fifteen day-fighter squadrons, nominally

¹ The numbers of the various heavy guns in service in December, 1941, at the end of 1942, and in June 1944, were:

	1941	1942	1944
3-inch	144	16	-
3·7-inch static	935	1,200	1,672
3·7-inch mobile	465	475	527
4·5-inch unconverted	416	406	259
5·25-inch twin barrel (naval)	-	3	3
5·25-inch single-barrel	-	-	25
4·5-inch converted to 3·7-inch Mk. VI	-	-	149
	<u>1,960</u>	<u>2,100</u>	<u>2,635</u>

under Hill's command but in practice lent to Air Marshal Sir Arthur Coningham of the Second Tactical Air Force 'for the duration of the assault phase', would revert to home defence at once if they were needed. Thus the greatest number of squadrons on which Hill could expect to call—including the fifteen which he would use only in an emergency—was forty-eight. This was less than half the strength assigned to home defence at the end of 1941, when most of the German air force was on the Eastern Front. The Chiefs of Staff agreed, however, that if a serious situation should arise at home while these arrangements were in force, the temporary diversion to home defence of all 'uncommitted' fighter squadrons in south-east England (other than United States squadrons) would be justified. Besides his own squadrons, Hill would have the handling of a few naval aircraft during the early stages of the assault on Europe, and at all stages would retain his predecessors' control of guns, balloons and search-lights.

Hill's position was in many ways unusual. The old term Air Defence of Great Britain, which was revived as a name for his command, did not fully convey his responsibilities, since his duties during the early stages of the landing in Europe would include the night-defence of the lodgement area and its communications with the United Kingdom. Moreover a directive which he received from Leigh-Mallory on 17th November not only charged him with the defensive tasks which had hitherto rested on Fighter Command, but also called on him to conduct offensive operations involving both his own command and part of Coningham's. The second part of this order was a temporary expedient, designed to free Coningham and his staff for their major task of preparing for the landing; but though the responsibility which it placed on Hill was scarcely more than nominal, its effect on the structure of his command was one which some commanders might have found unsatisfactory. In practice the operations in question were supervised by Leigh-Mallory himself until, in March, 1944, Coningham relieved him of the task. Their tactical direction was in the hands of Air Vice-Marshal H. W. L. Saunders, commanding No. 11 Group. Accordingly Saunders, while he never ceased to be Hill's subordinate, was in part the agent of Leigh-Mallory or Coningham. To some extent he was thus compelled to serve two masters.

In his relations with higher authority, too, Hill's position was abnormal. Unlike his predecessors at Stanmore, he was not a Commander-in-Chief, directly responsible to the Air Ministry for the handling of his forces. Nominally, and in some respects practically, his master was Leigh-Mallory. But Leigh-Mallory, preoccupied as he was with the Anglo-American air bombardment which would precede the landing in Normandy, and later with the landing itself

and with the advance through France and the Low Countries, had little thought to spare for purely defensive tasks. The free hand thus given to Hill in matters of operational concern had its advantages, but also imposed its penalties. Where the guidance or approval of higher authority was needed, Hill often found himself compelled to deal directly with the Air Ministry, the Chiefs of Staff and other bodies. Leigh-Mallory had no objection; but the control which he exercised in theory over operations, and in practice over administrative matters, gave his subordinate something less than the status which would normally have accompanied such responsibilities. Again, Hill's inheritance of responsibility for operational control of guns and searchlights made his position somewhat awkward, since General Pile, who commanded those weapons, was much his senior, had held his post since 1939, and was intimately acquainted with members of the Government who knew Hill only as a promising newcomer. Against these handicaps the new commander of the air defences could set exceptional tact and an unsurpassed knowledge of flying and its problems. A pilot of uncommon skill and daring, Hill could give lessons in airmanship to many of his subordinates. Although in his fiftieth year, he was capable of flying the latest and fastest fighters, and would willingly have led his squadrons in action if he had been allowed to do so. His habit of visiting stations in a Spitfire which he piloted himself did much to endear him to officers and men, and to procure respect for views which seemed not merely the mandates of a commanding officer, but the opinions of a colleague.

(ii)

In the early winter of 1943 two dangers seemed to threaten the United Kingdom and the preparations which were being made there for the forthcoming expedition to the European mainland. The development by the Germans of novel weapons of long-range bombardment will be discussed in later chapters and need not detain us here. The other danger was a series of more or less orthodox attacks by German bombers, which might be aimed at London, as the nerve-centre of the preparations, or at places where troops, ships and aircraft were assembling or would assemble in the spring. There was little disposition, either in London or at Stanmore, to over-estimate the threat from orthodox bombers, for the German bomber force had been unimpressive in recent months, and the training of crews for accurate bombing of well-defended targets was justly thought to have been so long neglected that a spectacular recovery was improbable. At the same time, Peltz, who was rightly expected to take charge of

the venture, had a reputation among British intelligence officers which the subsequent offensive did little to justify, though the fault was perhaps not altogether his. The Germans had taken the lead with 'blind' bombing by means of beams and navigational instruments early in the war. They were known to be studying, apparently with a view to imitation, the 'pathfinder' methods since adopted by our own bomber force. Reports that Peltz was making ready for a new series of attacks, though they caused no great alarm at the Air Ministry or among Hill's staff, seemed, therefore, to justify the inference that before long the Luftwaffe might make a resolute attempt to surprise the air defences, and that an improvement on the methods used in the early part of 1943 might be expected.

The countering of such a blow with his relatively few squadrons, and with pilots whose fighting spirit might conceivably suffer from their having been chosen to stay at home while their fellows prepared for a mobile role, was likely to be Hill's first big task. In the meantime—indeed throughout the period before the initial landing and for some time afterwards—one of his most important duties was to ensure that German reconnaissance aircraft photographed nothing which might compromise the Allied plan, and were not too blatantly permitted to photograph what might mislead them.

In the second task the air defences were almost unbelievably successful. In January, 1944, German aircraft photographed ports and aerodromes on and near the South Coast of England for the first time since August, 1943. The photographs taken then and subsequently threw so little light on the true state of affairs that, even after Allied troops had landed in Normandy on 6th June, the German High Command continued to believe that the main blow had yet to come and would probably fall much further east.

Meanwhile forecasts of the weight and scope of the attacks which Peltz might be able to deliver were rightly held to justify economies envisaged in Leigh-Mallory's directive of 17th November.¹ The directive reminded Hill that henceforth pure defence must be subordinated to offence. No. 14 Group, in the north of Scotland, had already been amalgamated with No. 13 Group; by the following June the number of groups was reduced to four and the number of sectors, from the nineteen existing when Hill assumed command, to fourteen—less than half the total at the end of 1941. Later the process was carried still further. But the speed of the Mosquito night-fighter, coupled with better anti-aircraft guns, new radar sets and methods of control elaborated in the light of long experience, promised a formidable defence against night bombing.

While these economies were in progress, and some five months

¹ See p. 324.

before the Anglo-American armies were ready to set foot on the Continent, Peltz showed his hand. At the end of the third week in January, 1944, the striking force at his disposal comprised 524 bombers and fighter-bombers, of which 462 were serviceable.¹ Nearly four-fifths were Junkers 88's and Dornier 217's; one unit only was equipped with the modern Junkers 188, another had the fast and formidable Messerschmitt 410, while elements of two units had the Heinkel 177, an aircraft designed as a heavy bomber but hitherto used chiefly against shipping. One *Gruppe* of single-engined fighter-bombers made up the total. The general standard of training and experience was poor; and Peltz, who seems to have had few illusions on this score, would appear to have pinned his hopes on a small band of 'pathfinder' crews who were to mark the target and the approaches to it with marker bombs and coloured flares. The 'pathfinders' themselves relied largely on 'Benito' and other beams whose successful application depended in great measure on the ability of a ground-controller many miles distant to gauge conditions over the target and allow for them. While Peltz was probably right in exhorting his largely unskilled crews to observe strict discipline and adhere closely to their instructions, a weakness of these arrangements was that such orders spelt certain failure should either the ground-controller or the 'pathfinder' crews fall short of expectations. There was little scope for the initiative which might in other circumstances have retrieved such errors.

The offensive began on the night of 21st January, when virtually every serviceable aircraft in the west was ordered to bomb London.² The German intention seems to have been retaliation for British bombing rather than dislocation of Allied plans, for which the time was not yet ripe. The attack was made in two waves separated by an interval of about six hours.

For the Germans the results were lamentable. The load carried by their crews was of the order of 500 tons; yet only about half that weight of bombs came down on land, and little more than thirty tons hit London. The Luftwaffe did not fully grasp the extent of their failure, but knew that the attack had not been entirely successful. They blamed too small a 'pathfinder' force and a sudden worsening of the weather after the first wave of bombers had dropped their load. A second attempt to bomb London eight nights later, again in poor weather, succeeded little better. On the two nights the Germans lost fifty-seven aircraft, or nearly eight per cent. of the sorties flown. A good performance by the defences in conditions which were anything but favourable to them was highly satisfactory to Hill, who

¹ For details, see Appendix XLI.

² For a summary of the raids mentioned in the remainder of this chapter, see Appendix XLII.

soon felt little doubt of his ability to cope with anything the German bomber force might do to interfere with Allied preparations for invasion. Against such forms of attack the methods tested and improved in the last few years seemed capable of providing a satisfactory defence.

In February the Germans continued the offensive against London with seven major raids. Accuracy was again poor on the first two nights, but improved considerably thereafter, largely as a result of better placing of flares. These seem to have been far more helpful to the majority of crews than the marker-bombs which continued to be used at least on some occasions. On the night of the 18th, for example, about three-quarters of the bombers which penetrated the defences succeeded in hitting Greater London, although flares were their sole guide, for dense clouds covered the capital and must have made marker-bombs unprofitable. Similar conditions on the night of the 20th brought similar results. It is perhaps significant that better weather on the next two nights of major bombing, which may have tempted crews to rely more on what they saw on the ground, brought a marked decline in accuracy. On the night of 24th February a moderately successful attack was made in cloudless weather marred by haze which may well have helped the attackers more than it hindered them, by hiding the ground from the majority of crews. Certainly on this night there was a marked correspondence between the positions of flares reported by British observers and the fall of bombs.

German losses in the February raids were relatively smaller than those incurred in January, amounting to about one-twentieth of the sorties flown; but a declining effort testified to the cumulative effect of casualties sustained since the start of the offensive, and to difficulties of maintenance and servicing. These signs boded ill for the Luftwaffe's chances if they were called upon to work at full stretch during the period of crisis which must be expected to follow an Allied landing.

In March, Peltz's forces made four major raids on London, besides one on Hull and one on Bristol. The Hull and Bristol raids were utter failures, no bombs falling on either town. In the four raids on the capital, about half the tonnage which fell on land hit London or its outskirts. German losses in major raids were heavier than in January or February, amounting to more than eight per cent. of the sorties flown, and the average effort in the last four raids was less than a third of that achieved on the opening night in January.

For Londoners the 'Baby Blitz' ended on the night of 18th April, when 125 bombers were sent to bomb the capital. Some fifty tons of bombs hit Greater London. Further attacks on Hull and Bristol were attempted on the nights of the 20th and 23rd respectively, but

again no bombs hit either target. Thereafter the bulk of the German effort went into attacks on South Coast harbours and shipping in or near them. Bristol was again the target on the night of 14th May, and this time a few bombs hit the city. Not one of the raids delivered in May and the latter part of April achieved anything of consequence. By this time interference with craft assembling for the assault on Europe was becoming the enemy's main object; but the chief effect of the raids was to reduce still further the striking force which would be available to the Germans when the Allied armada sailed. Long before that stage was reached, the enemy had squandered a great part of his resources on his ill-conceived attempt to score a moral victory by bombing London. Even if the 'Baby Blitz' had been more efficiently conducted, it could scarcely have achieved much of worth, since Peltz's force was too weak for the tasks it undertook. As it was, the raids had only a propagandist value which was all the more dubious since the claims made in respect of them bore little relation to the facts.¹ A major consequence was that the eve of the invasion found the German bomber force in the west on the verge of bankruptcy, and capable of only meagre efforts against targets of true military importance.

¹ After the raid on the night of 13th February, for example, the German radio claimed that 'several hundred aircraft' had dropped 180,000 incendiary bombs and several thousand high-explosive bombs 'in a concentrated attack on London'. In fact, the number of aircraft used was 230; less than four tons of bombs fell on London, about 157 tons in Kent and Essex. The number of bombs counted on land was 57,525, of which the vast majority were small incendiaries.

CHAPTER XXII
THE THREAT
FROM LONG-RANGE WEAPONS
(1939-1944)

(i)

SOON AFTER the outbreak of war in 1939 the British Naval Attaché in Oslo received an anonymous letter. His correspondent asked whether the British Government were interested in receiving a report on German technical developments. If they were they should, he suggested, signify their interest by causing a small change to be made in the preamble to our German news broadcast on a certain evening.

The offer was accepted; the change was made; and early in November the report arrived. It contained a wealth of information about German technical and scientific projects. Amongst other things, it told us that the Germans had two kinds of radar, that they were experimenting with gyroscopically stabilised rockets, and that they had an important experimental station at a place called Peenemünde, on the island of Usedom off the Baltic coast.

The information covered so wide a field, and implied such an intimate knowledge of so many subjects, as to cast doubt on the good faith of our correspondent. It was argued that one man could not know so much unless he had been briefed to hoax us. The outcome showed, however, that much, at any rate, of the report was accurate. The existence of two kinds of German radar—known respectively as *Freya* and *Würzburg*—was confirmed by testimony not to be denied. In due course the sets were photographed, and in 1942 a *Würzburg* set was inspected and dismantled by a British radio-mechanic in the course of a daring raid on the coast of Normandy.¹ Again, the Oslo report said that the enemy was experimenting with remotely-controlled glider bombs. After nearly four years the Henschel 293, a

¹ The set—located at Bruneval, near Le Havre—was dismantled in the dark by Flight-Sergeant C. W. H. Cox, who volunteered for the task at a time when he had never been out of England either on the sea or in the air. He was parachuted into France. Among those who took part in the accompanying seaborne expedition was a civilian scientist, one of several who had asked to go. Vital parts of the equipment were brought back to England.

weapon conforming with that description, was used against our shipping. And these were not the sole examples of a prescience which caused a leading member of the Intelligence Branch of the Air Ministry to say later that 'in the few dull moments of the war' he used to turn to the Oslo report 'to see what should be coming along next'.¹

Of the rockets mentioned in the report, practically nothing more was heard in the United Kingdom for the next three years. Doubtless something further might have been discovered within that time if the matter had been thought sufficiently important; but, naturally enough, it received no great share of attention from our intelligence services while more urgent problems competed for their notice. The early history of the weapon will, therefore, be best studied through German eyes, before we turn to the awakening of our own knowledge of the threat which it presented.

(ii)

German interest in large rockets as military weapons dates, for the present purpose, from about ten years after the end of the First World War. About that time the Ordnance Branch of the German Army conceived the hope that, by applying the national aptitude for research to a relatively novel field, they might not only overcome an immediate shortage of artillery created by the Treaty of Versailles but also help the Fatherland to steal a march over less far-sighted rivals. For example, should poison-gas be used again in war, rockets might provide a useful method of carrying it to its destination. According to Colonel Becker, head of the Ballistics and Munitions Section, even the rudimentary rockets which could have been used between 1914 and 1918 would have served that purpose better than the projectors then employed. At an early stage Becker recommended, therefore, that (besides relatively short-range anti-aircraft rockets) 'long-range precision rockets' should be developed 'in the first place as gas weapons'. Another employment soon foreseen for the long-range rocket was bombardment of a distant target with high-explosive, as an alternative to bombing.

Early in 1931 the Ordnance Branch secured the appointment of Captain Walter Dornberger, a thirty-five-year-old artillery officer whose training had included three years at the Technical High School in Berlin, to work on rocket development under a certain

¹ Quoted from a lecture delivered by Dr. R. V. Jones to the Royal United Service Institution on 19th February, 1947.

Captain Ritter von Horstig, who in turn was responsible to Becker.¹ A man of vision and a good organiser, Dornberger was well qualified to bridge the gap between the soldier and the scientist. Helped by a team of experts whose abilities he was quick to grasp, and who for the most part loyally supported him, he proved in the outcome capable of retaining—as probably no mere technician could have done—the confidence of his superiors through a period of exploration so protracted, and so beset by setbacks, as to call for a lively faith on the part of those who found funds for his efforts at the expense of other projects.

The field of discovery which awaited Horstig and Dornberger was not, however, altogether unexplored. Rockets had been used in war from very early times.² But in recent years the progress of artillery, and especially the increased accuracy conferred by the rifled barrel, had caused the rocket to fall into disfavour. Its development as a military weapon had been virtually at a standstill for more than a generation when, in the early part of the twentieth century, a Swedish officer named Unge patented a rotating rocket, or 'aerial torpedo', with a range of about 4,000 yards. Aimed solely by lateral and vertical adjustment of the tube from which it started on its course, Unge's rocket achieved about one-third of the accuracy attainable at the same range with a light howitzer. The weapon was tested some five years before the First World War by German armament manufacturers, who discarded it in favour of ordinary mortars.

After the Armistice research on rockets was continued by various workers interested in such diverse applications as rescue of shipwrecked mariners, collection of meteorological data, delivery of mail across the Alps or the Atlantic, and travel to the moon.³ Rocket-propulsion was also applied tentatively to wheeled vehicles and aircraft. German inventors were prominent in all these fields. In due course some of them were called in to help the Ordnance Branch. But up to the time when the German Army first turned its attention to the subject, no-one had produced a military rocket both powerful and controllable enough to compete seriously with orthodox artillery.

Where the long-range rocket was concerned—for anti-aircraft

¹ General Dornberger's own account of the large rocket and its development is given in his book, *V-2* (Eng. Ed. 1954).

² Missiles called by some translators 'rocket-arrows' are said to have been used by the Chinese against the Mongols in 1232. In Europe, short-range rockets were widely employed as siege weapons from about 1450 (and probably earlier), but those produced before the nineteenth century were mostly very unstable and inaccurate. The finned rocket introduced by William Congreve and used at Boulogne and Copenhagen in 1806 and 1807 (and in an improved form at Leipzig in 1813) was a great advance on its predecessors. Soon after the middle of the nineteenth century William Hale devised a rotating rocket with quite a good performance, but it was outmatched by the breech-loading rifled gun.

³ For a popular account of some of this work, see Kenneth W. Gatland and Anthony M. Kunesch, *Space Travel* (1953).

rockets do not here concern us—the problems which immediately confronted the Ordnance Branch were first to find a sufficiently powerful method of propulsion, and secondly to achieve a steady flight. Attempts to bring the missile to its target—whether by careful aiming or by some form of remote control—were bound to be ineffective unless it could first be made at least as stable as a projectile fired from a mortar.

Among many factors affecting the first problem, the choice of propellant was not the least important. Briefly, the possibilities were black powder, as used by Unge; a more powerful solid fuel, such as cordite; and some kind of gaseous or liquid fuel. In a paper published in 1919 Robert H. Goddard, an American pioneer of high-altitude rockets, had suggested using hydrogen and oxygen;¹ he had since experimented with liquid fuels, and as early as 1926 had launched a rocket propelled by petrol and liquid oxygen.² The outcome of his later experiments was a paper on 'Liquid Propellant Rocket Development' which appeared in 1936. Inspired by Goddard's first paper, and by other contributions to the theoretical literature of the subject, Herman Oberth, a Rumanian of Saxon origin living in Germany, had published in 1923 a technical treatise on inter-planetary rocket flight, in which the emphasis was laid on liquid fuels.³ In association with Oberth, an engineer named Rudolf Nebel—besides others in Germany—had experimented with such fuels, assisted by a number of helpers amongst whom a young technician named Wernher von Braun was prominent.

As for stability, devices for promoting it included a tail-rod (as with fireworks); rotation of the entire rocket about its longitudinal axis (as used by Unge and Hale, and in his later years by Congreve); external stabilising surfaces, such as wings and fins; and internal gyroscopes. One of the chief difficulties was to prevent the missile from wobbling too much at the beginning of its flight, while it was still travelling slowly. A possible remedy was to launch it from a long projector which would keep it on a steady course until it had gathered speed; but this method raised fresh problems, which would grow more acute as the size and power of the missile were increased.

By the beginning of 1932 Becker could claim that experiments made in the last twelve months with rotating 'black powder' rockets had

¹ 'A Method of Reaching Extreme Altitudes' (Washington, 1919).

² Still earlier experiments with liquid-propelled rockets are said to have been made by a Peruvian engineer, Pedro Paulet, between 1895 and 1897, and by the Swedish astronomer Birkland in 1905. Like other inventors whose claims to priority have been advanced in recent years, Unge considered the theoretical possibilities of liquid propulsion, but is not known to have tried it.

³ In 1929 Oberth expanded his treatise (originally called *Die Rakete zu den Planetenräumen*) and published the new version at Munich as a book of 431 pages, *Wege Zur Raumschiffahrt*. According to a well-informed source, it was this book which first roused the interest of the German Army in large rockets.

reached, and in some respects already passed, the stage where Unge had left off. On the other hand, development of a more powerful 'liquid' rocket with gyroscopic stabilisation was at a standstill for want of a suitable propulsion unit. In the meantime Dr. Heylandt, of the firm of that name, had produced a unit—employing petrol and liquid oxygen—which successfully propelled a motor-car at Tempelhof aerodrome.¹ But it consumed fuel too rapidly to be installed in a missile carrying a warhead of useful weight. Nebel's group, though recently assisted by a subsidy, had also failed to solve the problem, despite some early success with small 'liquid' rockets. Accordingly Becker reported in January that 'the only practical propellant at the moment is still black powder'. He added that rotation had proved the only reliable method of securing a steady flight with small and medium-sized rockets.

Nevertheless Dornberger retained his faith in the 'liquid' rocket as the missile of the future. He succeeded in persuading Becker to allow him to continue, and even extend, his work on liquid propellants and allied problems. In the course of the year he set a team of three technicians, consisting of Wernher von Braun from Nebel's organisation and two of Heylandt's former helpers (assisted by five mechanics) to study 'liquid' rockets at the artillery testing-ground at Kummersdorf; in addition one technician under his supervision continued work on 'solid' rockets in Berlin. Soon afterwards he succeeded in detaching himself from Horstig, whose attitude to 'liquid' rockets he later described as 'negative'. Thereafter he quickly established himself as the army's leading rocket expert. By 1936 his authority was unquestioned and his staff at Kummersdorf had grown to more than a hundred men.

The first big landmark in the development of the long-range rocket was reached in 1934. In December two liquid-propelled rockets with gyroscopic stabilisation were launched from the island of Borkum, off the North Sea coast, and reached a height of nearly one and a half miles. Fifteen months later General von Fritsch, Commander-in-Chief of the German Army, visited Dornberger's establishment at Kummersdorf and was much impressed by what he saw. Thus encouraged, Dornberger embodied some of his ideas in a plan for a specific weapon, in the shape of a rocket designed to carry a one-ton warhead over a distance equal to more than twice the range of the 'Paris Gun' of the First World War. About the same time plans were made for the construction of a new research and development station for rockets and other novel missiles in a secluded but reasonably accessible situation at Peenemünde. The project was made possible by the co-operation of the Luftwaffe, whose leaders agreed to

¹ In earlier (and widely-publicised) experiments with rocket-propelled wheeled vehicles and aircraft 'solid' rockets had been used.

contribute to the cost of the new site in return for the privilege of setting up their own experimental station alongside the army's and of sharing certain facilities needed by both stations.

The rocket planned in 1936 was substantially that used against this country eight years later, and known as the *A-4* or *V-2*. In the course of development the maximum range was increased from the original 172 miles to more than 200 miles.¹ Like its humble relative, the fire-work of commerce, the missile was launched and propelled by its own power, derived in this case from the combustion of alcohol, with liquid oxygen as oxidant. Each rocket consumed about four tons of alcohol and five tons of oxygen; in addition at least two tons of oxygen were lost by evaporation for each rocket launched. A subsidiary power-unit which pumped these liquids to the combustion-chamber utilised the reaction between hydrogen peroxide and a permanganate. Of these ancillary fuels relatively small quantities were used. A steady flight along the intended line of shoot was secured by a combination of external fins and a preset gyroscopic system which trimmed two sets of vanes placed respectively behind the fins and in the exhaust-stream.² Alternatively trimming during the early stages of the flight could be done by a radio beam, or *Leitstrahl*; but this method demanded topographical conditions not always attainable in practice. Remote control at later stages, though theoretically possible, was not attempted. Control of range depended on the termination of combustion at the precise moment when the rocket, under the influence of a device which progressively shifted the appropriate axis of the gyroscopic system, had reached the degree of tilt from the vertical, as well as the velocity, needed to take it to the target. These conditions were secured either by an appropriately-timed radio signal from the ground (*Radio-Brenschluss*), or by a preset integrating accelerometer (*I-Gerät*) carried in the missile. Except for its fins, the rocket looked not unlike a huge shell, some forty-six feet long and with an unusually sharp nose. Its all-up weight, complete with warhead and propellant, was nearly thirteen tons.³

But in 1936 the *A-4* was little more than an aspiration. As its name implied, it had a number of predecessors, including the two rockets—in fact belonging to the *A-2* series, but commonly known as 'Max und Moritz'—tested in 1934. In addition a small experimental model, the *A-5*, was used in relatively large numbers to provide working data during the long period of development which preceded the emergence of the final weapon. A minor success was achieved towards

¹ Experimental versions attained ranges of the order of 300 miles, but the normal maximum was between 200 and 220 miles. The warhead was originally to have contained a ton of explosive, but was reduced to a total weight of just under a ton, including about 1,650 pounds of explosive.

² This method was foreshadowed in a rocket launched by Professor Goddard in 1932.

³ For further details see Appendix XLIII.

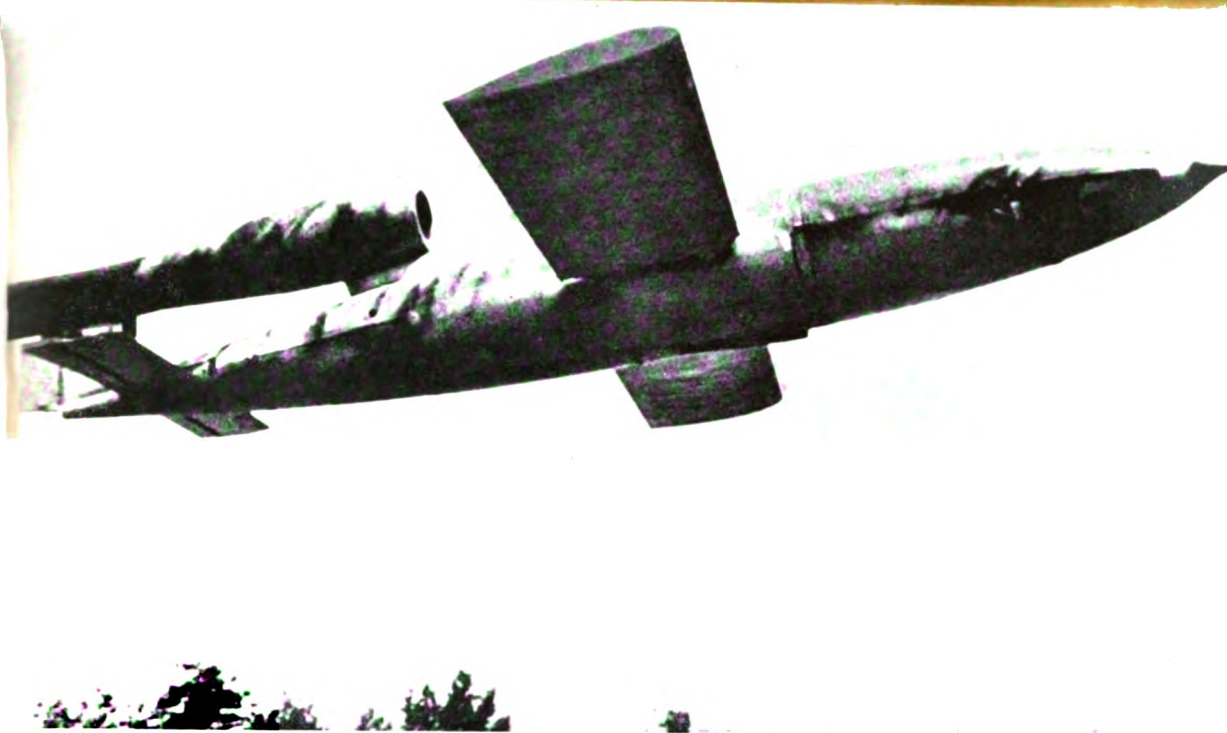


Plate 25. German Flying Bomb (*FZG.76*) immediately after Launching.

Plate 26. German Long-Range Rocket (*A-4*) in process of elevation to Firing Position.



the end of 1937, when two rockets larger than any previously tried, and belonging to the *A-3* series, were launched from the Greifswalder Oie, a small island north of Usedom; but many technical problems, including that of control, were still a long way from solution. Dornberger and his assistants had shown that they could make large rockets leave the ground, and even fly some distance, but had yet to prove that they could bring the missiles to a given target.

In 1938 help was sought from the firm of Siemens, who soon devised a method of control more satisfactory than any previously put forward. After the outbreak of war assistance was obtained, too, from the schools and universities. Thereafter both the design of the combustion-chamber and methods of control were much improved as fresh minds were brought to bear on an increasing volume of experimental data.

In the spring of 1939 the Führer visited Kummersdorf and witnessed a combustion-test. The experience failed to convince him that the large rocket would soon become an important weapon. On a previous visit in 1933 he had been shown little or nothing of the 'liquid' rocket project.

By the spring of 1942 the *A-4*—eighty times as powerful as 'Max und Moritz'—was at last somewhere near completion. Dornberger, who was in the habit of reporting progress at six-monthly intervals, took the opportunity to advance a tentative plan for the employment of the weapon. Drafted by one of his technicians, the scheme proposed the launching of 5,000 rockets a year at England from the coast of France by three field formations backed by a substantial fleet of tank wagons and special vehicles. The wide circulation given, on Dornberger's authority, to the paper embodying the proposals displeased the German High Command, who ordered the recall of all but a few copies. Nevertheless the move served a useful purpose in bringing the matter to the attention of the Führer.

Trial launchings began at Peenemünde in early June. At first the old problem of control continued to give trouble. But on 3rd October the third rocket of the *A-4* series to travel any appreciable distance crowned Dornberger's hopes by flying perfectly along the intended course, reaching a height of more than fifty miles and a speed of roughly 3,300 miles an hour.¹ Some twelve years had elapsed since Dornberger began his task; nearly eight years since the success of 'Max und Moritz'. The *A-4* itself had been conceived six years before. The 'long-range precision' rocket foreshadowed in 1930 had been long in gestation, and when born had proved refractory. It seemed

¹ The distance covered is variously given in published and unpublished accounts as 120, 125, 167·5 and 170 miles. The first is almost certainly the correct figure.

that now, at last, the monster had come to heel, and that the hopes of more than a decade were on the verge of consummation.

Yet in the outcome nearly two more years went by before the rocket was judged ready for employment, even by men in urgent need of new devices to offset methods of air attack which were proving more terrible in the hands of their enemies than in their own. The delay had several causes. In the first place, formidable technical obstacles were met in the final stages of development. Early experiments with small 'solid' rockets had been hampered by prematurely exploding warheads; but the extent to which this trouble would dog the larger weapon was not foreseen. Secondly, a dense thicket of warring ambitions, muddle and mismanagement barred the way to the arrangements necessary for the manufacture and employment of the rocket in large numbers. Finally, a new factor came into play as the British Government gained tardy and uncertain knowledge of the German preparations.

By this time, too, the rocket had a flourishing rival in the shape of the *FZG. 76* pilotless aircraft, or flying bomb, at one stage known as the Fieseler 103.¹ In appearance roughly resembling a small fighter, the *V-1*, as it was afterwards called, was an expendable flying missile driven by a simple pulse-jet unit with a working life of half-an-hour to an hour. Each missile carried up to 150 gallons of low-octane aviation spirit. The flight was controlled by an automatic pilot monitored by a magnetic compass, and was terminated by an electro-mechanical device designed to bring the machine to earth when a predetermined distance had been covered. The warhead was roughly equivalent to that of the *A-4*. Unlike its competitor, which left the ground vertically under its own power, the flying-bomb was either shot from an inclined ramp by an ancillary launching device (*Dampferzeuger*) employing hydrogen peroxide and a permanganate, or (more rarely) released from a bomber aircraft modified to carry it. Again unlike the rocket, it was open to engagement by guns and fighters, though it was originally designed to reach a speed which fighters could not yet attain. On the other hand, it could be manufactured much more rapidly and cheaply than its rival.

Early in December, 1942, Gerhard Fieseler, whose firm played an important part in the development of the flying bomb, launched an unpowered prototype from a Focke-Wulf 200 aircraft over Peenemünde. On the 24th of the same month the first ground-launched flying bomb was fired from a ramp there and satisfied the conditions of the test by flying about 3,000 yards. Tested for range and accuracy some months later, after some fifty practice launchings had been

¹ The term *Flakzielgerät* (anti-aircraft artillery target apparatus)—not *Fernzielgerät* (long-distance target apparatus), as has been commonly supposed—was adopted to conceal the true nature of the weapon. Hence the abbreviation *FZG*.

completed, the missile flew more than 150 miles and gave a somewhat flattering impression of its capabilities at the stage then reached by finishing little more than half-a-mile wide of the aiming-point. The final stages of development were, however, marred by technical shortcomings, some of which persisted after the weapon had gone into active service.¹

In 1943 Hitler's attitude to long-range weapons underwent marked changes, dictated largely by his increasing need of an answer to Allied bombing. About five months after the successful trial of the A-4 at Peenemünde he dreamed that the missile would never reach England, and his newly-kindled interest in it was temporarily eclipsed. In any case a rocket designed in 1936, and carrying a modest one-ton warhead, seemed a doubtful substitute for the weapon of annihilation—delivering, say, ten tons of explosive—which his imagination pictured. A detailed verbal report by Dornberger and a lecture by Wernher von Braun, illustrated by a film of the October launching, played a big and probably decisive part in persuading him that nevertheless the project was well worth pursuing. According to Dornberger himself, at the end of the interview the Führer apologised for his previous scepticism, declaring that 'if we had had the A-4 earlier and in sufficient quantities, it would have had decisive importance in the war'. Afterwards he ordered that a diploma conferring the title of professor on the lecturer should be prepared for his signature and presented to von Braun by Albert Speer, Reichminister for Armaments and War Production. On 25th July he signed a document decreeing that 'the successful prosecution of the war against England requires the maximum output of A-4 weapons in the shortest time', and authorising Speer to 'draw on the resources of all branches of the Armed Forces to their fullest extent as well as on the resources of the whole of the industrial war economy'.

Meanwhile, at Hitler's instigation, a newly-appointed Long Range Bombardment Commission had done their best to weigh the relative merits of the rocket and the flying bomb. After visiting the army and air force establishments at Peenemünde, where they were well entertained, the commissioners recommended that effect should be given to both projects. Plans were made to manufacture both missiles in substantial numbers and train men to use them. Sites for launching-points and stores in Northern France were reconnoitred and constructional work was put in hand. The structures planned included a small number of concrete 'bunkers' from which rockets could be launched immediately after servicing, to supplement those launched by mobile troops from simple platforms. By the summer a start had been made in nearly all these fields, though the missiles themselves

¹ For a further account of the flying bomb and its development, see Chapters XXIII and XXIV.

were still manifestly imperfect. If German hopes were realised, a heavy bombardment of the United Kingdom with both rockets and flying bombs would begin towards the end of 1943 or early in 1944.

(iii)

On the British side, scarcely anything was known of all this until 1943 was well advanced. Towards the end of 1942, however, an agent whose reliability was still untested—but who later showed himself trustworthy and well informed—had sent in the first of three reports which together indicated that trials of a long-range rocket had been held recently near Swinemünde. In the early part of 1943 reports from other informants linked such trials more precisely with Peenemünde. As we have seen, the experimental station there had been mentioned in the Oslo report as long ago as 1939. The place had been photographed by a reconnaissance aircraft in the spring of 1942, when 'heavy constructional work' was seen to be in progress. In April, 1943, the photographs taken on that occasion and on three more recent visits were reviewed in the light of the latest information from other sources. They revealed nothing which looked like decisive evidence of experiments with long-range rockets. On the other hand, support for the belief that the Germans were experimenting with unusual missiles—perhaps of several kinds—was obtained from prisoners of war, and especially from one officer of high rank who was unwittingly indiscreet.

Unfortunately nothing like a clear picture of the weapon or weapons which the Germans were said to be developing emerged from the information collected by the early spring. In connection with rockets, ranges up to 130 miles had been suggested, and a war-head containing five tons of explosive had been mentioned, as had one containing ten. But these estimates—in any case misleading—came in a context which made assessment of their accuracy anything but easy. On the other hand, even without the Oslo report—whose foreshadowing of the Henschel 293 had not yet been justified by the appearance of that weapon—the evidence received in the last few months did suggest quite strongly that the enemy was experimenting at Peenemünde with novel missiles, including one which could fairly be called a long-range rocket.

The task of collating and considering this evidence fell in the first place on the intelligence staffs of the fighting services. At the Air Ministry it fell particularly on the officer appointed for the express purpose of dealing from the viewpoint of a physicist with such matters. This was Dr. R. V. Jones, who had earned a high reputation as a student of enemy methods and technical equipment by his work on

German navigational beams in 1940 and by his insistence that his findings on that occasion should not be overlooked.¹

To Dr. Jones and his colleagues at the Air Ministry their duty in the circumstances which had now arisen seemed clear enough. On the assumption that the long-range rocket did exist, they must find out more about it, and thus put themselves in a position to assess the threat that it presented, before giving the alarm to those potentially concerned with counter-measures. Unless the weapon proved a myth, the operational staffs would have to be told about it in due course; meanwhile agents must be briefed to fill gaps in our knowledge, prisoners of war must be pressed to tell us what they knew, and the photographic reconnaissance organisation must be asked to keep watch on Peenemünde and on any other place which might come under suspicion.

Their counterparts at the War Office took a different, but equally legitimate, view of their responsibilities. Conceiving that the reports already received from a variety of sources pointed to a danger so grave that knowledge of it ought not to be confined to the intelligence staffs, they placed the matter before the Vice-Chief of the Imperial General Staff, Lieutenant-General A. E. Nye.

General Nye consulted Professor C. D. Ellis and Dr. A. D. Crow, respectively Scientific Adviser to the Army Council and Director and Controller of Projectile Development in the Ministry of Supply, with a view to obtaining, amongst other advice, their opinion as to the feasibility of the project imputed to the enemy. On 11th April a paper on 'German Long Range Rocket Development' was circulated, on General Nye's authority, to his colleagues and their immediate superiors, the Chiefs of Staff. Its avowed aims were to draw attention to the reports of experiments with long-range rockets which had been received since the previous December, to give some account of the potentialities of such a weapon and to suggest counter-measures. Perhaps unfortunately, the paper also drew a speculative picture of the rocket. An annex gave the general trend of the reports received in the last few months, but added that 'technical opinion' envisaged a missile ninety-five feet long and weighing about nine-and-a-half tons, launched ('unless an extremely accurate method of directional control in flight has in fact been developed') from a projector about a hundred yards in length. The weight of the warhead was put at one-and-a-quarter tons, including rather less than one ton of explosive. These figures appear to have been based on the assumption that a solid propellant would be employed, but that assumption was not stated.

In the body of the paper General Nye recommended that plans

¹ See pp. 157-158.

should be made for the detection by air reconnaissance of the hypothetical projectors, and for their destruction at short notice by air attack. He also suggested that Royal Observer Corps posts and Royal Artillery flash-spotting stations in the south-eastern counties should be told to watch for signs of ranging shots, and that the Ministry of Home Security, and also the Prime Minister in his capacity as Minister of Defence, should be warned that large rockets might descend on the country with little or no warning.

The Vice-Chiefs of Staff considered these recommendations on 12th April. They agreed that the Prime Minister and the Minister of Home Security should be warned, and that further consideration should be given, at the next meeting of the Vice-Chiefs on the 15th, to 'the scientific investigations to be put in hand'. Before that day arrived the War Cabinet Secretariat were able to report that the question of the further investigations to be undertaken had been examined. This report was accompanied by the suggestion that it might be thought proper to associate with the work a variety of authorities in addition to the Intelligence Branch of the War Office, the Scientific Adviser to the Army Council and Dr. Crow, and by the further suggestion that 'in view of the importance of the subject, the Vice-Chiefs might care to consider recommending to the Prime Minister that one individual, who could devote a considerable amount of time to the matter, should be appointed to take charge of the investigations so as to ensure that no aspect is overlooked and that the work is pressed on with all speed'. The Chiefs of Staff welcomed the proposal that one man, who could give time to the work, should head the investigation. On their recommendation the task was entrusted to Mr. Duncan Sandys, Joint Parliamentary Secretary to the Ministry of Supply.

(iv)

The position thus created was unusual and led to some misunderstanding. It was argued at the time and afterwards that, if the object of the investigation was to establish more or less precisely what the enemy was doing, the best co-ordinator would have been an intelligence officer who either was himself a trained scientist, or had a trained scientist experienced in the evaluation of intelligence reports at his right hand. Not unreasonably, it was claimed that an investigator accustomed to found his conclusions on evidence from the enemy's camp would be more likely—precisely because his outlook was more limited—to establish the nature of the new weapon than someone used to working in a wider field and therefore more apt to be influenced by the views of British experts as to what was feasible.

On the other hand it is clearer, perhaps, to-day than it was to many at the time that the assumption underlying these arguments was not necessarily valid. If the purpose in view was not so much to discover what the rocket was like as to find out whether it existed and, if it existed, to take immediate steps to counter the worst threat that it might present, then there was a good case for the appointment of a co-ordinator with the broad outlook and wide powers of a minister.

Mr. Sandys had no doubt that to satisfy himself of the existence of the rocket and, having so satisfied himself, to ensure that counter-measures were not neglected, were far more urgent tasks than discovery of the precise nature and performance of the weapon. At the same time it seems certain that his task would have been easier if more had been known about the rocket in the early stages. As Mr. Sandys discovered, it was sometimes difficult to persuade all those with whom he had to deal to assent to energetic and far-reaching measures of defence against a threat of which they could be given only vague and at times exceedingly misleading notions.

His first report was drawn up on 14th May, 1943, some three or four weeks after his appointment. By this time he felt sure enough of the existence of the rocket to make a number of recommendations for counter-measures, all of which ultimately bore fruit. Believing that he had now reached a stage where he must make some attempt to answer questions about the probable dimensions and performance of the weapon, he also put forward—with reservations prompted by the inconclusive and conflicting nature of the evidence from Germany—the tentative conclusion, based on a combination of evidence from prisoners of war and scientific calculations, that the missile might be a multi-stage rocket twenty feet long and ten feet in diameter, with a total weight of seventy tons and employing a new and unspecified propellant to carry a warhead weighing up to ten tons over a distance of a hundred to a hundred and fifty miles. Launching from projectors (now described as not necessarily very large or conspicuous) was again assumed, and was indeed suggested by the testimony of a number of informants, some of whom would seem in the light of after-knowledge to have been thinking of weapons distinct from the *A-4* rocket.

No one reading this report could doubt that, if the rocket was indeed so massive as was suggested by these figures, the effects of a prolonged bombardment with it were likely to be very serious. On a night in February, 1941, a two-and-a-half ton bomb, falling on a London suburb, had killed eighty people. On that basis the Ministry of Home Security calculated that a rocket with a ten-ton warhead might kill six hundred. A further estimate showed that, if one such missile fell in the London area every hour for thirty days, the cumulative casualties might, in theory, amount to 108,000 killed and as many

seriously injured. In practice the overlapping of one crater with another, and removal of part of the population to safer areas, might be expected to reduce these figures very considerably. But even when all allowances were made, a month's bombardment at that rate seemed likely to cause casualties at least five times as great as those suffered in September, 1940. Damage to property was also likely to be very heavy. Thus for Mr. Herbert Morrison, Home Secretary and Minister of Home Security, and indeed for every member of the Government, the new estimate of the rocket's mass raised momentous issues.

The first good evidence regarding the dimensions of the weapon was received in June, when objects which appeared to be rockets—as indeed they were—were revealed by photographic reconnaissance at Peenemünde. They seemed to be about thirty-eight feet long and seven feet in diameter; but nothing was known of their mass or capacity for destruction, except what could be gleaned from informants who put the weight of the warhead at anything from ten tons to a quarter of a ton or less, and from a prisoner of war who thought the rocket might weigh sixty tons, but some of whose notions were obviously far-fetched. Another prisoner claimed to have seen—and probably had seen—a relatively small experimental rocket launched some years before, and believed that the propellant used was pure alcohol. A weight of sixty to a hundred tons, including a warhead containing from two to eight tons of explosive, did, however, seem consistent with the apparent dimensions of the objects photographed, though the relevant calculations were misleading inasmuch as they rested on ignorance of the means by which the missile was propelled.

Accordingly these last figures were given in the third of the interim reports presented by Mr. Sandys. The report was circulated on 28th June. Meanwhile the presence at Peenemünde of substantial 'test stands' and other lofty buildings had brought back the old belief in large and probably conspicuous projectors. In view of that belief and of the huge mass attributed to the rocket—which in fact was light enough before fuelling to be transportable by road, and could be launched from simple platforms made of concrete or rough wooden sleepers—some hope was entertained that projectors intended for launching rockets against this country might be found in likely situations near railways. One possible projector had been spotted near Cap Gris Nez.

From the standpoint of the present it is clear that these attempts to draw conclusions (however tentative) about the weight of the rocket and its warhead, to say nothing of the method of launching, were invalidated by lack of evidence regarding the fuel employed, and also to some extent by failure to estimate correctly the dimensions of the

objects photographed at Peenemünde. The prisoner of war who thought that the fuel was alcohol had the root of the matter in him; but possibly he was unaware of the crucial fact that the oxidant was liquid oxygen. In any case there was no reason to regard his testimony as more conclusive than that of others. In the absence of a convincing lead from Intelligence, the prevailing tendency among British experts invited to consider the problem was to assume that the fuel was cordite, though the chance that the enemy had developed a novel fuel of unrivalled potency was not ruled out.

Not surprisingly, a picture in which so much was left vague, or was admittedly based on little more than guesswork, was not everywhere accepted without scepticism even at the time. Moreover, scepticism seemed all the more justified since the whole conception suggested by that picture was not entirely convincing. A rocket weighing sixty tons, which would be difficult to handle and apparently was intended for launching from large projectors scarcely likely to escape our notice, was not, some thought, a weapon to which the Germans would be very likely to devote their energies, even if they could be assumed capable of overcoming, by means unknown to us, the many technical problems inherent in the design and construction of so vast a missile.

The report circulated by Mr. Sandys on 28th June was considered next day by the Defence Committee (Operations). Mr. Sandys, believing that the rocket presented a threat which the Government ought not to ignore, advocated (among other measures) a heavy air attack on Peenemünde as soon as the nights were long enough. Lord Cherwell, who spoke with the authority not only of a minister but also of Scientific Adviser to Mr. Churchill, put the case for scepticism. He drew attention to the difficulty of believing that the Germans would genuinely devote time and effort to a weapon so unwieldy—and so hard to reconcile with current views of the possible—as the rocket was at that time thought to be. The whole story seemed to him to bear the marks of an elaborate cover-plan, designed to conceal some genuine development—possibly a flying bomb. The presence at Peenemünde of unconcealed and uncamouflaged objects purporting to be rockets he regarded as strong support for that interpretation. On the other hand Mr. Sandys pointed out that Peenemünde was undoubtedly a very valuable station, and that a hoax whose most probable result was to bring down a heavy attack on it would be an absurdity. Invited by the Prime Minister to give his views, Dr. Jones confirmed that the place was one of the two most important experimental establishments that the Germans possessed, and gave his support to the inference drawn by Mr. Sandys. He believed in the existence of the rocket—in his opinion the case for it was rather stronger than his case for the German radio beams had been in 1940

—but was not prepared to say when the enemy would be ready to use it against this country.

After further discussion the committee decided in favour of the attack on Peenemünde and of the other counter-measures which Mr. Sandys had recommended. They agreed that his work and that of a number of committees established under his aegis to consider various problems arising from the threat of rocket-attack should be pressed forward. In view of the suggestion that preoccupation with the rocket—whether it was spurious or not—might divert attention from other German projects, and also of recent informations which included a report from a well-placed source that ‘the secret weapon to be used against London’ was ‘an air mine with wings, long-distance steering and a rocket drive’, and was launched by catapult, they further agreed that Mr. Sandys should look into the question of jet-propulsion as applied by the enemy to aircraft, whether piloted or pilotless, and that Dr. Jones should be closely associated with that aspect of his enquiries.

Measures which flowed from these decisions included the installation at five C.H. stations between Dover and Ventnor of ancillary equipment which (it was hoped) would enable them to detect the rise of rockets and determine the approximate location of their launching-points; and a scheme to prevent the enemy—by means of smoke-screens, simulated rocket-bursts, a confidential notice to the Press and censorship of posts and telegraphs—from assessing the accuracy and effectiveness of his bombardment. By the early autumn plans were ready for the removal to safer areas of 100,000 Londoners and 20,000 residents of Portsmouth, Gosport and Southampton. Reserves of Morrison shelters were accumulated in the London area and near Portsmouth and Southampton; provisional plans were made to inform the public that rocket-attacks might be expected; and a system was devised which might, in favourable circumstances, enable the air defence authorities at Stanmore to give a brief warning that a rocket was on its way.

The attack on Peenemünde was made by Bomber Command on the night of 17th August. It proved outstandingly successful, though expensive. Five hundred and ninety-seven aircraft were despatched and forty failed to return. Considerable damage was done to buildings, and 735 people were killed, including some highly-placed technicians.¹ The effects of the raid could not be fully gauged at the time, though they were known to be substantial. In any case its execution was a source of keen satisfaction to Mr. Sandys, who had thus persuaded the Government to take the rocket seriously in face of Lord Cherwell’s criticisms and in spite of manifest gaps in our knowledge of the weapon.

¹ Dornberger, *op. cit.*, Chapter 15.

After the raid a plan—in any case unsatisfactory in many ways—which the Germans had made for the large-scale assembly of rockets in three factories at Peenemünde, Friedrichschafen and Wiener Neustadt was abandoned. Under the new scheme which replaced it, final assembly—and ultimately also the manufacture of most components—was done solely in an underground factory at Niedersachswerfen, in the Harz mountains near Nordhausen. Production at Niedersachswerfen began in January, 1944. The attack on Peenemünde was followed, too, by orders from the Führer that henceforth at least the majority of launching trials must be conducted further east, in an area safe from air attack. Political motives would seem to have been largely responsible for the choice of a site at Blizna, in Galicia, previously requisitioned as a training camp by the S.S.—a body which had sought since the spring to gain control of the rocket undertaking and which already exercised powers of general supervision over the factory at Niedersachswerfen. Here the first trials ever made of the A-4 rocket with live warheads against targets on land revealed such a high proportion of premature bursts that production soon had to be suspended while Dornberger and his assistants strove desperately to put the matter right.¹ After many experiments a packing of glass-wool between the fuel tanks and the outer skin was found to reduce the proportion of premature bursts to less than one-third. Ultimately the trouble was traced, not to the heat-transference which the packing was intended to prevent, but to a structural weakness which could be cured by reinforcing the front of the hull with a steel casing. Provided that a relatively insensitive fuse was fitted, premature disintegration of the rocket did not, however, necessarily imply premature detonation of the warhead, which frequently flew on alone towards the target. At the cost of reducing the destructiveness of the weapon, Dornberger therefore reluctantly accepted a less sensitive fuse than he would otherwise have used.

By the autumn of 1943 the failure of the original production programme, the attack on Peenemünde and the fortuitous destruction in a raid on Hamburg of a factory which made special vehicles for launching-troops had extinguished the prospect that the weapon might go into service early in 1944. For some time Dornberger believed that active operations might still be possible in the spring; but eventually his hopes were dashed by the trouble with premature bursts. Meanwhile, at the beginning of September, 1943, his functions had been defined by his appointment to two distinct posts in connection with the rocket. As Special Commissioner (Army) he was

¹ According to a German official report, 57 attempts to launch rockets at Blizna up to the middle of March, 1944, resulted in only 26 launchings. Of these 26 rockets, the vast majority disintegrated in the air, and only four reached the prescribed target area.

responsible for seeing that technical development and operational control of the weapon went hand in hand; at the same time, his appointment as *ARKO* (Artillery Commander) *91* placed him in charge of operations in the field. During the next few months a higher formation, *LXV Armee Korps*, was created under Lieutenant-General Erich Heinemann, an experienced artillery officer, to supervise the operations both of *ARKO 91* and of *Flakregiment 155 (W)* (Colonel Wachtel), the unit responsible for flying bombs. Dornberger's title as the officer responsible for active operations was then changed to *HARKO* (Senior Artillery Commander) *191*. On the ground that he lacked experience in the field, he was, however, soon replaced by a newcomer to rockets, Major-General Richard Metz, though he remained responsible, as Special Commissioner, for technical development and training. In the following April Metz reported that, because of premature bursts and other technical shortcomings, the *A-4* was not yet fit for use in war. At the same time he called attention to alleged defects in the training programme and to differences of outlook between himself and Dornberger, mentioned shortages of manpower which threatened to delay recruitment of launching units, and asked—in vain—to be relieved of his command.

In London Mr. Sandys and his helpers continued throughout the summer and autumn of 1943 their efforts to establish the nature of the threat. By the end of August there was a good deal in the evidence received from secret sources to suggest that at least two distinct missiles were in question—one a rocket some thirty to fifty feet long, another some kind of pilotless aircraft (or flying bomb) whose dimensions were not known. No launching sites for either weapon had been identified with certainty; but a large construction which had been photographed at Watten, near Calais, was clearly of importance to the enemy and might well have some connection with the matter.

In fact, as we now know, the site at Watten was intended by the Germans to comprise a launching point for the *A-4*, a store for the rockets themselves and also for liquid oxygen, an oxygen liquefaction plant, and a place where the missiles could be tested, fuelled and serviced. Two similar 'bunkers' were under construction at Sottevast and Equeurdreville (both near Cherbourg), though the last was never adopted by the German Army and was ultimately converted into a protected launching-site for flying bombs. In the outcome it was never used in either capacity. In addition, rockets were to be launched by mobile units from a much larger number of unprotected but inconspicuous positions in Artois, Picardy and western Normandy.

On 27th August 185 Fortress bombers of the United States VIIIth Bomber Command attacked the site at Watten with excellent effect. A lighter attack followed on 7th September. The raids left the place

'a desolate heap of concrete, steel, props and planking', more or less useless for its original purpose, though part was afterwards roofed in and earmarked purely as a liquefaction plant. An alternative site was chosen in a chalk pit at Wizernes, some miles to the south, where an underground storage dump for rockets was already planned.¹

From the standpoint of the present day, it is obvious that the attacks on Peenemünde and Watten were well timed and did good service to the Allied cause. We have seen, too, that soon afterwards any immediate prospect of rocket attacks on the United Kingdom was extinguished by the technical shortcomings of the weapon. At the time, however, the outlook remained so obscure in British eyes that there seemed little ground for optimism. The performance of the rocket, in terms of range and weight of warhead, was still unknown, as was the method used to launch it. In their attempts to throw light on these points, our experts were handicapped, not merely by their ignorance of the propellant favoured by the Germans, but also by the scant attention which had formerly been paid in this country to the whole subject of 'liquid' rockets.

During the late summer of 1943 a British fuel expert, Mr. I. Lubbock of the Asiatic Petroleum Company, visited the United States. There he was shown a fuel employed in experiments with assisted take-off of aircraft, and also suitable for rockets. The main constituents were nitric acid and aniline. More important still, he was made acquainted with the use of a pump to force such liquids into the combustion-chamber of a rocket, instead of the heavy compressed-air bottles hitherto envisaged. On his return to this country he produced, in a few days, a tentative design for a 'liquid' rocket with external dimensions similar to those photographed at Peenemünde.

According to Professor Ellis, the information brought back by Mr. Lubbock 'completely altered the picture'. In the light of it, ten members of a committee of eleven British scientists and technicians came to the conclusion that a single-stage rocket of the stipulated size, and 'using existing American technique for liquid jet motors,' could be made to give a range of 200 miles with a warhead weighing between one and five tons, or of 130 miles with a warhead up to fifteen tons. If thrust were increased by means demonstrated in laboratory tests in the United States, the range might be increased to 300 miles with the lighter warhead, or the weight of the warhead to five to twelve tons for a range of 200 miles and ten to twenty tons for a range of 130 miles. Dr. Crow, the eleventh member of the committee, dissented from these figures, but agreed that a multi-stage rocket, using the more primitive technique familiar in this country,

¹ For an account of the further development of the German programme, see Chapter XXV.

might carry a warhead weighing between one and ten tons to the smallest of these ranges. Completion of these estimates coincided roughly with the receipt of evidence which led Mr. Sandys to conclude that the enemy might already have manufactured 500 rockets and that an early attack might be expected.

Meanwhile the case for the rocket had been strengthened, too, by the appearance of the Henschel 293. Lord Cherwell was still sceptical, believing that, 'at the end of the war, when we knew the full story, we should find that the rocket was a mare's nest'; but his objections rested on the assumption that something like a sixty-ton rocket was still in view. Nevertheless the Defence Committee (Operations), at a meeting on 25th October attended by the Prime Minister and Field-Marshal Smuts, agreed on a further programme of counter-measures which bore witness to the gravity of the threat apparently presented by the weapon. These measures included high priority for attacks on factories believed to be engaged in making the rocket and on structures thought to be designed to house projectors; and a secret session of the House of Commons for the purpose of acquainting members with 'the chain of events connected with the rocket, and the steps which had been taken over the last six months to find out about it, and to deal with it'.

Just over a week later the Minister of Aircraft Production, Sir Stafford Cripps, after presiding over a meeting of those whom he comprehensively called 'the scientists and their assistants concerned with examination of the German long-range rocket', reported that there was 'nothing impossible in designing a rocket of 60-70 tons to operate with a 10-ton warhead at a range of 130 miles'. Unfortunately—though reasonably enough in view of the huge mass still falsely attributed to the missile—the scientists and their assistants continued to mislead the intelligence services by insisting on the necessity of some form of initial propulsion, in the shape either of a mortar or of the first stage of a two-stage rocket. The rockets photographed at Peenemünde had wide fins which threatened to interfere with insertion in a mortar. On the other hand there was little in the evidence to suggest that the rocket was other than single-stage. On the whole, the more widely-favoured concept was that of a single-stage rocket fired from a mortar; and the search for mortars consumed much needless effort.

Meanwhile a growing volume of evidence was reaching London about other, though related, projects. We have seen that in June the Defence Committee (Operations) agreed that Dr. Jones of the Air Ministry should be associated with those aspects of the investigation which bore on the application of jet-propulsion to aircraft, piloted or pilotless. Early in September the Air Ministry, at the request of Mr. Sandys, formally assumed responsibility for that part of the enquiry.

Within the next few months the Chiefs of Staff came to the conclusion that the problem of the rocket was entering a new phase. The chances of attack in the foreseeable future seemed to be increasing; and this possibility had led to a quickened tempo in the conduct of reconnaissance, the planning of counter-measures and the like. They concluded that the 'special enquiry' stage had passed and that henceforth counter-measures could with advantage be co-ordinated by an agency directly subordinate to one of their own number. After discussing the matter with Mr. Sandys they recommended to the Prime Minister that the functions he had hitherto performed should be transferred to the Air Ministry. Under the new arrangement, which was adopted during the third week of November, the Deputy Chief of the Air Staff (Air Marshal N. H. Bottomley) became responsible for co-ordination of intelligence and operational counter-measures with respect to rockets as well as to flying bombs. In order that the value of the experience gained by Mr. Sandys during the months which his investigation spanned should not be lost to the Chiefs of Staff, he sat with them thereafter when either weapon was discussed; and seven months later, when the flying bomb campaign had started, he returned to a more active role as chairman of a War Cabinet sub-committee appointed to watch and forward counter-measures. Responsibility for plumbing the mysteries of the rocket thus passed to the Air Staff.

CHAPTER XXIII

THE FLYING BOMB: PART ONE

(1939-1944)

(i)

THE *FZG. 76* flying bomb which emerged in 1942 as a rival to the *A-4* rocket was not an altogether new conception. Such missiles had been discussed at least as early as the nineteenth century; in the first two decades of the twentieth they were the subject of research in several countries. Before and during the First World War a French artillery officer, René Lorin, advocated bombardment of distant objectives (such as Berlin) with jet-propelled pilotless aircraft stabilised by internal gyroscopes, maintained at a given altitude by barometric means, and guided from piloted aircraft carrying radio-transmitters. Among the forms of propulsion which he considered were a pulse-jet—as afterwards adopted for the German weapon—and, alternatively, a ram-jet giving continuous combustion. As Lorin pointed out, the principle of propulsion by direct reaction was well known to students of mechanics; and he seems to have been more concerned to meet objections founded on the alleged wastefulness of such devices than to counter any which might arise on the score of novelty.¹

Though certainly among the first men to conceive, in considerable detail, a jet-propelled pilotless aircraft which anticipated many features of the modern guided missile, Lorin was not alone in his concern with the methods of propulsion which he favoured. In 1907—according to Lorin the year when he himself began work on his project—Victor de Karavodine was granted in Paris a patent for a pulse-jet designed to produce a swift succession of powerful reactions from a combustible mixture fed into it by a low-pressure blower and electrically ignited.² But Karavodine seems to have made no claim for his device as a direct means of propulsion. Although his suggested applications included the working of a turbine, his chief concern was apparently to provide a handy source of power for stationary

¹ For a popular exposition of Lorin's views on jet-propulsion and pilotless aircraft, see his pamphlet *L'Air et la Vitesse* (Paris, 1919).

² French Patent No. 374,124. (Specification lodged 9th April, 1906; patent granted 10th April, 1907.)

machines. A more direct forerunner of the pulse-jet used in the *FZG. 76* was that devised some two years later by Georges Marconnet, who described it as particularly applicable to the propulsion of aeroplanes and dirigible balloons.¹ With this elegant and eminently practical device—the third of a series of six jet-propulsion systems covered by a single patent—Marconnet would seem to have anticipated by some thirty years the principles ultimately applied to the propulsion of the German flying bomb.

After the First World War both pilotless aircraft and jet-propulsion continued to be studied in many parts of the world, though rather as separate issues than as a single subject. Remotely-controlled aircraft driven by orthodox machinery found employment as targets for anti-aircraft gunnery, notably in the United Kingdom. In Germany the use of similar machines for photographic reconnaissance was considered; and such an aircraft was successfully demonstrated at Rechlin in July, 1939, though it was never used on active service. The application of jet-propulsion to aircraft likewise attracted attention in Germany, as in England. In the early thirties the German inventor Paul Schmidt worked on the problem, and some years later the technical staff of the aero-engine firm of Argus Motorenwerke, under the technical direction of Dr. Fritz Gossiau, devised and produced a pulse-jet of their own. Dr. Gossiau has stated that he then knew nothing of Karavodine or Marconnet, though he afterwards became acquainted with their work and recognised its relevance. After a trial on 13th November, 1939, the Argus duct was demonstrated to the German Air Ministry on the last day of that month. As subsequently developed, and with a valve-mechanism designed by Schmidt in place of that first used, it formed the propulsion-unit of the *FZG. 76*.

But in 1939 the application of the Argus duct to a flying bomb still lay some way ahead. Shortly before the outbreak of war the firm of Argus were invited by the German Air Ministry to submit proposals for a missile with a range of about 350 miles; and for such a range a short-lived pulse-jet would scarcely have been suitable. They suggested a pilotless aircraft propelled by a 600-horse-power piston-engine, or alternatively by a turbo-jet system or a ducted fan. The accuracy required for the attacks on purely military targets which were then in view could, however, hardly have been attained by such means. Perhaps partly for that reason—but also because the radio devices needed for control were none too plentiful, and because the spectacular success of the German armies soon seemed to promise rapid victory—the scheme was shelved until, in the early spring of

¹ French Patent No. 412,478. (Specification—already lodged in Belgium on 17th February, 1909, according to the inventor's declaration—lodged in Paris on 10th February, 1910; patent granted 3rd May, 1910.)

1942, the bombing of Lübeck led the Führer to order 'terror attacks' on British cities.¹ In reply to an enquiry the firm were then advised that development of the projected weapon should proceed. The restricted output of radio equipment would still, however, be a bar to its production in large quantities.

Meanwhile the German occupation of northern France had made radio control unnecessary by reducing the range, and consequently the inherent accuracy, required of the missile. Moreover these conditions made it possible to contemplate the use of a relatively cheap and simple jet-propulsion unit. For the flight to southern England from the French coast, a working life of little more than half-an-hour would suffice, and a degree of roughness unacceptable in ordinary aircraft would not matter. The Argus duct—already tentatively applied to powered gliders—thus came into its own when the fortunes of war created the demand for an expendable missile whose virtues were speed, simplicity and cheapness rather than long life or refinement.

(ii)

As long-standing advocates of pilotless flight, and as designers of the propulsion-unit employed for the *FZG. 76*, the firm of Argus played a big part in the creation of the weapon. They were not, however, its inventors, at least in the accepted sense. The design and manufacture of airframes—as distinct from engines—lay outside their province. The firm of Gerhard Fieseler were called in to do that part of the work; and the prototype was made by Fieseler under the guidance of Robert Lusser. Lusser, a specialist ultimately employed by Fieseler, was in touch with Argus during the early part of 1942, and acknowledged at the end of March that credit for the idea of the flying bomb belonged to the latter firm.

On 19th June, 1942, at a meeting attended by representatives of both firms, Field-Marshal Milch agreed on behalf of the Air Ministry that the highest priority should be given to the development and production of the new missile. According to Dr. Gossiau, who represented Argus, this decision was made on the strength of a verbal description and a rough drawing. Thereafter development proceeded, under the guidance of the Air Ministry, as a joint venture by Argus, Fieseler and Askania, the last firm being responsible for the control-mechanism.

As we have already seen, the missile first flew six months later.² Thereafter a year was expected to elapse before it could be used on active service; but in practice eighteen months were not enough to

¹ See p. 305.

² See p. 338.

ensure a satisfactory standard of reliability when operations started. As with the *A-4* rocket, attempts at large-scale production while development was still in progress led to many difficulties. In the circumstances co-operation between the various firms and agencies connected with the venture was anything but easy. Apart from Fieseler, who manufactured prototype airframes and a limited production series needed for experiment and training, and Argus, who made the propulsion-units, the firms of Askania and Walter, concerned respectively with the control mechanism and the launching-ramp, had important parts to play. Other interested parties were the Luftwaffe experimental station adjacent to the rocket establishment at Peenemünde, and the launching regiment training nearby at Zinnowitz.

In the summer of 1943 an Allied bombing attack on the Fieseler works at Kassel had the undesigned effect of holding up delivery of limited production models for some days. A consequent check to development at Peenemünde threatened to delay the further programme whereby mass-produced components of the definitive design were to be assembled in quantity at the *Volkswagen* factory at Fallersleben. Partly in consequence of this setback, but mainly because of the inherent difficulty of settling details of production while frequent modifications were still being made to the design, output from Fallersleben did not begin until late September, less than three months before the date originally fixed for the commencement of the campaign.

Meanwhile a start was made with launching-sites. Besides two 'bunkers' at Siracourt (near Saint-Pol) and Lottinghem (between Boulogne and Saint-Omer), ninety-six open-air sites in Picardy, Artois and Normandy were planned. Each was intended to provide not only for the firing of the missiles from a ramp, but also for their servicing in blast-proof buildings of distinctive shape. Since *Flakregiment 155 (W)*, the unit responsible for operations in the field, had four *Abteilungen* each comprising two maintenance and supply *Batterien* and four firing *Batterien* each capable of manning four positions, simultaneous fire from sixty-four positions was foreseen.

Towards the end of October, 1943, part of the first *Abteilung* of *Flakregiment 155 (W)* moved to northern France, ostensibly to assist in the final preparation of the launching-sites and make ready for the opening of the campaign in December. The bunkers at Siracourt and Lottinghem were still a long way from completion; but according to an estimate made early in November, eighty-eight of the other sites would be ready by the middle of December. The hope that operations could begin on that date was, however, belied by facts well known to those responsible for the development and manufacture of the weapon. As we have seen, large-scale production had started only

in late September; and a number of technical shortcomings remained to be overcome before the bombs could be entrusted to units in the field. Moreover the German plan, as it then stood, had radical weaknesses; to understand them, we must return to London and the investigation there in progress.

(iii)

By the end of August, 1943, ample evidence had been received in London to suggest that, in words used later by an official chronicler, 'some form of pilotless aircraft was just as real and immediate a threat as the rocket'. As early as June a well-placed source had transmitted the report of 'an air mine with wings', to be launched by catapult, of which we have already taken notice.¹ A highly circumstantial report of 12th August confirmed the existence of such a weapon and expressly stated that it was distinct from the *A-4* rocket, which our informant referred to by that name. On the 30th of the same month a new source, who unfortunately confused the two weapons, gave us the names of *Flakregiment 155 (W)* and its commander, Colonel Wachtel, stating that the regiment would be deployed in France about the beginning of November and would man 108 'catapults'. Soon afterwards brief particulars were received in London of a pilotless aircraft which had landed on the Danish island of Bornholm in the Baltic.

More important advances in our knowledge of the flying bomb came in the autumn. The briefing of agents in France to investigate constructional work suspected of a connection with 'secret weapons' bore fruit towards the end of October, when one of our sources there gave a valuable description of a site at Bois Carré, ten miles north-east of Abbeville. Photographs taken by a reconnaissance aircraft a few days later revealed a concrete platform some thirty feet long and twelve feet wide, with its major axis aligned on London; three rectangular buildings, one of which was square; and three buildings shaped like skis laid on their sides. Similar though less finished sites had been photographed as early as September; and a review of existing photographs, supplemented by further reconnaissance, soon revealed twenty-nine sites remarkable for the presence of ski-shaped buildings. Reports from agents gave the approximate locations of seventy to eighty more. Existing photographs of Peenemünde were also reviewed, and attention was thereby drawn to the recurrent presence at that station of small aircraft with a wing-span of only

¹ See p. 346.

about twenty feet. These, of course, were flying bombs, though as yet the fact was not established.

A firm link was awaited between the constructions seen in France and activities on the Baltic coast. The 'ski sites' might well be—as indeed they were—intended for the 'catapults' imputed to Colonel Wachtel; but as yet there was no proof of it. Ultimately the connection was established as the result of a watch which had been kept for many months on a German signals unit and of fresh reconnaissance of Peenemünde. The *Luftnachrichten Versuchs Regiment*, which specialised in radio beams and radar, was thought likely to assist in the tracking of long-range missiles, and its activities were therefore studied as closely as German security allowed. By October, the 14th Company of the regiment was known to be deployed on the islands of Rügen and Bornholm and on the Baltic coast of Germany as far east as Stolpmünde. In the course of the month good evidence was received that the company was tracking flying bombs launched from Peenemünde and also from the neighbourhood of Zinnowitz, where *Flakregiment 155 (W)* were undergoing training. Unfavourable weather made it impossible to follow up this report by photographic reconnaissance until 28th November; but the photographs then taken clinched the matter. They showed at Zinnowitz buildings similar to some of those seen at Bois Carré. Both at Zinnowitz and at Peenemünde ramps were visible, aligned in the direction in which trial shots were known to have been fired; and careful scrutiny revealed on one of the ramps at Peenemünde one of the small aircraft seen in less compromising circumstances on earlier photographs. Henceforth it was scarcely possible to doubt that Bois Carré and the other 'ski sites' in northern France were intended for launching flying bombs against this country.

Accordingly, on 4th December arrangements were made for photographic reconnaissance of the whole of northern France within 140 miles of London or Portsmouth, in order that no site might be overlooked; and next day attacks on sites already identified were begun by fighter-bombers and light bombers of the Second Tactical Air Force and the United States IXth Air Force. Experience soon showed that only a slow rate of destruction could be expected from the use of such aircraft in weather which was equally unpromising for night attacks by the British Bomber Command. British and American authorities agreed therefore that, as an exceptional measure, the heavy bombers of the United States VIIIth Air Force—whose allotted role in Anglo-American air strategy was to attack the German aircraft industry as a prelude to the forthcoming landing in France—should be used for a weighty attack in daylight on as many of the sites as possible. On 24th December 672 Fortresses attacked 24 sites, dropping more than fourteen hundred tons of

bombs. Altogether more than three thousand tons of bombs were aimed at 52 sites in December;¹ according to a British estimate, some twenty-one sites were virtually destroyed or seriously damaged, another fifteen probably sustained some damage and six were left untouched. At the remaining ten sites the effects of the bombing could not be assessed.

Captured records show that in December seven sites were in fact destroyed, and that by early January the programme of construction was seriously impeded. Perhaps the most important effect of the bombing was, however, to emphasise a major weakness of the German plan. Soon after taking up his appointment in December, General Heinemann, commanding *LXV Armee Korps*, made a tour of launching-sites. His observations convinced him that their design and the methods adopted for their construction were unsound. The flying-bomb bunkers at Siracourt, Lottinghem and Equeurdreville—like the rocket bunkers at Wizernes and elsewhere—found little favour in his eyes; but these 'protected' sites were dear to his superiors, and work on them could not easily be countermanded. As for the 'ski sites', they seemed to Heinemann needlessly elaborate and far too vulnerable to air attack. Their distinctive buildings made them easily identifiable, and little had been done to render them less conspicuous by careful use of natural cover. Furthermore, by employing French labour and sometimes even French contractors, those responsible for the work had gone far to ensure that every site was swarming with potential spies. In any case the technical shortcomings of both the rocket and the flying bomb put an early start with either weapon quite beyond the bounds of possibility. In reply to the suggestion that, as the date in December originally projected for the beginning of flying-bomb attacks could not be met, the campaign should start in the middle of January, Heinemann reported that the bomb—though not the rocket, which was causing Dornberger and his technicians endless worry—might possibly be ready in May or June.

He concluded that the intervening months could be most profitably devoted to a drastic overhaul of arrangements for flying-bomb launching and supply. After early January work on the 'ski sites' was continued only as a blind; for practical purposes they were replaced by a new series of launching-sites, less elaborate, less easily visible from the air, and capable of rapid construction from pre-fabricated

¹ The numbers of sites attacked, and bomb tonnages aimed at them, by the various formations concerned were as follows:

	<i>Sites attacked</i>	<i>Bomb Tonnages</i>
Second Tactical Air Force and IXth Bomber Command	23	1,398
VIIIth Bomber Command	24	1,472
British Bomber Command	5	346
Totals	52	3,216

parts. About a hundred and fifty of these new sites would seem to have been planned; and more than half of them were brought to the verge of completion during the first five months of 1944. At the same time storage depots in caves and tunnels well back from the coast were adopted in place of the eight 'supply sites' which the Allies had located, though the latter remained available as alternative accommodation if they should be needed. In the interests of security, access to the new sites was confined to those with special passes; the headquarters of *Flakregiment 155 (W)* were moved twice within a few months, and for some time its commander was designated by a pseudonym; drastic limitations were placed on leave and the despatch of mail; and French labourers employed at the superseded launching-sites were withdrawn with a stealthiness calculated to foster the impression that the sites were still important. The Germans were fortunate, too, in intercepting a quantity of intelligence material consigned to London and in capturing a number of workers who had hitherto done splendid service in the Allied cause.

To a great extent these measures fulfilled their purpose. Between 1st January and 12th June, 1944, the superseded 'ski sites' attracted a further twenty thousand tons of bombs—or rather more than the Germans had aimed at London during the eight months of the 'Blitz'—while the 'modified' sites which replaced them went unscathed. The bunkers and other underground workings at Watten, Wizernes, Sottevast, Equeurdreville (otherwise called Martinvast), Mimoyecques, Siracourt and Lottinghem—none of which Heinemann meant to use for launching flying bombs or rockets if he could help it—drew another eight thousand tons.¹ And, as we shall see presently, in due course the 'supply sites' also attracted attention which their place in the German system no longer warranted.² But the Allied effort was perhaps not altogether wasted. Despite his timely abandonment of the 'ski sites' and distaste for bunkers, Heinemann might doubtless still have used them if we had not bombed them.

The existence of the new series of launching-sites was vaguely reported by agents in February, but was not established until late in April, when air photographs revealed the first of them at the village of Belhamelin, in the neighbourhood of Cherbourg. During the next fortnight another nineteen were discovered, and by 12th June the number identified had risen to sixty-six.

By the middle of May there was thus a strong, if superficial, case

¹ As we have seen in Chapter XXII, the first four were planned originally as rocket sites, though Watten was later earmarked as a liquefaction plant and Equeurdreville as a flying-bomb site. Mimoyecques was intended to house a multi-barrelled long-range gun which never emerged from the experimental stage, while Siracourt and Lottinghem were designed from the start as flying-bomb sites.

² For a summary of the Anglo-American air effort against the various classes of site up to 12th June, 1944, see Appendix XLIV.

for diverting to the 'modified' sites the bomber effort hitherto expended on the 'ski sites'. But the times were not propitious for acceptance of such a programme by air commanders bent on the offensive, and perhaps inclined to grudge the many sorties already devoted to the older sites. In the first place the 'modified' sites were not attractive targets. Small, well camouflaged, and offering few good aiming-points, they threatened to be hard to damage. Secondly, the menace they presented was not everywhere so deeply felt as that arising earlier from the 'ski sites'. A member of Leigh-Mallory's staff may have misinterpreted his chief's views, but spoke presumably for at least some of his colleagues, when he countered a warning from his less sanguine counterpart at Hill's headquarters with the formal response that 'the Allied Expeditionary Air Force attaches little importance to the new sites'. Finally, by this time the landing in Normandy was only a few weeks away, so that any proposal calling for diversion of part of the Allied air effort from tasks essential to the success of that all-important venture merited jealous scrutiny. A month earlier the British Chiefs of Staff had exercised their right to intervene in the control of the Allied air forces by the Supreme Commander 'should their requirements for the security of the British Isles not be fully met', by asking General Eisenhower to ensure that everything possible was done to damage 'ski sites' and the installations known to the Germans as 'bunkers' and to us as 'large sites'. Thereupon both the Tactical Air Forces and the United States VIIIth Air Force had notably increased their effort against those objectives. On the eve of the landing, ought they to be asked to devote a comparable effort to the 'modified' sites, with all their disadvantages as targets?

There was, however, another class of objective, whose destruction promised—though uncertainly—to disrupt the enemy's plans at a cheaper rate. The purpose of the eight so-called 'supply sites' which the Allies had discovered in northern France had never been established; but their situation and their construction at the same time as the 'ski sites' suggested that they might be intended for the storage and servicing of flying bombs. As we now know, when firing from the 'ski sites' was envisaged the Germans had indeed assigned that role to them. If the enemy still meant to use them, now that he had apparently abandoned the 'ski sites' in favour of the 'modified' sites, attacks on them should provide a simple answer to the Allied problem. Accordingly, on 16th May the Chiefs of Staff invited the Air Ministry to 'examine and report on the desirability of attacking supply sites rather than the new-type pilotless-aircraft sites'.

In fact, of course, the enemy no longer meant to use the 'supply sites', at any rate while the caves and tunnels which replaced them remained at his disposal. The Air Ministry could not know this;

what they did know was that no connection had ever been traced between the 'supply sites' and the 'modified' sites, and that even the association of the former with the 'ski sites' was conjectural. They suggested, therefore, a trial attack to test the enemy's response. If closely followed by reconnaissance, it might do something to reveal the purpose of the sites.

In the outcome United States bombers made two attacks on a selected site at Beauvoir, where they dropped close on 300 tons of bombs. Gaps were torn in the railway line that served the place; and twelve days after the first attack it was noticed that the enemy had done nothing to repair them. Nor were there any indications at other 'supply sites' that the Germans were moving in supplies.

Meanwhile the 'modified' sites had gone unmolested except for an unsuccessful experimental attack by fighter-bombers on 27th May; and no further attempt was made to interfere with them during the short time that elapsed before the Germans used them. At Hill's headquarters, and perhaps in certain sections of the Air Ministry, the omission caused some disappointment; but the decision was broadly justified by subsequent events. Supply was indeed General Heine-mann's weak link, though the proper method of assailing it had not yet been discovered.

(iv)

In order to trace the evolution of plans for the direct defence of the United Kingdom against flying bombs, we must now return to December, 1943.

Early in that month the Chiefs of Staff decided that, while the attacks on 'ski sites' which were just beginning might do much to reduce the danger from such missiles, measures of direct defence must also be studied. With their approval the Air Staff therefore furnished Air Chief Marshal Leigh-Mallory with an appreciation of the threat from pilotless aircraft and accompanied it by instructions 'to consider, in consultation with the G.O.C.-in-C., Anti-Aircraft Command, counter-measures possible with the resources at his disposal and to prepare plans accordingly'. Leigh-Mallory gave corresponding instructions to Air Marshal Hill, as the officer directly responsible for air defence.

Thereupon Hill, in consultation with General Pile, produced an 'outline plan' which he submitted to Leigh-Mallory in the middle of the month. Observing that, despite the absence of a pilot who could be killed or incapacitated, the missiles would presumably be vulnerable to the same forms of attack as were used against ordinary aircraft, he recommended that fighters, guns, searchlights and balloons

should all be used, and should be deployed in such a manner as to avoid causing mutual interference. At the same time he pointed out that the bombs—which were said to move at anything from 250 to 420 miles an hour—might well prove too fast for his fighters, and would in any case make difficult targets for anti-aircraft gunners. He asked, therefore, that the offensive against 'ski sites' should be vigorously maintained, and that he should be kept informed of the progress made by two committees which were examining the chances of countering the missiles by radio-jamming or electro-magnetic interference. In the event, as we have seen, the offensive against 'ski sites' was offset by the building of the 'modified' sites; while the measures considered by the two committees proved either inapplicable or impractical.

After further consultation with Pile, Hill followed early in the New Year with a detailed plan, which Leigh-Mallory approved and re-mitted to higher authority. But meanwhile the success of the offensive against 'ski sites' had made it probable that attacks with flying bombs would not begin until the Allied landing in Normandy was close at hand. Early in February the Chiefs of Staff asked, therefore, for a new plan designed to reconcile defensive needs with full provision for the support of the Expeditionary Force. In the meantime Hill and Pile were authorised to proceed with certain administrative arrangements envisaged in the existing plan.

The outcome was a scheme of limited scope, whereby the two commanders sought to offset the danger from the much-mauled 'ski sites' mainly with weapons which could be spared from Operation 'Overlord', and some of which would be held in a reserve created at the expense of the defences assigned to embarkation areas and the like. The 'Overlord/Diver' plan, as it was called—these being the respective code-words for the landing in Europe and attack by flying bombs—was submitted to Leigh-Mallory towards the end of February, was then approved in turn by the Supreme Commander and the Chiefs of Staff, and on 4th March was sent on Hill's authority to formations which might one day have to give effect to it. The plan assigned the leading role to fighters. Whenever an attack seemed imminent in daylight, standing patrols for the defence of London would be flown at 12,000 feet off the coast between Beachy Head and Dover, over the coast between Newhaven and Dover, and over Kent and Sussex between Hayward's Heath and Ashford. When an attack began, further aircraft would patrol the same lines at 6,000 feet. In darkness, fighters under various forms of radar control would be reinforced, if necessary, by more fighters controlled by sector-stations. Additional security for London would be provided by 192 heavy and 246 (later 192) light anti-aircraft guns and 480 balloons. To reduce the risk that their radar equipment might be jammed, the heavy guns would be

sited in folds and hollows of the North Downs; the light guns would be deployed mainly on searchlight sites and would have the assistance of about 200 searchlights specially earmarked for the task. The balloons would fly from the belt of high ground between Cobham (Kent) and Limpsfield, and were expected to remain permanently airborne.

The plan provided also for the defence of Bristol and the important area round the Solent. At neither place were standing patrols thought necessary in view of the relatively long warning which could be expected before the missiles reached their targets; but fighters would be held ready to intercept in the normal way. In addition, Bristol would be defended up to the time of the Allied landing in Normandy by 96 heavy and 36 light anti-aircraft guns, the latter assisted by searchlights already present. In the neighbourhood of the Solent the big deployment of heavy and light anti-aircraft guns already contemplated in connection with 'Overlord' would suffice, with a few additional searchlights, to meet the threat from flying bombs. In all three areas, the plan rested on the correct assumption that radar stations and Royal Observer Corps posts would be able to track the missiles, and furthermore to distinguish them—respectively by 'track behaviour' and by the noise they made—from ordinary aircraft.

The 'Overlord/Diver' plan was designed to meet such an offensive as the enemy might be capable of launching from 'ski sites' left intact by Allied bombing. That it did not match the effort of which the 'modified' sites proved capable was not the fault of Hill, who subsequently met the problems thus created with an energy and power of decision which earned him a high reputation. But if the plan was a reasonable insurance against the dangers predicted by the Air Ministry in March and April, it fell short of providing that margin against unforeseen contingencies which its author, in common with every prudent commander, would have sought if his choice had been unfettered. As compared with the earlier plan it provided, for example, only 288 heavy and 282 light anti-aircraft guns instead of 528 and 804 respectively.¹ Moreover, as Hill prophetically observed, the gunners would face a particularly awkward problem if the

¹ The respective figures were as follows:

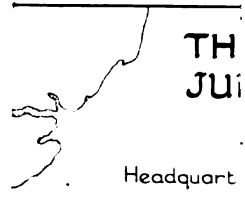
	<i>Original Plan</i>		<i>'Overlord/Diver' Plan</i>	
	<i>H.A.A.</i>	<i>L.A.A.</i>	<i>H.A.A.</i>	<i>L.A.A.</i>
London	400	346	192	246(*)
Bristol	96	216	96(†)	36(†)
Solent	32	242	—	—
	<u>528</u>	<u>804</u>	<u>288</u>	<u>282</u>

(*) Reduced by D-day to 192.

(†) To be withdrawn by D-day.

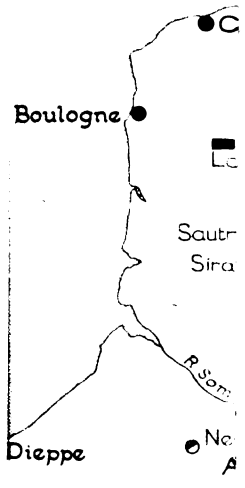
missiles flew at 3,000 feet or so, instead of the 6,000 or 7,000 feet predicted, and at one time contemplated by the enemy.

With this plan in their files the formations under Hill's control awaited, as March gave place to April, April to May, and May to June, the offensive which Heinemann and Wachtel were working against time to mount.



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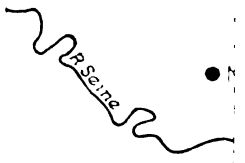
Headquart
Principal St
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Supply Site
La



● St. Martin-l'Hô

Biennais

Rouen



St. Germain-en-Lay

● Chartres

CHAPTER XXIV

THE FLYING BOMB: PART TWO

(1944-1945)

(i)

ON 6th June, 1944—almost exactly four years after the British Expeditionary Force had been driven out of France—Allied forces under the supreme command of General Eisenhower landed in Normandy. The story of that exploit belongs elsewhere, and need not be recounted here. In the present context we need only note that some hours after British and American forces had set foot on the Continent, General Heinemann received instructions which led him to order Colonel Wachtel to put the *V-1* into action six days later.

By the date of the landing all four *Abteilungen* of *Flakregiment 155 (W)* had arrived in France. Some seventy to eighty 'modified' sites—apart from those constructed in the neighbourhood of Cherbourg—were virtually ready in that part of northern France which lies between the Pas-de-Calais and the Seine. The majority were aligned on London, a smaller number on Southampton. During the next six days 873 flying bombs were distributed to the sites from two underground storage depots at Nucourt and Saint-Leu-d'Esserent.¹ By the end of that time petrol and other fuels had also arrived in sufficient quantities to give every *Abteilung* a chance of firing, though not all had their full quota. Allied air attacks on railways caused considerable difficulties and led to orders that trains carrying supplies for the flying-bomb units should move only at night.

Of these events nothing was known in London before the late afternoon of 10th June. The Air Ministry then learned from a good source that a train of thirty-three wagons, each nearly sixty feet long and carrying three objects described as 'rockets', had passed through Ghent in the direction of the Franco-Belgian frontier.

Meanwhile the Air Staff were preparing a report on the prospects of a German attack with flying bombs. On the assumption that those of the 'ski sites' which had escaped destruction by Allied bombers might yet be used, they believed that an effort equivalent to that of

¹ See Map 29.

eight completed sites, and aimed at London, might be expected from them if in fact the enemy was ready. The 'modified' sites, they thought, would probably not be fit for use 'on any appreciable scale' within the next few weeks.

Circulated on Sunday, 11th June, this document was rapidly overtaken by fresh discoveries. On the same day an improvement in the weather enabled photographic reconnaissance aircraft to visit some of the 'modified' sites for the first time since 4th June. At six of the nine sites photographed, 'much activity' was visible, and at four of them rails had been laid on the launching-ramps; at six sites a characteristic building had been completed very quickly. A reasonable hypothesis was that the 'rockets' mentioned in the previous day's report were flying bombs, perhaps bound ultimately for those very sites. In fact, their immediate destination was probably one or other of the storage depots.

On the morning of the 12th the Assistant Chief of the Air Staff (Intelligence) (Air Vice-Marshal F. F. Inglis) therefore warned the Chiefs of Staff and others of 'indications that the Germans are making energetic preparations to bring the pilotless aircraft sites into operation at an early date'. The Deputy Chiefs of Staff, for their part, observing that the 'modified' sites might be capable of delivering 400 tons of high-explosive during the first ten hours of their active life, contemplated asking the Chiefs of Staff to agree on the following day to air attacks on four of the still-enigmatic 'supply sites'. That Nucourt and Saint-Leu-d'Esserent, not the 'supply sites', were now the keys to the enemy's system of supply was not yet known in London.

While the Deputy Chiefs of Staff and others in this country were considering the implications of the disclosure made by Air Vice-Marshal Inglis, on the far side of the Channel General Heinemann, Colonel Wachtel and their respective staffs were making their final preparations for an offensive due to begin that very evening—almost exactly two years after the allotment of high priority to the project by Field-Marshal Milch. On the 11th Heinemann's Chief of Staff, Colonel Eugen Walter, had discussed the outlook with Wachtel and his principal advisers, who had been summoned for the purpose to the headquarters of *LXV Armee Korps* near Paris. In the course of the conference Wachtel drew attention to the difficulty he had found in getting up supplies, and especially to a lack of the dummy missiles needed for testing his hastily-completed launching-sites; but, under pressure from Walter, he would seem to have assented to the order to start active operations on the 12th, though at heart he thought it a mistake. Walter claims thereupon to have placed responsibility for a good start to the offensive squarely on the regimental commander's shoulders by affirming his chief's willingness to postpone the opening

date if Wachtel was not satisfied that his troops had all they needed to ensure success. The weapon, as he claims to have pointed out, was novel, and was about to be used in conditions very different from those of the practice-ground at Zinnowitz, where technical experts were constantly at hand. But Wachtel, though he must have known that the bomb was an awkward flyer and its launching-mechanism unreliable and even dangerous, is perhaps unfairly represented as confident that his men could overcome these handicaps.

Some time after midday on the fateful 12th, Heinemann left his own headquarters for Wachtel's command post at Saleux, near Amiens, to which place the regimental staff had moved a day or two earlier from their old quarters near Beauvais. There he seems to have remained for the rest of the day and at least part of the ensuing night.

The position that evening was that 54 (or possibly 55) of the 64 launching-sites were ready, in the sense that they had been fitted with launching-mechanism; but that two-thirds of them had not yet fired a trial shot. Moreover, certain safeguards intended to precede active operations could not be taken for lack of the necessary equipment. Communication between the command post and some of the sites was made difficult by the effects of Allied bombing.

Meanwhile detailed orders for the forthcoming operation, presumably drafted by Walter, had reached Saleux. They laid down that an opening salvo, timed to reach London at twenty minutes before midnight, should be launched from all positions, and that thereafter all positions should undertake 'harassing fire' until a quarter to five on the morning of the 13th. The effort envisaged was of the order of 500 missiles. An earlier plan to co-ordinate the operation with a raid on London by aircraft of *Fliegerkorps IX* was cancelled in view of orders from higher authority that all available bombers must be used against the Allied bridgehead.

About a quarter of an hour before the time appointed for the opening salvo, Wachtel received the disquieting news that, in the continued absence of the safety equipment, not one of his sites was in a state to fire. In this extremity he put through—seven minutes before the salvo was due—a call to *LXV Armeekorps* asking permission to postpone the operation for an hour.

As Heinemann himself was still at Saleux, the request may well have struck his subordinate as odd; and it appears that not until Heinemann personally intervened in the conversation did Walter agree to the postponement.

By ten minutes to midnight, further reports from his subordinate formations had convinced the unfortunate Wachtel that even the new programme could not be kept. Making the best of a bad job, he ordered that no salvo should be attempted before 3.30 a.m. on the

13th, and that sites should undertake independent harassing fire as they became ready.

In the outcome ten bombs—and ten bombs only—were launched in the early hours of the morning. Five crashed almost immediately, and the fate of a sixth remains unknown; the other four reached Southern England. The first of them—duly heard, seen and identified by the Royal Observer Corps—crossed the North Downs ‘making a noise like a Model-T Ford going up a hill’ and came to earth near Gravesend at 4.18 a.m. The second fell in Sussex, the third at Bethnal Green and the fourth near Sevenoaks. The only casualties inflicted by any of the four were at Bethnal Green, where six people were killed and nine seriously injured. A little earlier the German long-range guns at Cap Gris Nez had opened fire, dropping twenty-four rounds at Folkestone and nine further inland; but there is no evidence that this contribution to the night’s alarms was made at the request of Heinemann or Wachtel, or even with their knowledge.

As soon as the extent of the fiasco became known at Heinemann’s headquarters, Walter ordered on his behalf that all ramps should be camouflaged and that no more launchings should be attempted until the causes of failure had been investigated. Ultimately, after a court martial—which Wachtel afterwards declared he would have welcomed—had been threatened and dropped, the night of the 15th was chosen for a fresh attempt.

(ii)

On the morning of 13th June the Chiefs of Staff considered the situation created by Wachtel’s opening move. Owing to the confusion of radar tracks of the missiles with those of our own aircraft and the enemy’s, coupled with weather which had hampered continuous observation by Observer Posts, the number of bombs which had approached the country was not accurately known; but clearly the effort had been small. The Chiefs of Staff agreed with Air Marshal Hill that it did not justify the far-reaching deployment of guns and balloons laid down in the ‘Overlord/Diver’ plan. On the other hand, attacks on the enemy’s launching-sites or system of supply appeared to them a wise precaution against a resumption of the offensive. As many thousands of bomber sorties would be needed to knock out all the ‘modified’ sites, the Chief of the Air Staff suggested that at least part of any air effort which General Eisenhower could safely spare from ‘Overlord’ should be devoted to their four ‘supply sites’ which seemed most worthy of attack. To deal with these about a thousand heavy bomber sorties should suffice. Lord Cherwell, who attended the discussion, deprecated a hasty acceptance of the assumption that

the 'supply sites' were important; but Sir Charles Portal's view prevailed. Later in the day the War Cabinet agreed that the Supreme Commander should be asked to authorise heavy attacks on the 'supply sites', and also attacks on all completed 'modified' sites 'in so far as this was possible without prejudicing in any way the urgent needs of the Battle in France'. They also agreed that for the present the public need not be told that the enemy had used a new form of attack.

Meanwhile Hill had arranged that 'intruder' aircraft should visit some of the 'modified' sites; and in the outcome no other action was taken against such sites for several days. Of the four 'supply sites' supposed worthy of attack, two were bombed (one of them several times) between 13th and 15th June by heavy bombers of the United States VIIIth Air Force. As we now know, these attacks were wasted, since the enemy was storing his supplies elsewhere.

We must now return momentarily to Wachtel and his preparations for a fresh start to the offensive. By the 15th he had so far put his house in order as to ensure that his earlier disaster would not be repeated. Well supplied with bombs and fuel, and this time better acquainted with the problems that confronted them, his troops began firing about ten o'clock that evening. The attack started with a small salvo, and 'harassing fire' continued until noon on the 16th. During that time 244 missiles aimed at London were launched from 55 'modified' sites on both sides of the Somme. Forty-five crashed soon after they had left the ramps. In addition about 50 bombs appear to have been aimed at Southampton and its neighbourhood. Up to midnight on the 16th 155 missiles were observed by the defences, 144 crossed the English coast, and 73 reached Greater London. Of those that fell outside the capital, fourteen were shot down by anti-aircraft guns and seven by fighters, while another was credited to guns and fighters jointly. In addition, guns of the Inner Artillery Zone brought down eleven bombs within London's built-up area. Many bombs miscarried, one so widely that it came to earth in Norfolk; and of those that did reach Greater London, more than two-thirds fell south of the river.

Clearly by the morning of the 16th the country was confronted with a situation very different from that of the 13th. Hill had no doubt that the time had come to give effect to the 'Overlord/Diver' deployment, and at once took preliminary steps. At their morning meeting the Chiefs of Staff approved the execution of the plan. By the evening some of the artillery and balloon units concerned were on the move, and in the early hours of the 17th the first of the anti-aircraft regiments to reach its destination took up its new positions.

On the morning of the 16th the Home Secretary told the House of Commons that attacks with pilotless aircraft had begun. Many

Londoners and others have since testified to the eerie impression which this news made on them; and certainly the new form of bombardment proved in some respects more trying to the nerves than the long-drawn night attacks of 1940-1941. As Hill has said in his despatch, to some at least 'an intermittent drizzle of malignant robots seemed harder to bear than the storm and thunder of the "Blitz"'.¹

That afternoon the Prime Minister held a 'staff conference' attended by the Secretary of State for Air (Sir Archibald Sinclair), the Chiefs of Staff or their deputies, the Deputy Supreme Commander (Air Chief Marshal Sir Arthur Tedder), Air Marshal Hill and General Pile. Those present agreed that Hill 'in consultation with the G.O.C.-in-C., Anti-Aircraft Command, should redistribute the gun, searchlight and balloon defences, as necessary, to counter the attacks'.² Other decisions were that General Eisenhower should be asked to take 'all possible measures to neutralise the supply and launching sites, subject to no interference with the essential requirements of the battle in France'; that air-raid warnings should be sounded to indicate the beginning of a bout of firing, rather than the approach of individual bombs; and that for the time being anti-aircraft guns both inside and outside London should continue to engage such bombs as came their way. Engagement by guns inside the London area was abandoned two days later, after experience had shown that less than half the bombs hit by anti-aircraft fire exploded in the air. Following a suggestion made at the conference, Hill decided after a few days that balloons deployed against flying bombs should be fitted with the 'double parachute link' used for normal barrages, but at first omitted from the 'Diver' barrage because it was not designed to cope with anything moving much faster than an ordinary bomber. The device—admittedly imperfect against fast-flying missiles—provided for the severance of the middle portion of the cable, which was intended to wrap itself round the aircraft that made impact with it.

In the course of the next few days Anti-Aircraft Command and Balloon Command, led respectively by General Pile and Air Vice-Marshal W. C. C. Gell, performed great feats by completing their deployment in little more than a third of the time envisaged in the plan. By 21st June all the balloons and nearly all the guns prescribed were in position. By that date, too, eight single-engined fighter squadrons (equipped with Tempest V, Spitfire XIV, Spitfire IX and Typhoon aircraft) and four twin-engined fighter squadrons (equipped with Mosquito aircraft) were employed on flying-bomb patrols. On the 20th a War Cabinet 'Crossbow' Committee, headed by Mr.

¹ Supplement to *London Gazette*, 19th October, 1948.

² Compare p. 383.

Duncan Sandys, was set up to consider policies and plans for counter-measures.

Meanwhile about 100 bombs a day were coming within the compass of the defences. After the first day or so all were aimed at London, except a few directed at Southampton early in July by aircraft specially adapted for the purpose of air launching.¹ Fighters were bringing down some thirty bombs a day, guns and balloons some eight to ten. The rest flew on towards the capital, though some passed wide of it, with the result that roughly fifty bombs a day were reaching Greater London. Clearly a scale of defence designed to meet the threat from the much-bombed 'ski sites' could not match the effort of which the 'modified' sites were showing themselves capable.

Accordingly Hill and Pile agreed on a substantial reinforcement of the gun defences; and by midday on 28th June 363 heavy and 422 light guns were in position on the Downs. By the middle of July the respective figures were 376 and 392. In addition, nearly 600 light guns manned by the Royal Air Force Regiment, and some twenty to thirty of the Royal Armoured Corps, were deployed on the South Coast. Valuable contributions to Pile's abiding manpower problem were made by the Royal Navy, the Royal Marines and the Field Army.

At the same time Hill arranged to double the strength of the balloon barrage by drawing on other barrages throughout the country. Only that at Scapa Flow was left untouched. By the beginning of July a thousand balloons were in position, and were flown or grounded at the discretion of the Barrage Commander in the 'Diver' operations room established at Biggin Hill. Within the next few days arrangements were made to add yet another 750 balloons by 8th July. By this means the barrage was extended slightly to the west, and at the same time made more dense. Elsewhere slight departures were made from the original deployment in order that bombs brought down by balloons should not fall near buildings on the southern outskirts of London and in Kent and Surrey.

Where fighters were concerned, the problem was not so much one of numbers, as of getting the best out of those which could find elbow-room. The work of the defences, said Hill, could be likened to 'a very fast game played on a very small ground'. He and his staff made strenuous efforts to step up the performance of aircrew, controllers, radar stations and Observer Posts, not only by inculcating those methods which analysis showed to be most effective, but also by improving their equipment. Hill himself made many sorties against flying bombs, and discussed his experiences with his subordinates. To raise their speed, aircraft used exclusively for 'Diver' were deprived

¹ See p. 389.

of their armour and certain other fittings, and their external surfaces were stripped of paint and polished. Their engines were modified to accept more boost and special fuel.

Of the fighters used at first, the fastest were the Tempest V and the Spitfire XIV; but Hill had only a wing of each, and they could not be everywhere at once. With Leigh-Mallory's consent he therefore borrowed from Air Marshal Coningham at first a flight and later a wing of Mustang III's, which were designed to give their best performance at low altitudes. At night, Mosquitos were barely fast enough for the work unless their crews were exceptionally skilful; and Tempests manned by volunteers from the Mosquito squadrons proved in some respects more suitable. In any case a flying bomb could seldom be overhauled in a stern chase unless the pursuer started well above it and increased his speed by diving. Generally the most effective method was to fly on roughly the same course as an approaching bomb, allow it to catch up, and open fire as it passed. Some pilots found, however, that they could cause a bomb to crash by flying close beside it and using a wing to tip it over. Still others proved that a bomb could be similarly thrown off balance by the displaced air travelling in their wake.

Whichever procedure was adopted, the fighter had first to be brought to the right spot. Over the sea, pilots were guided either by precise instructions from controllers at radar stations on the coast, or by a running commentary on the behaviour of all bombs near them. The second method left each pilot free to choose his target, thus entailing some risk of duplicated effort. Over the land a running commentary—supplemented by various indications such as signal rockets, shell-bursts and searchlight-beams—was the only practicable system.

By the middle of July thirteen squadrons of single-engined fighters and nine Mosquito squadrons were in action against flying bombs. Of nearly 3,000 missiles reported by the defences up to that date—the enemy having launched about 4,000—fighters destroyed just short of a third, the majority falling in the sea or in open country or exploding in the air.¹ A few came down in built-up areas, despite all efforts to prevent such happenings.

If the fighters had a stiff task during the first phase of the 'battle of the bomb', that which faced the anti-aircraft gunners was in many ways more trying still. Admittedly the bomb was in some respects a perfect target. It could not dodge, and thus its course could be accurately predicted. But in other ways it was anything but a gunner's dream. It did not fly as fast as its designers planned; but, even so, moved fast enough to make an awkward mark.² At its normal

¹ For precise figures, see Appendix XLV.

² According to Dr. Gossiau, the defect responsible for the lowered speed could have been remedied without great difficulty if the German High Command had not believed

height of two or three thousand feet above sea-level—again a lower figure than that first contemplated—it was at once too far from the ground to suit the light guns, and too near it to suit the heavy. Heavy gun crews found that the missile crossed their field of fire too rapidly to give them all the time they needed to use their instruments and afterwards traverse the 3·7-inch mobile guns which they were manning. New devices which would ease the problem—notably the S.C.R. 584 radar set and the No. 10 Predictor—had been ordered in the United States, but had not yet reached this country in substantial numbers. The 3·7-inch static gun, which could be traversed more quickly, was on that account a better weapon, but its emplacement on concrete was too lengthy a business to meet the conditions of the battle. Brigadier J. A. E. Burls, of Headquarters, Anti-Aircraft Command, with his staff of Royal Electrical and Mechanical Engineers, went far to overcome the difficulty by devising a portable platform—popularly called the 'Pile Mattress'—which could be rapidly installed and on which the static guns could rest. Replacement of mobile by static guns was begun towards the end of June, and by the middle of the next month 32 of the static pieces had been emplaced.

At an early stage of the offensive, some changes in the disposition of both heavy and light guns were found desirable. The 'Overlord/Diver' plan provided for the siting of the heavy guns in places where their radar sets were not too much exposed to jamming, but where, in consequence, their users' task was made difficult by echoes from surrounding contours. Counter-measures taken for a wider purpose on the eve of the landing in Normandy were soon found to have made jamming so improbable that removal to higher and more favourable ground could be undertaken with negligible risk. The change—completed about the end of June—meant not only the removal of many of the guns themselves, but also the re-laying of their communications. General Pile decided, too, that he could improve the chances of the light guns by concentrating them in front of the heavy guns. In their new positions they could derive no help from the searchlight radar sets which would otherwise have been at their disposal; but Pile found that he could use them to even better purpose against 'unseen' targets by linking each troop of four guns with a heavy-gun predictor and the corresponding G.L. set.

Despite these reforms, the performance of the guns remained for some time disappointing. During the first five weeks of the offensive anti-aircraft gunners destroyed fewer than a tenth of the bombs observed by the defences. To the causes of this poor return for so

that it encouraged us to divert guns and fighters from the battle in Normandy. On the other hand, there is evidence that a higher speed would have been welcomed by Heine-
mann and probably by others.

much thought and labour we shall return in a later section of this chapter.

(iii)

Meanwhile offensive counter-measures were making progress after a poor start.

We have seen that the policy endorsed in the middle of June by both the Chiefs of Staff and the War Cabinet was to bring to bear against the enemy's arrangements for supply and launching the greatest number of bomber aircraft that General Eisenhower could spare from the more momentous task of supporting the troops newly lodged across the Channel. By virtue of an arrangement made in the previous winter, when attacks on 'ski sites' were in question, its execution was the task of the Allied Air Commander.

The striking forces immediately available to Leigh-Mallory for the purpose comprised the light and medium bombers and the fighter-bombers of the British Second Tactical Air Force and the United States IXth Air Force, insofar as they were not committed to direct support of troops. The heavy bombers of the British Bomber Command and the United States VIIIth Air Force—on which he would largely rely to carry out the policy—were not at his direct disposal, though he could ask for their assistance.

During the past six months both Air Chief Marshal Harris and Lieutenant-General Doolittle, the respective commanders of the British and American heavy bomber forces, had contributed generously to the bombing of 'ski sites' and 'large sites'. We have seen, too, that immediately after Colonel Wachtel's first bout of firing, General Doolittle met the wishes of the British Chiefs of Staff by making several attacks on two 'supply sites'.

On 16th June Leigh-Mallory, having learnt from the Air Ministry that the targets whose destruction was thought most likely to hamper Wachtel were still the four 'supply sites' chosen earlier, followed by eleven 'ski sites' and after that by twelve 'modified' sites which showed signs of having fired, arranged with Air Chief Marshal Harris that the four 'supply sites' should all be attacked by Bomber Command as soon as possible. Accordingly, Harris sent substantial forces to bomb them on that night and the next.

The position on the morning of the 18th was, then, that all four of the 'supply sites' supposed worthy of attention had been heavily assailed during the past five days, two of them by day as well as at night. Otherwise there had been no bombing of any class of site since flying-bombs began to reach this country. Leigh-Mallory had the right to ask for further heavy-bomber attacks if he were so minded,

but not the power to insist on them. Harris and Doolittle, for their part, were not only preoccupied with their immediate task of assisting Allied troops in France by attacking the enemy's communications, but had also in mind the 'strategic' offensive against German industry which they believed to be the most effective long-term contribution they could make to victory. There was thus little likelihood that they would welcome further 'Crossbow' operations—as attacks on objectives associated with flying bombs or rockets were called—unless persuaded that the targets suggested to them justified the diversion of their forces from objectives nearer to their hearts.

In this respect the picture presented to them during the second half of June was not encouraging. Soon after the middle of the month there was good reason to believe that installations at Nucourt, Saint-Leu-d'Esserent and Rilly-la-Montagne (the last near Rheims) were of some importance to the enemy, and more than guesswork to suggest that they might be equated with three depots which were thought to figure prominently in the German 'secret weapon' programme. Admittedly the cardinal role in Wachtel's system which the first two were already playing had not yet been established; but the status of the 'supply sites' was at least as doubtful. Yet the Air Ministry's current list of 'Crossbow' targets gave first place to the 'large sites', which had no known connection with the flying-bomb offensive and were included chiefly because they were suspected of being rocket-sites; second place to the 'supply sites'; and third place to launching-sites. By 18th June 44 'modified' sites had been identified north of the Somme, besides three in Calvados and about a score near Cherbourg. The fact that none had yet been found between the Somme and the Seine gave rise to the otherwise groundless assumption that 'ski sites' in that neighbourhood were being used, and to their consequent inclusion in the target-list as late as 27th June.

To the two commanders much of this might well seem unsatisfactory. On the 18th Harris intimated that, having attacked the 'supply sites' on the last two nights, he was unwilling to do so again until photographic reconnaissance had established the need. Moreover, neither he nor his American counterpart was confident that the problem of the 'modified' sites had been properly considered. The sites were notoriously hard to hit, and were so numerous that only a very heavy blow seemed likely to make much impression on them. Such an operation would need better weather than had prevailed lately. As an alternative to the series of harassing attacks implied by the relatively low place of the sites in the target-list, a major effort undertaken when the time was ripe had considerable attractions.

At 11.20 a.m. on Sunday, 18th June, a flying-bomb struck the Royal Military Chapel at Wellington Barracks, midway between

Buckingham Palace and Whitehall. Fifty-eight civilians and sixty-three members of the fighting services were killed; another twenty and forty-eight respectively were seriously injured. This was by far the largest number of casualties yet caused by any of the missiles; and the incident would seem to have made a strong impression on ministers, officials, commanders and staff officers.¹

On the same day General Eisenhower defined his attitude to the problem of the counter-offensive by ruling that, for the time being, 'Crossbow' targets must take precedence over 'everything except the urgent requirements of the battle'. As his deputy explained to the air commanders, this pronouncement clearly meant that for the moment flying-bomb and rocket targets must rank higher than the German industrial towns, aircraft factories and oil installations which were the mainstay of the 'strategic bombing' plan. Accordingly, he expected a big 'Crossbow' effort in the immediate future, while the battle on land was still going well. But the commanders of the heavy bomber forces were still reluctant to amend their plans in favour of attacks on some, at any rate, of the 'Crossbow' targets commended to their notice. Sir Charles Portal, too, remained at the height of the flying-bomb campaign of the opinion that 'Crossbow' should not be allowed to detract from the offensive against German oil targets.

The question was not, however, one for the air commanders or even for Air Chief Marshal Portal to decide. The decision lay with the Supreme Commander. His views were clear, and furthermore were in accordance with those recorded by the British War Cabinet and the British Chiefs of Staff. Air Chief Marshal Tedder continued, therefore, to urge on all concerned the necessity of giving effect to them. On 23rd June he ruled that even fleeting opportunities of attacking 'Crossbow' targets must be seized. He suggested that a part of the United States VIIIth Air Force should be held ready for the purpose. General Doolittle agreed to set aside two hundred aircraft.

Meanwhile 'large sites', 'supply sites' and other installations whose relevance to the flying-bomb campaign was doubtful continued to figure in the target-list. The problem of how and where to hit the enemy was, however, eased by the addition to it, during the last ten days of June, of Nucourt and Saint-Leu-d'Esserent, whose importance was now established beyond question. These were targets eminently suitable for heavy bombers. Attacks on both by the United States VIIIth Air Force during the last week of the month, followed by very heavy bombing of the second by the British Bomber Command on the nights of 4th and 7th July, caused a sharp though temporary decline in Wachtel's effort against London. Further

¹ The only other occasions when a single flying bomb killed or seriously injured more than 100 people in the United Kingdom were in the Strand on 30th June (198); at Turks Row, Chelsea, on 3rd July (124); and at East Barnet on 23rd August (211).

attacks on Nucourt were made on three occasions before the middle of July.

The bombing of 'modified' sites was less effective. By the middle of July sixty-eight of the eighty-eight 'modified' sites hitherto identified between the Seine and the Pas-de-Calais had received attention, but the number intact remained sufficient at all times to handle all the bombs delivered to the launching-units. Attacks by the United States VIIIth Air Force on the flying-bomb assembly factory at Falersleben on 20th and 29th June were the first of a series which contributed to the ultimate removal of the work to safer quarters adjacent to the A-4 rocket assembly plant at Niedersachswerfen. Even so, during the first five weeks of the flying-bomb campaign the Allied heavy bomber forces devoted as much of their effort to their general offensive against German industry as to 'Crossbow'.

Dissatisfaction with the Air Ministry's choice of 'Crossbow' targets came to a head about the end of the first week in July. Until that time the choice was made at the Air Ministry by the Director of Operations (Special Operations). One of his functions was to marshal, in the light of operational requirements, the evidence tendered by Air Intelligence. Without more help from outside his own directorate he was not, his critics thought, in a good position to understand the problems of all the operational commands concerned; and it was alleged that the best use was not always made of the intelligence that reached him. Whether those criticisms were justified or not, certainly the system was not working well; and on 8th July a spokesman of General Doolittle's superior formation suggested that it should be overhauled.

During the next few days Air Chief Marshal Tedder negotiated a new arrangement with the Air Staff and with Lieutenant-General Carl Spaatz, commanding the United States Strategic Air Forces in Europe. Henceforth the handling within the Air Ministry of intelligence bearing on 'Crossbow' would be solely the responsibility of Air Intelligence. An officer selected by Air Vice-Marshal Inglis would collate the material, and would then pass it to a committee of officers representing both the intelligence and the operations staffs of the Air Ministry and the United States Strategic Air Forces in Europe. The Joint 'Crossbow' Target Priorities Committee, as it was called, would study the collated evidence and decide what targets were most worth attacking. Before discussing the sequel, we must return to the 'Diver' defences and their problems.

(iv)

By the middle of July the defences contemplated in the 'Overlord/Diver' plan were working at full stretch and in a much-expanded form. We have seen that by that date between two and three times as many light and heavy guns as were specified in the plan were in position on the North Downs, besides roughly another 600 light guns sited further forward. The number of balloons deployed for the defence of London had risen by successive stages to twice, and then to between three and four times that first envisaged.

Despite great efforts by all concerned, the results were disappointing, largely because the expanded system did not provide the 'freedom from mutual interference' which Hill had postulated. Partly because not all the guns were in the gun-belt, but also because the weather was always a factor to be reckoned with, the ideal of separate spheres of action for the different arms of the defence was not attained. Such problems were a commonplace of air defence, and seldom permitted solutions equally acceptable to all concerned; but they were aggravated in the present case by the cramped area in which flying-bombs approaching London could be tackled. The solution adopted during the first five weeks of the campaign rested on the assumption that in perfect weather fighters had the best chance of success: accordingly in such conditions gunfire was prohibited and fighters had freedom of action from the English Channel to the forward edge of the balloon barrage. Conversely, in weather unsuitable for fighters, the gunners were free to fire as they liked. In middling weather—and middling weather is the usual lot of the United Kingdom—gunners in the gun-belt were allowed to fire up to a height of 8,000 feet, and fighters were denied entry unless in pursuit of a visible flying bomb; outside the belt the preference went to fighters, and gunners were permitted to open fire only on 'seen' targets, in daylight and when no fighters were about. At best these rules imposed restrictions on the gunners which, however necessary, could not fail to be irksome; and in practice their observance in doubtful weather proved so difficult that many awkward incidents occurred. Both flying bombs and fighters moved so fast that infractions by gunners and fighters alike could scarcely be avoided. The obligations placed on gunners in the belt to cease fire if a fighter legitimately entered their sphere of action, and on those further forward to withhold it unless they were sure no fighter was approaching, were particularly onerous.

During the period of reduced activity which followed the bombing of Nucourt and Saint-Leu-d'Esserent the defences did especially well. Between 6th and 13th July they brought down 57 per cent. of the

bombs observed, as compared with 41 per cent. in the preceding week. The proportion which reached Greater London declined from 48 to 34 per cent.; but even so some twenty-five bombs a day were falling on the capital. Observing that friction between guns and fighters was probably the factor which would henceforth limit progress, Hill reluctantly concluded that further improvement was unlikely under the existing system. Indeed, progressive deterioration was not improbable if misunderstandings were allowed to multiply. As early as 10th July he decided, therefore, that the concession which permitted fighters to enter the gun-belt in certain circumstances must be withdrawn soon after the middle of the month.

At a conference held to discuss the change, General Pile pointed out that an obvious corollary was the removal to the belt of the guns which had hitherto remained outside it. Irrespective of the weather, guns and fighters would then have separate spheres of action, defined by no more complex regulation than a line drawn on the map. Moreover, once within the belt, all anti-aircraft artillery units not in action would be free to train without fear of infringing rules or of harming fighter-pilots henceforth excluded from their territory. In view of these arguments, Hill agreed to examine detailed proposals for removal to the gun-belt of all guns except a few which would stay on the coast to fire marker-bursts for the benefit of fighters. Among those strongly in favour of a new deal for the guns was Mr. Sandys in his capacity as Chairman of the War Cabinet 'Crossbow' Committee.

For the fighter squadrons, the arrangement proposed by General Pile would have the disadvantage of slightly cutting down their sphere of action. On the other hand, the risk of destruction at the hands of their own side would be lessened. In order that the reasons for the change should be clear to all concerned, Hill instructed his Deputy Senior Air Staff Officer, Air Commodore G. H. Ambler, to draw up an explanation for the benefit of his subordinate formations.

Air Commodore Ambler was not sure that the move proposed went far enough to solve the problem. He agreed that fighters should be banished from the gun-belt; he agreed, too, that the arguments for placing all the guns within the belt appeared well founded. But whether the belt was in the right place was another matter. Months before, deployment on the North Downs had been agreed upon largely because the folds and hollows there reduced the risk of jamming; but in recent weeks that risk had shrunk to negligible proportions. Thus one of the main arguments for the existing location of the guns had disappeared; and it might be that a better place could be found for them.

To clarify the issue, the Air Commodore decided to draw up a formal appreciation 'strictly in accordance with the recommended method contained in the War Manual'. As a result, he became

convinced that the right course was to move the gun-belt forward to the coast. In that position it would bisect the sphere of action of the fighters; but as interception over the sea and interception over the land were, to a great extent, already separate problems, Ambler felt sure that this handicap would be much outweighed by the advantages of an uninterrupted field of fire for the guns.

Ambler finished his appreciation during the night of 12th July. On the morning of the 13th he made ready to lay his conclusions before Air Marshal Hill. As it happened, Sir Robert Watson-Watt—whose work as a pioneer of radar has been mentioned in another chapter—called that morning at Hill's headquarters. Sir Robert had made an independent study of the problem. A brief discussion revealed that he had arrived at substantially the same conclusions as the Air Commodore. The two men immediately put their case before Hill and his Senior Air Staff Officer, Air Vice-Marshal W. B. Callaway.

Ambler's arguments convinced Hill that 'unless discounted by some faulty technical assumption, the tactical theory behind the case for moving all the guns to the coast was sound'. Watson-Watt confirmed that removal to the coast would much improve the performance of the radar sets on which the guns relied so largely; and his support had great weight with the Air Marshal. At the same time, the decision that Hill was asked to make was clearly a momentous one. Fighters had destroyed 883 of the 1,192 flying-bombs hitherto brought down, and no move that threatened to reduce their effectiveness could be undertaken lightly. Hill decided to give himself the better part of the day to think the matter over, and to discuss it at a conference in the late afternoon. In the meantime he asked Sir Robert—who was on his way to visit General Pile—to acquaint the General with the proposal, so that he should not come to the conference unprepared.

General Pile, with three of his staff officers, conferred with Hill at half-past five that afternoon. At the Air Marshal's request, Sir Robert Watson-Watt also attended, as did Air Vice-Marshal Saunders, of No. 11 Group, and a representative of the Allied Air Commander. Both Hill and Saunders were accompanied by members of their staffs.

The General has since told us that a plan similar to that proposed by Ambler had already been discussed at his headquarters, but was thought unlikely to secure Hill's approval. In any case the advantages of Ambler's plan from the gunners' point of view were so obvious that, when asked whether the proposed move to the coast was agreeable to him, Pile at once assented. Air Vice-Marshal Saunders, who might have been expected to demur at the bisection of the area allotted to his fighters, saw the merits of the plan and welcomed it as 'the most satisfactory that had yet been produced'.

In view of the authority which had been given to him to 'redistribute the gun, searchlight and balloon defences, as necessary, to counter the attacks',¹ Hill decided not to court the delay which he believed a reference to higher authority would bring, but to act at once on his own responsibility. Before the conference broke up he therefore ordered that the necessary arrangements should be set in train. A few hours later advanced parties were on their way to the coast.

After the conference the Air Marshal informed the Allied Air Commander personally of the decision he had reached. Leigh-Mallory asked whether a trial deployment on a short stretch of coast would not have been better. Hill replied that such half-measures would be worse than useless: the change, if made at all, must be made at once, before the process of emplacing the static guns on the Downs had gone too far.

During the next few days all the mobile guns in the existing belt, with their equipment, were moved to the coast and deployed from St. Margaret's Bay to Cuckmere Haven. The work of replacing heavy mobile by static guns then went on in the new positions. Almost simultaneously a demand arose for a separate deployment round the Thames Estuary, from the Blackwater to Whitstable, to protect London against flying bombs launched by aircraft from aerodromes in Holland. The moves involved 23,000 men and women—for a number of Mixed Batteries were used—and some 60,000 tons of stores and ammunition. Communications between battery and battery alone entailed the laying of 3,000 miles of cable. By dawn on 17th July all the heavy guns moved from the Downs to the South Coast were ready for action; within the next two days they were joined by the light guns, which had stayed longer in their old positions to cover the change. On the morning of 19th July the weapons ready for action on the South Coast comprised 412 heavy and 572 light guns belonging to Royal Artillery and United States Army Anti-Aircraft Artillery formations—the latter providing sixteen 90-millimetre heavy guns—besides 584 light guns manned by the Royal Air Force Regiment and twenty-eight contributed by the Royal Armoured Corps. Some 200 rocket-barrels were also in position. A month later the weapons deployed against flying bombs—including 208 heavy and 578 light guns round the Thames Estuary—totalled no less than 800 heavy guns (of which the United States Army provided eighty), more than 1,800 light guns and more than 700 rocket-barrels. An additional contribution to the eastward defence of London was made by the 'Maunsell Forts' described in Chapter XXI.

The period immediately following the move from the Downs to

¹ See p. 372.

the South Coast was an anxious time for Hill. Mistakenly supposing that undue sensitiveness to the difficulties of the gunners had led him to take less than a just view of the problem as a whole, the Air Staff disapproved his action. In their view he ought to have consulted them before ordering the change, or at least to have given them an opportunity of sending a representative to his all-important conference. He was not asked to undo what he had done, but was left in no doubt that his professional reputation would stand or fall by the result.

Fortunately for Hill and for the country, the Air Staff's fear that the better chances given to the guns would not counterbalance an inevitable decline in the achievement of the fighters was not realised. During the first week of the new deployment, the defences as a whole destroyed half the flying bombs observed, as compared with slightly less than 43 per cent. during the previous five weeks. Thereafter the figure rose steadily to 74 per cent. during the third week in August, declined next week to 62 per cent. and rose again to 83 per cent. during the last few days of Wachtel's campaign from northern France. On 28th August guns, fighters and balloons destroyed respectively 65, 23 and 2 flying bombs out of 97 which approached the country; and on that day only four reached London. By that date neither Hill nor the Germans could doubt that a substantial victory over Wachtel's weapon had been won.

To that victory the new deployment made the largest single contribution. Other important factors were the introduction, in growing numbers, of the new radar sets and predictors made in the United States, and the increasing skill and confidence of those who used them. The S.C.R. 584 radar set had been eagerly expected since February, and proved, on its arrival at the end of June, ideally suited for the work; but hitherto the need to train men in its use had prevented its employment in large quantities. Above all, the move to the coast gave the gunners an easier and more rewarding task by permitting the use of shells so fused that they burst automatically when they came within a suitable distance of the target. Thanks to American manufacturing facilities and resourcefulness, the 'proximity fuze' which conferred this benefit was now available in substantial quantities; but doubts about the effectiveness of the self-destroying device designed to prevent shells so fused from becoming dangerous to civilian life and property if they missed their mark would almost certainly have hampered its employment if the guns had stayed in their old positions. The value of the 'Pile mattress'—which alone made possible the rapid emplacement of static guns—we have already noted; and with the move to the coast this device also came into its own. By the middle of August 379 3·7-inch static guns were in position. As was foreseen—and as the appended table



Plate 27. German Flying Bomb about to descend near Drury Lane in London.

Plate 28. German Flying Bomb engaged and brought down at Night by Anti-Aircraft Fire.



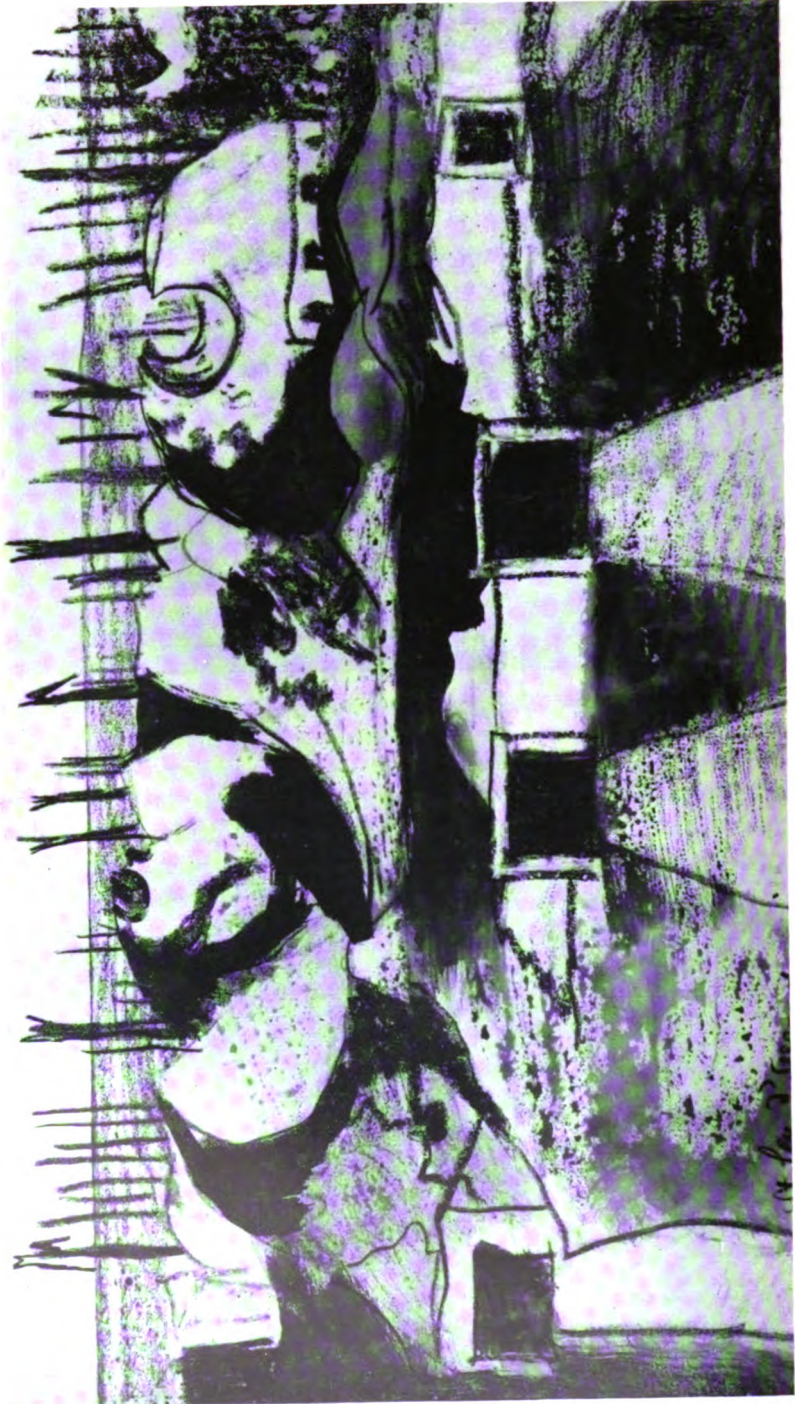


Plate 29. German Flying Bomb Storage Depot at Saint-Leu-d'Esserent.

shows—the change entailed a set-off to the vastly increased success of the guns, in the shape of a decline in the achievement of the fighters; but constant study of their problems, coupled with the introduction of the jet-propelled Meteor fighter, enabled the latter nevertheless to destroy some 23 per cent. of the bombs observed between 17th July and 5th September, as compared with roughly 32 per cent. during the previous five weeks.¹ Altogether, from the beginning of the campaign in the early hours of 13th June until the descent of the last flying-bomb launched by an aircraft from a Dutch aerodrome on 5th September, the defences destroyed 3,463 of the missiles out of 6,725 observed and about 9,000 launched.

The lull that followed did not mark the end of the flying-bomb offensive; but our account of the work of the defences may be conveniently interrupted at this point.

(V)

The Joint 'Crossbow' Target Priorities Committee met for the first time on 21st July. Among its leading members were Air Commodore C. M. Grierson, Director of Operations (Special Operations), who took the chair, and Colonel R. D. Hughes of the United States Strategic Air Forces in Europe. In the light of the latest intelligence and of the carefully-considered views of Colonel Hughes, the committee had no great difficulty in deciding that storage depots and 'industrial and production centres' were much better targets than 'large sites', 'supply sites', or such debatable objectives as electrical power stations and buildings used by the Germans as headquarters. As Nucourt was believed to have been severely damaged recently, first place went to Rilly-la-Montagne, Saint-Leu-d'Esserent, and an additional depot (in fact intended for rockets) in the valley of the Oise. With them ranked seven 'industrial and production centres', including Peenemünde and Fallersleben. Fifty-seven 'modified' sites were recommended for harassing attacks on a lower order of priority. 'Large sites', the committee thought, should be reserved for certain experimental attacks which the United States VIIIth Air Force wished to make.

On the following day Leigh-Mallory willingly relinquished his formal responsibility for 'Crossbow'. His preoccupation with the battle in France left him little time for other tasks; and in practice his task of co-ordination had already devolved on Tedder. Detailed planning of operations involving more than one command would henceforth be done by the Combined Operational Planning

¹ See Appendix XLV.

Committee, an Anglo-American body set up some time earlier to plan 'strategic' bombing missions and operations in support of them.

The revised target-list had at least the advantage of giving air commanders a clear and simple brief. At the outset the new arrangements proved, however, no more successful than the old in inducing them to assign to 'Crossbow' the stipulated preference over 'strategic' targets, the latter drawing about four times the tonnage allotted to the former during the next fortnight. Moreover, perhaps inevitably, some days elapsed before the recommendations of the policy committee were reflected in the commanders' choice of targets. Between 16th and 18th July Nucourt, Rilly-la-Montagne, and Peenemünde with the adjoining Zinnowitz, were all attacked by heavy bombers. All except the first—omitted only because by the 21st it was deemed to have had enough attention—were objectives subsequently approved by the committee. But of the 4,185 tons of bombs devoted to 'Crossbow' during the next week, 2,723 were aimed at launching-sites, which were merely secondary targets, and less than 800 at storage depots and industrial and production centres, while 'large sites' drew nearly 700. The following week, however, saw a great improvement, with 2,019 out of 2,798 tons aimed at suspected storage depots and the balance at launching-sites.

On 29th July the policy committee added two more suspected storage depots and two suspected fuel dumps to its list and removed two industrial and production centres. The number of launching-sites recommended for harassing attack was increased to 58. Meanwhile the weight of bombs directed at 'Crossbow' targets of one sort or another since the start of the flying-bomb offensive in mid-June had risen to nearly 50,000 tons.

A few days later the Combined Operational Planning Committee presented a plan for a general offensive against 'Crossbow' targets on lines suggested by Air Chief Marshal Tedder. The United States VIIIth Air Force, contributing 1,500 sorties, were to attack Peenemünde, Fallersleben, hydrogen-peroxide plants at Ober Raderach and Düsseldorf, two suspected storage depots and twenty launching-sites. The British Bomber Command would devote 1,000 sorties to twenty-two launching-sites and three suspected storage depots. Finally the United States IXth Air Force and the British Second Tactical Air Force would together expend 400 sorties on 40 launching-sites. In this way nearly every major 'Crossbow' target, besides every launching-site known or suspected to have fired recently, would be assailed at one blow.

Cloudy weather, coupled with the demands made by the battle in France on the Tactical Air Forces, prevented the execution of the whole plan within twenty-four hours, as had been intended. After an unsatisfactory start the heavy bomber forces did, however,

manage to carry out the greater part of their share within a week. Between 2nd and 9th August nearly 15,000 tons of bombs were aimed at 'Crossbow' targets of several kinds; and further efforts during the next week brought the load expended on 'Crossbow' since mid-June to more than 73,000 tons. During those nine weeks more than 26,000 tons had been aimed at launching-sites alone—unfortunately, as many suspected at the time and as we now know, with little effect on Wachtel's ability to launch the bombs that reached him.

In the second half of August the problem was complicated by two new factors. One was a revival of the fear that attacks on the United Kingdom with long-range rockets might be imminent. Already, at their third meeting on 5th August, the policy committee had agreed to recommend the bombing of liquid-oxygen plants whose output might go into rockets, and of radio-beam stations whose destruction was expected to ease the work of intercepting transmissions which might be associated with the missile; later, rocket-targets bulked still larger. The other new factor was perhaps an outcome of the familiar process by which a committee originally composed of experts tends to grow into an assembly of representatives more attuned to broader issues, but less intimately acquainted with subject-matter so abstruse that its elucidation devolves increasingly on a sub-committee working in the background. Within a week of its creation the policy committee had found it expedient to delegate a great part of its labours to such a sub-committee; and in August the process went much further. At the fourth meeting of the main committee on 12th August the chair was taken by Air Commodore C. B. R. Pelly, who had succeeded Air Commodore Grierson as Director of Operations (Special Operations). From that date the conclusions of the working committee were no longer circulated to air commanders; instead, the commanders were given the gist of them in a summary approved by the main committee. At the same time the target-lists began to be cast in a new and much more complex form. That issued on 13th August recommended no less than 122 targets, belonging to fourteen separate classes and arranged in seven 'priorities' and ten sub-categories. Its successor raised the number of recommended targets to more than 130, and the respective numbers of 'priorities' and sub-categories to eight and fourteen. If they gained in comprehensiveness, the lists thus lost the simplicity of their earlier counterparts, which had confined themselves to two or three priorities, and to a relatively brief array of targets whose supposed role in the German system was not difficult to grasp.

But if the arrangement of the later lists was complex, their burden was plain. It was that rocket-targets were now quite as important as those associated with the flying bomb. In the third week of August the air commanders nevertheless preferred the latter, aiming about

1,200 tons of bombs at storage depots and fuel dumps, a hydrogen-peroxide plant, 'modified' sites, and aerodromes used or likely to be used by aircraft playing the part of mobile ramps. But the next week brought a change. Of the 4,500 tons expended on 'Crossbow', about 2,000 were aimed at industrial and production centres, and notably at a factory suspected of making parts for flying bombs; but rocket-targets, including 'large sites', drew the greater part of the remainder.¹ Finally, on 31st August and 1st September the British Bomber Command aimed nearly 3,000 tons at suspected rocket-storage depots captured shortly afterwards by Allied troops.

These attacks brought the total weight of bombs expended on 'Crossbow' since mid-June to 82,348 tons. About 8,000 tons had been aimed at targets associated primarily with the rocket, the balance at a variety of objectives known or thought to be connected with the flying bomb. Altogether, since the first attack on Peenemünde in August, 1943, the offensive against flying-bomb and rocket objectives had meant for the Anglo-American air forces the dropping of roughly 118,000 tons of bombs and the loss of nearly 450 aircraft and about 2,900 pilots or other aircrew. The share of this huge load directed at targets associated mainly with the flying bomb was nearly 98,000 tons, or rather more than forty times the weight of high-explosive which had hitherto reached London as the result of Wachtel's efforts.²

On the whole, offensive counter-measures to the flying bomb brought no direct return commensurate with the great effort devoted to them. The effects of the bombing of 'ski sites' between December, 1943, and 12th June, 1944, we have already noted.³ Of attacks made between 13th June and 1st September, those on storage depots were the most successful. A bolder investment in that class of operation might have achieved much. But the Western Allies, hampered by their failure to make a clear-cut choice between the various courses of action open to them, never achieved the singleness of purpose which might have helped them to stake successfully on information

¹ The precise figures—the hydrogen-peroxide plant at Peenemünde being reckoned for this purpose as a flying-bomb target—were:

	<i>Flying-Bomb Targets</i>	<i>Rocket Targets</i>
Industrial and production centres	1,779	266
'Large sites'		1,234
'Modified' sites	835	
Liquid-oxygen plants		223
Aerodromes	150	
Radio-beam stations		41
	2,764	1,764

² For details, see Appendix XLVI.

³ See Chapter XXIII.

that fell short of certainty. Their effort, like that of the Luftwaffe against our air defences in 1940, was expended on too many targets, some of them with only a remote bearing on the main issue and some with none. Notwithstanding the devoted work of countless bomber crews and ground crews, of many intelligence officers who worked almost unceasingly to discover and confound the enemy's arrangements, and of innumerable helpers who risked death or torture to keep track of what our enemies were doing, the 'battle of the bomb' was not won by offensive counter-measures, but by the defences. It is, of course, true that the defences themselves owed much to the watch kept by intelligence, which alone enabled them to shape their plans before the arrival of the first bomb on British territory. It is also true that the counter-offensive, coupled with the general Allied offensive against German industry, did something to delay the German attack. But technical difficulties would probably, in any case, have prevented Wachtel from starting active operations more than a few weeks earlier than the date in fact achieved.

The upper hand was gained, however, only when the first and most important phase of the flying-bomb campaign was within a few weeks of its close. About the middle of August Wachtel began to withdraw his left flank in face of the Anglo-American advance. At the same time he started to thin out the remainder of his line. Equipment which could be removed intact was sent to depots in Holland and Germany. Units which remained on his right flank continued to fire at London until the early hours of 1st September; thereafter the remainder of the regiment withdrew to a camp near Antwerp, and soon afterwards to the neighbourhood of Deventer. Meanwhile Heinemann, accompanied by most of his staff and followed by the rest, had moved to Waterloo, near Brussels, whence he, too, removed to Deventer on 4th September. Within the next few weeks the launching-troops began to take up new positions in preparation for an offensive against Continental targets.

The United Kingdom could still be reached, however, by flying bombs launched under cover of darkness from specially-adapted Heinkel 111 aircraft. Since the end of the first week in July the third *Gruppe* of *Kampfgeschwader* 3 had been so employed. Up to the end of August the unit had aimed some three hundred bombs at London, ninety at Southampton and (on the penultimate night of the month) about a score at Gloucester. In the early hours of 5th September—four-and-a-half days after the last missile had come from Wachtel's ramps in northern France—the air-launching unit added, as it were, a postscript to the main offensive. Between five and six o'clock that morning nine bombs were observed approaching London from the east.

The lull of eleven days that followed, coupled with the rapid

advance of the Allied armies and the hope that they might soon get a foothold across the Rhine, was responsible for some over-sanguine statements by observers in this country. On 6th September the Vice-Chiefs of Staff reported, with insufficient warrant from the facts, that all areas from which flying bombs or rockets might be aimed at London were already, or would soon be, in our hands. They wisely added that this did not necessarily apply to air-launched flying bombs. Published statements in the same sense by ministers about the flying-bomb campaign led some members of the public to assume not merely that the main phase of the campaign was over—as indeed it was—but also that little further danger need be feared from long-range weapons. In fact, well over two thousand flying bombs and rockets were to be aimed at the capital in the course of the next seven months.

✓ About the end of the first week in September the third *Gruppe* of *Kampfgeschwader 3* moved from the bases in Holland which it had hitherto occupied to a group of aerodromes in north-west Germany. In succeeding weeks its crews were joined by others drawn from moribund bomber *Gruppen*. Towards the end of October the unit was transformed into the first *Gruppe* of *Kampfgeschwader 53*, and by the middle of November all three *Gruppen* of that *Geschwader* were in action.

Operations from the new area began towards dawn on 16th September. About fifteen aircraft took part, and succeeded in launching at least nine bombs. The Royal Navy destroyed two at sea, leaving seven to come within the ken of the defences. Fighters brought down one at sea and two over the land. Of the remaining four, two fell far from London, one reached Woolwich, and the other came to earth at Barking. Further launchings were made on most nights during the rest of the month and on a number of nights in October, November, December and the first half of January. Altogether 638 bombs were observed by the defences, but the number launched would seem to have been about 1,200.

The new phase confronted Hill and Pile with some awkward problems. Interception of launching aircraft was difficult, for they flew so low that radar stations could seldom track them well at the ranges within which they ventured. Mosquito fighters were sent towards their bases whenever they were known to be in action, but had a difficult task, especially as their airborne radar did not work well in such close proximity to the surface of the sea. Modifications to the equipment of radar stations, and control of the Mosquitos from a naval frigate (H.M.S. *Caicos*), or alternatively from a Wellington aircraft fitted with air-to-surface-vessel radar, proved helpful only when the phase was nearly over. Even so our aircraft made a useful contribution. Between 16th September and 14th January German

casualties included forty-one launching aircraft lost on operational flights and four destroyed on the ground. In earlier operations from Dutch bases one aircraft was lost on an operational flight and one on the ground. From first to last the launching-units lost seventy-seven aircraft from all causes. Although many of these losses were doubtless due to accidents arising from the hazardous nature of the work, it seems fair to credit the Mosquitos with at least the sixteen victims claimed.

Interception of the bombs themselves was a familiar problem, but one whose difficulty was increased in the new phase by the fact that all activity was now at night. In darkness the tongue of flame emitted by the pulse-jet was plainly visible; but estimation of its range had always been difficult for those not specially qualified by experience or natural aptitude. A distinguished scientist, Sir Thomas Merton, devised a simple range-finder which proved valuable; but personal skill remained the most important factor. One Tempest pilot, Squadron Leader J. Berry, was outstandingly successful, claiming more than sixty bombs at night from the summer onwards. During the phase now in question Tempests, aided by a belt of searchlights stretching from Saffron Walden and Sudbury in the north to Southend and Brightlingsea in the south, destroyed some fifty bombs over the land, while Mosquitos working further forward destroyed another score or so. The Royal Navy were credited with the destruction of ten bombs and a share in the destruction of another.

By far the biggest share of success went, however, to the anti-aircraft guns. To deploy them to the best advantage threatened to be no easy matter. Although in practice the enemy did little to exploit the mobility of launching-aircraft as compared with ramps, there was always the chance that he might open fire in an unexpected quarter. We have seen that during the main offensive Hill and Pile had thought it prudent to guard the eastern approaches to London against air-launched bombs by installing guns in what was called the 'Diver Box', on the shores of the Thames Estuary. After the middle of September they further extended their left flank by adding a 'Diver Strip', stretching from the northern edge of the 'Box' to Yarmouth and held mainly by units withdrawn from the original 'Diver Belt' on the South Coast. By the middle of October 1,107 heavy and light guns were deployed in the 'Box' and 'Strip', these figures including many 3·7-inch static guns manned by Light Anti-Aircraft units and used in an 'intermediate' role. After a time Light Anti-Aircraft gunners so employed were found to be making a smaller contribution than had been expected, and were replaced by Heavy Anti-Aircraft gunners. Guns already installed at defended ports like Harwich, Lowestoft and Yarmouth were incorporated in the 'Strip'. In case the 'Strip' should be outflanked, a plan was made

for the addition of a 'Diver Fringe' between Skegness and Whitby. Meanwhile a start had been made with the provision of winter quarters for the 'Diver' gunners—a task described by General Pile as equivalent to the building of a town the size of Windsor, and completed in two-and-a-half months.

For several reasons, of which the most important was the proximity of large numbers of Allied bomber aerodromes, gunners in the 'Strip' could not be given the same freedom of fire as those in the 'Belt' had enjoyed during the later stages of the main offensive. They were also handicapped by the low height at which many air-launched bombs approached the coast. New equipment for controlling low-angle fire was coming into service; but as it was still scarce, Pile had to overcome the difficulty as best he could by siting his radar sets where they were least troubled by interference from natural features, but where in consequence the length of warning they could give was less than it might otherwise have been. Despite these restrictions, the guns performed extremely well, destroying well over half the bombs which approached the 'Strip' or the 'Box' between mid-September and mid-January.¹ Altogether only 205 bombs aimed at London eluded the defences during those four months, and out of that number only 66 reached the capital.

The fear that the 'Diver Strip' might be outflanked was realised towards dawn on 24th December, when some fifty aircraft of *Kampfgeschwader 53* set out to launch flying bombs at Manchester from points off the East Coast between Skegness and Bridlington. Thirty bombs crossed the coast; and though seven of them passed over the defended area of the Humber and were engaged by guns there, none was destroyed by the defences. Only one reached Manchester itself, but six fell within ten miles of the centre of the city and eleven within fifteen miles. Thirty-seven people were killed and sixty-seven seriously injured.

Hitherto Hill had been reluctant to move guns to the 'Fringe' on the mere chance that bombs might approach that particular strip of coast. Within a few hours of the attack on Manchester, however, he authorised the immediate deployment of sixty heavy guns between Skegness and Filey. Two days later they were joined by four troops of light guns, and searchlights were deployed in the 'Fringe' as an aid to fighters. On 11th January the Chiefs of Staff approved a more far-reaching scheme involving 212 heavy guns. In practice, gradual additions brought the number to 88 by the end of that month, and to 152 by early March. The number of light guns remained at sixteen. Schemes were drawn up, too, for the 'Diver' defence of the

¹ Namely, 321 out of 576 which reached the coast without succumbing to the Royal Navy or to fighters working to seaward of the guns.

thickly-populated areas round the Tyne, Tees, Forth and Clyde, but were never carried out. In the outcome no more flying-bomb attacks were made on any northern city.

Of offensive counter-measures between September and January there is little to be said. Soon after the close of Wachtel's offensive from northern France, the Joint 'Crossbow' Target Priorities Committee and the Directorate of Operations (Special Operations) ceased to function, and the Supreme Commander, with his deputy, moved across the Channel. The departure of Air Chief Marshal Tedder placed a heavier responsibility for 'Crossbow' on the Deputy Chief of the Air Staff, though indeed the latter had been responsible throughout for representing the views of the British Air Staff, as distinct from the Anglo-American viewpoint represented by the former. On the disbandment of the Allied Expeditionary Air Force in the middle of October, Air Defence of Great Britain regained its old name and status, Hill remaining at its head and assuming the post of Air Officer Commanding-in-Chief, Fighter Command. Thereupon Hill became responsible, at least in theory, for both defensive and offensive counter-measures to flying bombs and rockets aimed, or likely to be aimed, at the United Kingdom. As he had no aircraft capable of striking effectively at air-launching bases in north-west Germany, or of bombing still more distant industrial and production centres, his control over offensive counter-measures to the flying bomb was limited in practice to the power of making representations to other commanders or to the Air Staff.

In September the most promising objectives for such counter-measures were believed to be four aerodromes at Varrelbusch, Zwischenahn, Aalhorn and Handorf-bei-Münster. Long-range fighters could reach them, but only bombers could severely damage them. During the lull which followed the last launchings by aircraft from Dutch bases, the Chiefs of Staff agreed that the suspension of 'Crossbow' measures which they then approved should not apply to air-launching bases. These would continue to be attacked as part of a general offensive against the German air force. Handorf was in fact bombed on several occasions between 23rd September and the end of the first week in October; but for the moment little was achieved by these attacks. Towards the middle of October a heavier blow at aerodromes in north-west Germany, including Varrelbusch and Zwischenahn, was nullified by bad weather.

A few days after the reshuffle which changed Air Marshal Hill's responsibilities, two of his intelligence officers visited Air Chief Marshal Harris's headquarters at High Wycombe. Staff officers there agreed that Handorf, Varrelbusch and Aalhorn were acceptable objectives, but could not promise that they would soon be tackled. Thereupon Hill wrote informally to the Deputy Chief of the

Air Staff, expressing his concern that so little was apparently being done to check the growth of the air-launching unit. But the relative lightness of the German effort, the success of the defences, and the many demands then being made on Allied air power, were all arguments against his case. Another was the commencement of flying-bomb and rocket attacks on Continental cities, since this seemed likely to entail yet another claim on Anglo-American air striking power.

Nevertheless launchings by *Kampfgeschwader 53* dwindled in November, and towards the middle of January ceased entirely, not for lack of flying bombs or aircraft, but because the Allied air offensive, though less particularly directed at the bases of the unit than Hill wished, was in fact enough to persuade the Germans that the bases would soon become untenable. About the same time the *S.S.* General Kammler gained virtual control of both flying-bomb and rocket operations.

Between 20th and 27th November only about a score of bombs approached the country, and during the next week none at all. Thereafter an intermittent effort culminating in the attack on Manchester was followed by another week of inactivity. In the fortnight after that the defences were troubled on four nights only. The end came shortly after 2 a.m. on 14th January, when the last air-launched bomb to reach the United Kingdom fell at Hornsey.

Meanwhile a new version of the flying bomb, with the same dimensions as the original *FZG. 76* but made of lighter materials and capable of flying further, was under development at Peenemünde. In February fragments of the new missile were picked up in Belgium. Accordingly on the 25th of that month the Air Ministry warned the Chiefs of Staff that the United Kingdom was once more within reach of ground-launched flying bombs. If aimed at London, they would necessarily be despatched from western Holland, since that was the only suitable territory in German hands. In fact—as we now know—the Germans had recently constructed six new ramps there, of which three were aligned on London and the rest on Antwerp.

On the following day photographic reconnaissance revealed two of the three ramps aligned on London. As they threatened to make awkward targets, and as the enemy was thought to be in no position to do much for at least some weeks, no immediate steps were taken to attack them. But a plan was at once made to reinforce the 'Diver Box' and the southern part of the 'Diver Strip' by twelve batteries (96 heavy guns) to be moved from the northern part of the 'Strip' and replaced in part by six Mixed Batteries hitherto in training. In practice, reinforcement ceased in early March, when about three-quarters of the plan had been put into effect. In addition, three Mustang squadrons and a squadron of Meteors were chosen to work

by day, and a squadron of Tempests by night, between the guns and London, and three more Mustang squadrons and two squadrons of Mosquitos to intercept by day and night respectively to seaward of the guns. A direct link was established between the headquarters of No. 11 Group at Uxbridge and radar stations which the Second Tactical Air Force had installed in Belgium to cover the Dutch coast.

The new phase began early on 3rd March and ended less than four weeks later. During that time 275 bombs were aimed at London, but only 125 of them flew far enough to be observed by the defences. The guns, surpassing all earlier achievements, destroyed no less than 86, besides one shared with the Royal Navy. So successful were they that only the Tempest squadron and one Mustang squadron, out of the ten fighter squadrons originally allotted to the work, were called upon. The four bombs brought down by these aircraft brought the total destroyed to 91, so that only 34 eluded the defences. Thirteen reached the target.

Offensive counter-measures against the two launching-sites discovered on 26th February were taken during the third and fourth weeks of March. On the 20th and again on the 23rd fighter-bombers of Fighter Command attacked one at Ypenburg, near The Hague; the other, at Vlaardingen, near Rotterdam, was attacked on the 23rd by the Second Tactical Air Force, also with fighter-bombers. Both sites were severely damaged. The third site, in the neighbourhood of Delft, was not located until it had ceased to fire.

Greater London received its last flying bombs on the morning of the 28th, when two exploded at Chislehurst and Waltham Cross. But still the bombardment was not quite over. A few minutes before nine o'clock on the following morning the last bomb to elude the defences came down at Datchworth, a village near Hatfield; and an hour later the last to succumb to anti-aircraft fire after crossing the coast descended at Iwade, near Sittingbourne in Kent. Finally, at 12.43 p.m. that day a bomb approached the coast at Orfordness, but was successfully engaged by the guns of the 'Diver Strip' and crashed into the sea.

So ended an ordeal perhaps as trying to Londoners as any they had endured throughout the war. It had lasted, with a few short breaks, for more than nine months and had cost them almost constant worry, besides much injury to life and property. Unlike an ordinary bomb, the missile made a shallow crater. Its blast effect was proportionally widespread, so that in the crowded districts south of the river, where the bombs fell thickest, many hundreds of buildings were sometimes damaged at one blow. In the most frequently-hit borough, Croydon, three houses out of four are said to have suffered in one way or another from the many missiles which exploded there; and

Wandsworth and Lewisham were not far behind.¹ It is not surprising, therefore, that in the early stages of the offensive the output of some London factories declined markedly, partly because of the hours lost by workers in taking shelter or attending to their damaged homes, and partly because efficiency was lowered by anxiety and loss of sleep. Later the decline was checked as local warning-systems were improved, as a bigger labour-force was made available for urgent repairs and, above all, as ordinary men and women learned to greet the buzz and rattle of approaching 'doodle bugs' with something akin to resignation. Measures which helped the Civil Defences to cope with a difficult though not unforeseen task included reinforcement of the London Civil Defence Region from other parts of the country, generous support from the Home Guard and the Women's Voluntary services and, incidentally, the use of trained dogs to trace victims buried under fallen masonry.

Outside London nerves were likewise strained by the long-drawn threat from bombs which might, and often did, fall short of the capital or pass wide of it or beyond it. The biggest sufferers were not the inhabitants of towns which happened to be secondary targets—for Portsmouth and Southampton received perhaps a sixth of the bombs intended for them, Manchester about a fiftieth and Gloucester none—but those who lived or worked where intercepted or defective bombs fell thickest. Between them those parts of Kent, Sussex and Essex which lay outside the London Civil Defence Region received more bombs than the whole of London, and the corresponding part of Surrey more than any London borough.² Many dwellers in rural districts, far from any military objectives, endured the transformation of their fields and gardens into 'graveyards for buzz-bombs stricken by the way'. But though their ordeal was severe, and though the lives of some were taken, and the homes of many more destroyed, with the result that the capital was spared some part of its agony, the fact remains that on a broad view damage was relatively light in country districts, and that about nine-tenths of the six thousand people killed and eighteen thousand seriously injured by flying bombs were dwellers or workers in London or its outskirts.

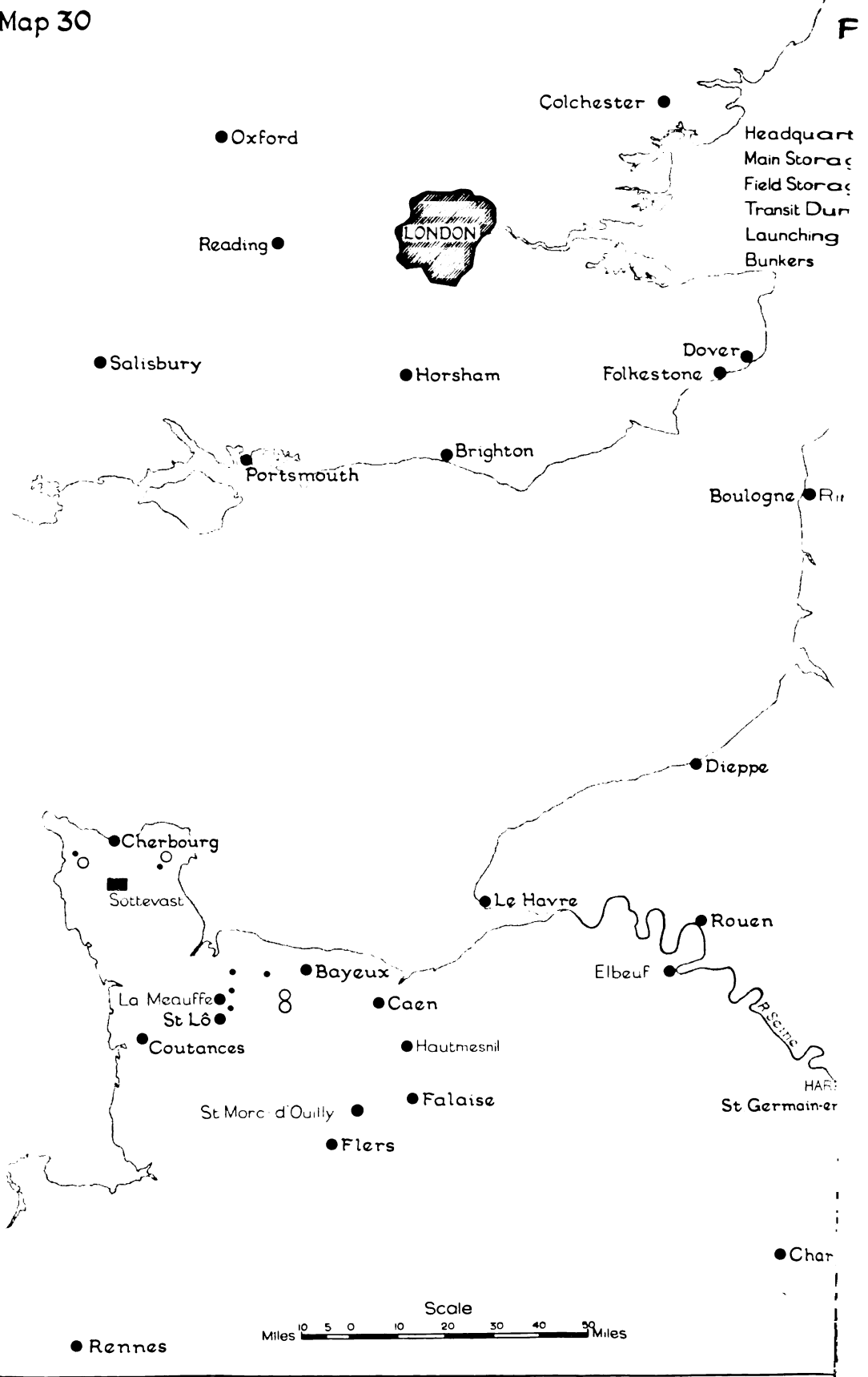
To assess the effectiveness of the flying-bomb campaign from the standpoint of those who launched it is nevertheless no easy matter. In a sense their objects were defeated by the inaccuracy of the weapon and the success of the defences. Of roughly 10,000 missiles aimed at Central London, less than a quarter descended within the much wider boundaries of the London Civil Defence Region, an area stretching as far afield as Staines and Sunbury, Uxbridge, Elstree, Chigwell, Orpington and Esher. Of the remainder, many succumbed

¹ See Appendix XLVII.

² See Appendix XLVIII.

to mechanical faults, or were shot down, before they reached the coast; but roughly half flew far enough to descend on British soil when the defences, or their own mechanism, terminated their career. And though the casualties they caused were relatively light, the enemy was not far wrong if he reflected that every missile reaching the United Kingdom might do some harm, were it only to disrupt the routine of workshop or farm for half an hour. It does not derogate from the achievement of the defences to recognise these facts, or to acknowledge that the flying-bomb offensive was not altogether unavailing as a relatively cheap reply to Allied bombing.

The further hope that the campaign might check the Allied advance in Normandy by diverting guns and fighters to purely defensive tasks was less well founded. At the time some Allied commanders, eager for every weapon that might help their troops to sustain the battle, may perhaps have grudged the batteries and squadrons deployed on this side of the Channel; but probably few would claim to-day that the guns and fighters used for home defence could not be spared, or that the triumphs of Generals Montgomery and Bradley were delayed because Air Marshal Hill was destroying flying-bombs in Kent and Sussex. On the other hand, the flying-bomb campaign and its preliminaries did cause a big diversion of Anglo-American air striking power from tasks whose earlier achievement, some may think, might conceivably have hastened Germany's ultimate collapse. And whether or not there was justice in the view that 'strategic' bombing was the key to victory, it is doubtless true that, from the standpoint of the enemy, a notable achievement of the campaign was that it induced the Western Allies to spend, and sometimes to waste, on objectives in France a heavy weight of bombs which they would otherwise have dropped on Germany.



Headquart
Main Storage
Field Storage
Transit Dum
Launching
Bunkers

LONDON

St Germain-er

Scale
Miles 10 5 0 10 20 30 40 50 Miles

CHAPTER XXV

THE LONG-RANGE ROCKET

(1944-1945)

(i)

WE LEFT the story of the long-range rocket at the point where the flying bomb emerged as a more immediate threat to the United Kingdom. At that stage the Air Ministry assumed responsibility for investigating first the flying bomb and later the rocket also.

We noted in Chapters XXII and XXIII that the German officers most concerned had little reason to suppose, at the end of 1943 and in the early part of 1944, that the rocket could soon be put to active use. General Dornberger, though more hopeful than the others, knew too well that the problem of the premature burst must first be overcome; General Heinemann was apparently convinced by December, 1943, that the date when operations might begin could not yet be foreseen; and General Metz, who had been chosen to command the launching units in the field, was so despondent that in the spring of 1944 he wished earnestly to be rid of his appointment. Nevertheless plans were made during the first half of that year for an offensive against London, Bristol, Southampton, Portsmouth, Winchester and Aldershot from two 'bunkers' and forty-five unprotected positions between Cap Gris Nez and the Cotentin. Rockets would be supplied through seven main storage depots, four field storage depots and six transit dumps. (See Map 30.) Liquid oxygen drawn from seven production-centres would reach launching-units through a storage site between Boulogne and Calais and a protected siding between Caen and Flers. Alcohol would be stored at two rear sites, respectively near Lille and in the northern outskirts of Paris, and at eight forward sites.

Nominally this was the plan envisaged in the early summer of 1944. To the well-informed the chances of putting it into execution must have seemed remote. Originally Metz was to have commanded one Bunker *Abteilung* and three Mobile *Abteilungen*. At the end of March only one of the Mobile *Abteilungen* (*Art. Abt. (mot) 836*) was anything like complete, though a second (*Art. Abt. (mot) 485*) might be ready within the next six or seven weeks. A start had been made with the

Bunker *Abteilung* (*Art. Abt. (t. mot) 953*) and in addition an independent *Batterie* (*S.S. Werfer Batterie 500*) was being formed by the *S.S.*

As the sequel to a demonstration at Blizna in May, Metz agreed with Dornberger and others that there was a reasonable prospect of starting active operations about the beginning of September. After the Anglo-American landing in Normandy and the loss of the sites near Cherbourg, a special effort was made to complete those installations which lay north of the Somme, in readiness for an offensive from that area by *Art. Abt. (mot) 836*, assisted in a subordinate capacity by *Art. Abt. (mot) 485*. On 18th July the Führer conceded that the plan of launching from 'bunkers' need not be pursued, owing to their susceptibility to bombing, but insisted that high priority should be given to the preparation of at least three positions from which mobile units could work with their vehicles under bomb-proof cover. In the outcome Allied bombing allowed little scope even for this programme. In August a provisional plan was made for an offensive against London from Belgium, should the advance of the Allied armies render the remaining sites in northern France untenable.

(ii)

We must now return to London, and to the attempts made there to establish the nature of the weapon and the scope of the enemy's organisation and intentions.

In the latter respect the work of the Air Ministry and its coadjutors was not made easier by frequent changes in the German plan, or by the anomalies which these shifts forced upon the German planners. To British intelligence officers a system which made Metz the intermediary between a corps headquarters and a single *Abteilung* seemed as unreasonable as it did to Metz himself. Not surprisingly, great difficulty was experienced in determining the strength of the troops assigned to rocket-launching, their chain of command and the effort of which they might be capable. As for the nature of the weapon, amplification and correction of the picture sketched in 1943 proved so hard a task that the weight of the rocket, the size of the warhead and the method of launching all remained uncertain till the summer of 1944 was well advanced.

In the meantime perhaps the most important step was the discovery that trials of the rocket were going on at Blizna. We now know that launchings there began in the autumn of 1943; but not until the following March did reliable news of these activities reach London. Even then the precise nature of the work transferred from Peenemünde was in doubt. A splendid opportunity thus arose for our

Polish allies, who were masters of a powerful intelligence service in their homeland. Under the direction of local organisers, willing helpers kept watch for the descent of missiles near their homes, and agents were planted in the German camp itself. By the end of June the leaders of this devoted band were able to transmit to London information which made it almost certain that one, at least, of the weapons under trial in their midst was the *A-4* rocket. On several occasions about that time, agents or sympathisers succeeded in retrieving fragments of fallen missiles almost under the noses of the Germans.

To crown these efforts, in July the head of the local organisation, laden with such fragments and documents as he could carry, cycled from the neighbourhood of Blizna to a secluded aerodrome where he was to be picked up, under cover of darkness, by an Allied aircraft. By day the place was used by the Germans as an occasional landing-ground for aircraft in transit or on training flights; at night it sometimes served a better purpose. After a hazardous ride of about two hundred miles, the emissary was embarked, with other clandestine travellers, in a Dakota whose crew were beginning to despair of his arrival. But his trials—and those of the crew and of his fellow-passengers—were not yet over. The aircraft became bogged, and left the ground only at the fifth attempt, after hurried adjustments to its undercarriage. Meanwhile the aerodrome was guarded by partisans determined to stand no nonsense from enemy patrols.

Reaching the United Kingdom on 28th July by way of Italy, the Polish leader very properly—though much to the disappointment of British officers who eagerly awaited his arrival—refused to divulge any information until he had reported to his superior in London. When disclosed, his news showed that many of the rockets launched at Blizna had burst prematurely, and hence that the weapon was as yet imperfect.

Meanwhile the capture of prisoners and documents in Normandy had at last thrown light on the method of launching, and had revealed the whereabouts of some rocket-installations in northern France. Attempts were then made to detect on air photographs launching-sites whose location was thus disclosed. The sites, each consisting of a group of three rectangular platforms let into the surface of a road, proved so inconspicuous that those who examined the photographs would probably have seen nothing if they had not known where to look. Even with that information, they might have failed if neighbouring trees had been in full leaf.

By a happy chance, on 13th June a rocket launched from Peene-münde landed near Malmö, in Sweden. It carried a quantity of special equipment, and to that extent was a misleading specimen. But the Führer was wrong if he concluded—as he is said to have

DD

done—that examination of it would not enhance our knowledge of the weapon. Two British intelligence officers who inspected the remains in Sweden submitted a report embodying evidence which hinted that the oxidant might be liquid oxygen, not hydrogen peroxide as had been hitherto supposed. Arrangements were then made to carry the remains to England, where they could be examined in detail and where an attempt could be made to reconstruct the missile. The first batch arrived by air towards the middle of July, the last by sea about a fortnight later. The work of reconstruction began at the Royal Aircraft Establishment at Farnborough on the last day of the month.

Throughout the early part of 1944 Dr. Jones and his collaborators had been able to carry on their task of investigation in a climate relatively free of the alarms that had led in the previous year to some unlucky estimates of the weight of the rocket and its warhead. Not unnaturally, the launching of the flying-bomb offensive in June caused various highly-placed authorities to take a closer interest in the rocket, and brought back something of the earlier atmosphere of urgency. In the second week of July Dr. Jones was therefore called upon for an account of progress. None knew better than he that the time was not yet ripe for a definitive report: he had still much to learn from the Swedish rocket and from the leader of the Polish network. Perhaps foreseeing that in these circumstances the effect of anything he might say would be to encourage further speculation, he undertook the task with some reluctance.

His report was circulated to members of the War Cabinet 'Crossbow' Committee on 16th July. It emphasised the gaps in our knowledge, pointing out that much had yet to be discovered about methods of launching and control, arrangements for production and supply, and the organisation which would handle the weapon in the field. On the question of weight, Dr. Jones said only that craters seen in Germany and Poland suggested that the warhead might weigh from three to seven tons. He made it clear that the missile, though apparently still imperfect, was in production and might soon be used against us.

At the next meeting of the War Cabinet 'Crossbow' Committee two days later, the Prime Minister made one of his rare appearances, and expressed some doubt whether due care had been taken to advise all concerned of developments as they occurred. He directed that his Scientific Adviser, Lord Cherwell, should be kept 'fully informed of all aspects of intelligence on the long-range rocket'.

A week later Mr. Churchill was still more critical. On 24th July Mr. Sandys, who had set up a sub-committee under Professor Ellis to make an independent study of the evidence, circulated a report in

which he committed himself to the opinion that, since the launching-platform was now known to be nothing more than an inconspicuous slab of concrete, and since the Germans were believed to have made about a thousand rockets, it would be unwise to assume that a rocket-offensive was not imminent. When the committee met on the following day both the Prime Minister and the Home Secretary expressed surprise that a threat apparently so grave had developed with so little warning. Dr. Jones—supported by Sir Archibald Sinclair and Sir Charles Portal—responded by pointing out that much of the information on which Mr. Sandys relied had only just become available, and that whether attack was imminent was still an open question. In his opinion, which was also that of his colleagues, the westward movement of launching-troops which must precede an offensive from northern France could not have taken place without their knowledge. We now know that in fact the move had not occurred, and that, even in the more favourable circumstances which prevailed before the Allied landing, the Germans did not expect to begin their offensive until September.

Within the next few weeks the arrival of the Polish leader, examination of further documents captured in Normandy, and above all a review of the evidence in the light of the hypothesis that the oxidant was liquid oxygen, cleared up most of the misconceptions which had beset the path of the investigators since the early part of 1943. On 10th August Dr. Jones was able to report that the total weight of the rocket was about twelve tons, and that of the warhead about one ton. Although disputed by those whose estimates had been based on less objective data, these figures were soon corroborated by reconstruction of the Swedish rocket. Finally, on 27th August Dr. Jones embodied the results of many months of patient investigation in a comprehensive paper which was sent to every department and formation likely to be concerned in countering the rocket if it came.

(iii)

We have seen in earlier chapters that, after the bombing of Peenemünde in August, 1943, counter-offensive measures to the rocket were virtually confined for the best part of a year to attacks on 'large sites' in northern France. In the summer of 1944 attacks were made on hydrogen-peroxide plants at Peenemünde and elsewhere, but these were directed quite as much at the flying bomb as at the rocket. Blizna was not attacked, as it would have made an awkward target, and in any case seemed likely to fall soon into Russian hands. With the concurrence of Marshal Stalin, arrangements were made for British experts to inspect the place when the time was ripe. The

mission reached Teheran on 31st July and, after spending some time there and in Moscow, was allowed to go to Blizna early in September.

We have also seen that in August, 1944, renewed fears that the rocket might soon be used against us, coupled with the arrival of fresh intelligence about the weapon, led the Joint 'Crossbow' Priorities Committee to give some prominence in their target lists to objectives associated with it. As a result, on the 24th of that month Fortresses of the United States VIIIth Air Force aimed the best part of 300 tons of bombs at a factory near Weimar which was suspected of making parts for rockets, and also possibly for flying bombs. During the next week attacks were made on five liquid-oxygen plants and two radio-beam stations; and on 31st August and 1st September Bomber Command aimed nearly 3,000 tons of bombs at nine 'forward storage depots' in northern France. We now know that by the end of August Metz and his associates had abandoned the hope of conducting an offensive from that area, and were on their way to safer quarters.

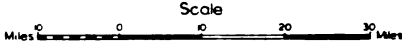
Wisdom after the event should not, however, lead us to slight a scheme of counter-measures drawn up while an offensive from northern France was still a risk that could not be discounted. The scheme took into account the probable effects of a general programme of attacks on rail communications between France and Germany, but provided also for the bombing of storage depots, liquid-oxygen plants, beam-stations and (in certain circumstances) production centres, and for a system of armed reconnaissance designed to make the most of any opportunities that might arise of hampering units concerned specifically with the transport, servicing or launching of the missile. As early as the summer of 1943 steps had been taken to detect the launching of rockets by means which included radar stations with specially modified equipment and also flash-spotting and sound-ranging formations of the Royal Artillery. Data so obtained—and especially that provided by the radar stations—would, it was hoped, define the positions of launching sites with sufficient accuracy to serve as a guide for armed reconnaissance. The same means might enable the air defences to give the public a few minutes' warning that a rocket was on its way. In addition, photographic reconnaissance aircraft would be sent to all points indicated by the radar evidence as launching-sites, and attempts would be made to jam any radio transmissions which might be used to control the missile.

We shall see later to what extent this scheme proved appropriate when the attack developed from another quarter.

THE V-2 OFFENSIVE

LEGEND

Kammler's Headquarters
 Areas from which rockets were aimed at the United Kingdom with targets and dates



Terschelling

Vlieland

• Sneek

• Stavoren

North Ipswich
 25 9 44 - 12 10 44

Amsterdam

• Ap

LONDON
 8 9 44 - 18 9 44

• Leiden

LONDON
 3 10 44 - 29 3 45

THE HAGUE

• Loosduinen

Rotterdam

• Alblasterdam

Nijmegen

• Berg

UNIT
 17 9 44

LONDON
 14 9 44 - 18 9 44

Walcheren

• Flushing

• Bruges

Antwerp

• Ghent

• Malines

Brussels

• Maastricht

• Tournai

• Liège

(iv)

During the last week in August the Allied advance to the Seine disposed of the German hope of a rocket offensive from any of the launching-positions shown on Map 30. On the 29th the Führer approved plans for an offensive against London and Paris from an area between Tournai and Ghent, in Belgium; but next day that area was held to be too near the advancing armies, and the neighbourhood of Antwerp and Malines was substituted for it. At the same time *LXV Armee Korps* relinquished its responsibility for the higher control of long-range rocket operations. Nominally this task then devolved on Metz, but effective control soon passed to the S.S. General Kammler, who on 6th August had been appointed Special Commissioner for A-4 Matters by the notorious Heinrich Himmler. As we have seen in Chapter XXIV, Kammler later acquired control of the flying-bomb offensive also.

Charged by Himmler with the supervision of preparations for a series of attacks which the Germans hoped to launch within a week, Kammler established himself at Kleve at the end of August, but left soon afterwards for Berg en Del, near Nijmegen. (See Map 31.) Within the next few days some six thousand officers and men concerned with launching and supply, with nearly sixteen hundred vehicles, were ordered to leave their training areas and concentrate in two groups in Western Germany and Holland. *Gruppe Nord*, comprising the first and second *Batterien* of *Art. Abt. (mot) 485*, under a Colonel Hohmann, advanced across Germany to the neighbourhood of Kleve. *Gruppe Süd*, comprising the second and third *Batterien* of *Art. Abt. (mot) 836*, under a Major Weber, moved from the Rhineland to the neighbourhood of Venlo, and thence southwards to the vicinity of Euskirchen.

Meanwhile Allied troops had entered Belgium and liberated Brussels. On 5th September Kammler, overriding such authority as still remained in theory with General Metz, ordered *Gruppe Nord* to take up a position near The Hague, and to hold itself in readiness to open an attack on London within the next few days. At the same time he ordered *Gruppe Süd* to prepare for attacks on targets in northern France and Belgium. An experimental and demonstration unit, *Lehr und Versuchs Batterie 444*, was placed under the orders of the *Gruppe* for the purpose of opening an attack on Paris.

The first unit to go into action was *Lehr und Versuchs Batterie 444*. After two abortive attempts on 6th September, the *Batterie* succeeded, about half-past eight on the morning of the 8th, in launching a rocket which fell within the built-up area of the French capital, but was then forced by the Allied advance to withdraw from its

forward position and was soon afterwards allotted other targets. Meanwhile *Gruppe Nord* was making ready for its attack on London.

At the time virtually nothing was known of all this in the United Kingdom. As late as 26th August the opinion of the Air Staff was that attacks on London might be expected to begin during the first half of September; but soon afterwards the rapid progress of the Allied armies brought a different outlook. On 2nd September the Director of Intelligence (Research) told the Joint 'Crossbow' Priorities Committee that the threat from the rocket 'would disappear when the area in Northern France and Belgium 200 miles from London was "neutralized" by the proximity of our land forces and the operations of our Tactical Air Forces'. Four days later the Vice-Chiefs of Staff committed themselves to the opinion that rocket attacks on London need no longer be expected.

Should the rocket be used against the British capital or any other part of the United Kingdom, immediate responsibility for such defensive measures as might be possible would fall mainly on Air Defence of Great Britain. The chances of attack were therefore keenly studied at Hill's headquarters. As soon as the opinion of the Vice-Chiefs of Staff became known there, the intelligence officer immediately concerned pointed out that it was not consistent with current knowledge of the rocket. According to the best authorities, the range of the weapon was such that it could still be launched at London from western Holland, even if the Allied armies reached the Rhine. That no launching-sites had been identified there proved nothing, since the sites were inconspicuous, and in any case could be constructed very quickly. The Chief Intelligence Officer of the command, Group Captain Vorley Harris, thereupon informed Air Marshal Hill that notwithstanding what the Vice-Chiefs of Staff had said, the evidence did not exclude the risk that rocket attacks on London might begin within the next few days or weeks. This view was proved sound a few days later, when *Gruppe Nord* opened fire at London from the outskirts of The Hague.

(v)

At 6.40 p.m. on 8th September the first long-range rocket to strike the United Kingdom fell at Chiswick, killing three people and seriously injuring another ten. Sixteen seconds later a second came to earth near Epping, but caused no casualties. During the next ten days a further twenty-five rockets fell on or near the United Kingdom, bringing the number counted since the 8th to twenty-seven. Of that total, sixteen fell in the London Civil Defence Region,

six in Essex, two in Sussex, one on a mud-flat near All Hallows, Kent, and two in the sea off Shoeburyness and Clacton. It is estimated that six to eight others despatched during that period failed to arrive. The majority of the launchings were made by the first and second *Batterien* of *Art. Abt. (mot) 485* from the suburb of Wassenaar, north-east of The Hague; a few by *Lehr und Versuchs Batterie 444* from the island of Walcheren, to which place that unit had moved on Kammler's orders after its initial effort against Paris. The aiming-point for both formations was about a thousand yards east of Waterloo Station; the nearest rocket to that point fell at Lambeth. Casualties were nowhere very heavy, many rockets falling in open country and doing little damage.

At the outset the primary task of the defences was to find out where the missiles were coming from. Without that knowledge, nothing useful could be done to check the rate of fire, either by armed reconnaissance of launching-sites or by attacking communications or supplies. For the identification of launching-sites the plan drawn up by the Air Ministry in August relied largely on photographic reconnaissance of places indicated as likely points of origin by radar, sound-ranging and flash-spotting data. In practice the method proved ineffective, partly because the radar stations and sound-ranging and flash-spotting units had been deployed in expectation of attack from northern France, partly because their equipment was inherently too inaccurate to fix points of origin with anything like certainty at such long ranges, and partly because the launching-sites were in any case virtually undetectable by high-altitude photography. On the other hand the launching of a rocket, with its accompanying noise and clouds of smoke or flame, was not a matter which could be concealed from observers on or near the spot. Consequently local adherents to the Allied cause were able to keep tally of almost every missile launched; and means were found to transmit their observations to this country almost as soon as they were made. Other sources of information included reports from Allied aircrew, who sometimes saw the trail made by an ascending rocket.

As Hill's headquarters were already a clearing-house for the information furnished by radar-stations and the like, and as prompt identification of launching-sites was a most important requirement for armed reconnaissance, arrangements were made for the rapid passing of the gist of relevant messages from Holland to one of his intelligence officers, who thereupon collated this information with the rest of the evidence. Within a few days it was clear that all or most of the rockets hitherto launched had come from suburbs of The Hague. There was some evidence of launching from other places, including Walcheren, but it was considered weak; and indeed we now know that operations from Walcheren did not begin until the

14th. Attention was drawn by agents to suspected storage-sites on three estates known as Ter Horst, Eikenhorst and Raaphorst.

On 14th September Bomber Command attacked Raaphorst, dropping 190 tons of bombs. On the 17th a similar attack was made on Eikenhorst. Fighters of Air Defence of Great Britain flew frequent sorties over suspected areas, occasionally opening fire on vehicles and troops which might or might not belong to the organisation concerned with long-range rockets. According to a German source, these interventions had no great effect during the phase in question here.

Other counter-measures made provision for the detection and jamming of radio-transmissions associated with the flight of rockets. It was, however, soon suspected that radio-control was not an essential feature of the German system. In fact the *Leitstrahl* method of controlling direction was not used in the early stages, and was never generally adopted; while the *Radio-Brenschluss* method of controlling range was never as commonly employed as that which depended on the *I-Gerät*. For the detection of rockets as they rose into the air, Hill deployed additional radar equipment near the East Coast; and the 11th Survey Regiment, Royal Artillery, which undertook sound-ranging and flash-spotting, brought into use a number of balloons to supplement its existing facilities. Arrangements were also made to deploy radar, sound-ranging and flash-spotting units (the last two comprising the 10th Survey Regiment, Royal Artillery) in Belgium, and for them to report to a special formation called No. 105 Mobile Air Reporting Unit, with headquarters at Malines, near Brussels. This extension of Air Defence of Great Britain to the Continent called for special communications between Malines and Stanmore, and between the 10th Survey Regiment and its counterpart at Canterbury.

(vi)

On 17th September the Western Allies began their attempt to get a footing across the Rhine by means of an airborne landing near Arnhem. The imminence of this operation was one of the factors which had led to a too-sanguine appreciation of the outlook earlier in the month. Among its immediate effects was the withdrawal of *Art. Abt. (mot) 485* from The Hague to the neighbourhood of Burgsteinfurt (north-west of Münster) and of *Lehr und Versuchs Batterie 444* from Walcheren to Zwolle. At the same time Kammler withdrew in haste from his headquarters near Nijmegen, also to the neighbourhood of Münster. The offensive against the United Kingdom was thus brought to an abrupt, though temporary, standstill some ten days after its commencement.

Meanwhile the British Government had decided that, for the present, no public announcement about the rocket offensive should be made. It followed that no effect could yet be given to the provisional plan which had been made to warn Londoners, by means of maroons remotely fired from the Filter Room at Stanmore, that a rocket was thought to be on its way. In any case technical imperfections made it unlikely that the system would yield satisfactory results, at any rate until No. 105 Mobile Air Reporting Unit and its ancillaries were properly installed in Belgium.

On 25th September the Chiefs of Staff gave fresh consideration to the matter, in the light of a report prepared by the Deputy Chief of the Air Staff in consultation with Mr. Sandys. In the meantime no rockets had reached the United Kingdom since 18th September; on the other hand, the airborne force at Arnhem had been checked, and the rocket-launching area near The Hague seemed likely to remain in German hands. Air Marshal Bottomley and Mr. Sandys believed, however, that even so the Germans would be prevented by general disorganisation and the insecurity of their communications from aiming many more rockets at London. The Chiefs of Staff concluded that it would be best to delay any public announcement about rockets for at least another week. As for the question of specific warning that a rocket had been launched, they pointed out that hitherto the performance of the radar, sound-ranging and flash-spotting units had been such that, if warnings had been based on it, several rockets would have arrived unheralded, while conversely a high proportion of warnings would have proved vain.

Meanwhile Kammler had ordered *Lehr und Versuchs Batterie 444* to keep the campaign alive by opening fire on Norwich and Ipswich. For that purpose the unit moved to the neighbourhood of Staveren in Friesland. Operations from that quarter began on 25th September. At ten minutes past seven that evening a rocket fell at Hoxne, in Suffolk; and next day a second fell at Ranworth, eight miles north-east of Norwich. Between 25th September and 12th October *Lehr und Versuchs Batterie 444* aimed 44 rockets at the two places.¹ Thirty-two came down on land in the United Kingdom and five were seen to fall into the sea. The nearest rocket to either target fell in the outskirts of Norwich on 3rd October, harming no-one; and casualties everywhere were very light.

At first such evidence of the origin of the missiles as reached this country was inconclusive, pointing to the neighbourhood of Apeldoorn and (more doubtfully) to the islands of Vlieland and Terschelling, as well as to the true locality of the launching-sites in Friesland. Later information strengthened the case for Friesland,

¹ According to a German source only one of these was aimed at Ipswich.

establishing with fair accuracy the whereabouts of several launching-sites and suggesting that they were supplied from a neighbouring railhead at Sneek. As all places suspected as sources of the missiles aimed at Norwich and Ipswich were too remote to be adequately covered by fighters from the United Kingdom, Hill agreed that the Second Tactical Air Force should undertake the task from its more convenient bases on the Continent. His intelligence officers continued their study of the evidence, and passed their conclusions at frequent intervals to Coningham's headquarters.

Early in October two intelligence officers from Stanmore visited Belgium to discuss their problems with representatives of the Second Tactical Air Force, No. 105 Mobile Air Reporting Unit and the 10th Survey Regiment. On returning to England they reported that in recent weeks at least fifty rockets had apparently been aimed at Continental cities and that hitherto only belated and incomplete reports of such occurrences had reached this country. They recommended, therefore, that an organisation should be established on the Continent to keep track of the situation.

Meanwhile the Arnhem operation had so clearly failed to achieve its purpose that, on 30th September, Kammler judged conditions safe for the return of part, at any rate, of *Gruppe Nord* to south-west Holland. Accordingly the second *Batterie* of *Art. Abt. (mot) 485* moved back to that area and prepared to resume the offensive against London. News of the move was received in London and at Stanmore on 3rd October, so that the arrival of a rocket at Leytonstone soon after 11 o'clock that evening came as no surprise. Thereafter until 12th October, when *Lehr und Versuchs Batterie 444* ceased operations from Friesland, both London and East Anglia were under fire. On that date Hitler ordered that in future London and Antwerp should be the sole targets for long-range rockets; accordingly, on 20th October *Lehr und Versuchs Batterie 444* joined the second *Batterie* of *Art. Abt. (mot) 485*, which was simultaneously reinforced by part of the third *Batterie*, whose training had now been completed. Later moves reduced the strength of the units at The Hague to one-and-a-third *Batterien* for a brief period in December, and afterwards maintained it at two *Batterien*.

In practice the volume of fire would seem, however, to have been governed not so much by the number of launching-units available, as by the rate at which rockets and fuel could reach them. The flight from France had nullified the planned system of supply, compelling Kammler and his subordinates to improvise new measures in face of difficulties arising from the vast programme of attacks on communications undertaken by the Allies as part of their main strategic plan. In September and October missiles on their way to launching-units were deposited in transit dumps ill-equipped for maintenance and

servicing. As many had already lain for some time in store before despatch, the consequence was that a high proportion reached their ultimate destinations in poor conditions, their delicate mechanical and electrical equipment having deteriorated through corrosion. Later a different procedure (known as the *Warme Semmel* or 'Hot Cakes' system) was adopted, whereby rockets were taken by rail direct from the production plant to an unloading point close to the appropriate launching area, thence by road to an assembly- and testing-point where they were serviced without delay, and finally by road again to the launching-sites. By this means, which incidentally entailed the scrapping of some 500 missiles already accumulated at storage depots in Germany, a rocket could be launched within three or four days of leaving the production plant. It seems fair, however, to assume—as Hill and other commentators on the problem of defence have done—that this procedure would not have served to nourish more than a comparatively small scale of attack. A weightier offensive would probably have called for well-equipped forward storage depots, like those envisaged in the earlier plan for attacks from France, and these would doubtless have proved as vulnerable to bombing as did the flying-bomb storage depots at Saint-Leu and Nucourt.

The resumption of attacks on London, coupled with the probability that attacks would continue to be made on Continental cities, raised a difficult issue for the air defences. On 2nd October the Chief of the Imperial General Staff had suggested to his colleagues that Brussels and Antwerp, rather than any part of the United Kingdom, might well become the enemy's main targets. The threat to the Anglo-American forces in Europe which might arise from long-range bombardment of their bases and centres of supply was likewise plain to the Supreme Commander and his staff, who had received intelligence of German preparations to bombard Continental targets with flying bombs as well as rockets. In consequence Hill was unable to resist the transfer to the Supreme Commander's control of No. 105 Mobile Air Reporting Unit and its subordinate radar and signals units. At a time when attacks on the United Kingdom were quite light, he would not have felt justified in objecting to the change, especially as provision was made for continued contact between Malines and Stanmore. As a corollary, the 11th Survey Regiment moved to Belgium to replace the 10th, which could no longer be spared for 'Crossbow' duties; and it, too, passed out of Hill's control. The loss was acceptable, since the performance of the radar stations had improved. In the common interest Hill also willingly assented to the posting of some members of his staff to a new 'Crossbow' organisation at Supreme Headquarters. The problem that now confronted him arose less from these reforms, which

indeed he considered fully justified, than from the recent transfer of responsibility for armed reconnaissance to the Second Tactical Air Force. While that arrangement held good, it was too much to expect that The Hague would be as closely reconnoitred as places occupied by units suspected of bombarding Continental cities, or would receive the attention which his own squadrons were capable of giving to it.

As part of the new system, he therefore agreed with Coningham on a division of responsibility. Henceforth Fighter Command—as Hill's command had now become—would undertake armed reconnaissance of The Hague and its neighbourhood, Coningham's forces of places further east which seemed to be occupied by units bombarding Continental cities. On days when English aerodromes were weatherbound and Continental bases usable, the Second Tactical Air Force would do its best to cover The Hague on Hill's behalf. Its attacks on the enemy's communications would also make an important contribution.

During the third week in October home-based squadrons therefore resumed the duties which they had undertaken at the beginning of the German offensive. Originally performed by No. 11 Group, the work had been entrusted after a few days to No. 12 Group, whose aerodromes were better placed for sorties over Holland, and who now took up the task again. The Germans were rightly thought to be using launching-areas further south and nearer to the centre of The Hague than those used in September; and accordingly attention was directed chiefly to a number of suspected sites in the city and its southern outskirts. In the course of the next five weeks about 600 fighter sorties were flown for the purpose from United Kingdom bases. Ter Horst and Eikenhorst were believed to be no longer in use as storage sites; but a number of other places were suspected of sheltering rockets, vehicles and stores, or launching-troops. There was also reason to believe that two railway stations at Leiden played some part in the system of supply. At the urgent request of Hill's intelligence officers, target material relating to these places was quickly prepared by the Air Ministry for distribution to formations which might be asked to bomb them. Between 16th and 18th October Bomber Command were in fact invited to attack two contiguous properties in the southern outskirts of The Hague, and the Mosquito bombers of the Second Tactical Air Force to tackle a third site there in addition to the two stations at Leiden. Raaphorst remained under suspicion for some time after its bombing in September, but during the third week in October was withdrawn from the target-list for lack of evidence that it was still in use.

In early October rockets aimed at London were arriving at the

rate of some two or three a day. Rumours of the reinforcement of the launching-units at The Hague reached this country; and by 24th October Hill had reason to fear that a heavier scale of attack might be expected in the future. On that day he wrote to the Deputy Chief of the Air Staff, expressing his concern that so little was being done to tackle aerodromes used by German aircraft which launched flying bombs;¹ and he took the opportunity of pointing out that the rocket-targets recently suggested to Bomber Command might also be thought worthy of attention. But the bomber forces had much else to do, and his arguments were unavailing. In the outcome neither the targets proffered to Bomber Command, nor those recommended as objectives for Coningham's Mosquito bombers, were attacked within the next three weeks.

Towards the end of October the number of rockets reaching the United Kingdom rose markedly in consequence of the reinforcement which in fact occurred at the end of the third week in that month. At the same time the German attack became more accurate, presumably as a result of growing experience. Between 26th October and 4th November, forty-four missiles reached the country. Thirty-three of them came down in the London Civil Defence Region and another seven within twenty-five miles of Charing Cross. The mean point of impact of these forty rockets was in Poplar. Casualties grew heavier, though they remained considerably lighter than the Germans seem to have supposed. On 1st November a rocket which fell in Camberwell killed or seriously injured forty people, and another in Deptford more than eighty. Altogether, more than 1,400 people were killed or wounded by rockets during the month which followed Hill's remonstrance, as compared with about a sixth of that number in the preceding seven weeks.

On 8th November the Germans announced publicly that the *V-2* offensive against London had begun. Two days afterwards Mr. Churchill told the British public that long-range rockets had indeed been launched at the United Kingdom, but did not mention that London was the target, lest the enemy should draw conclusions about the accuracy of his fire. As attempts to give specific warning would still have led to many false alarms, the system designed for that purpose was not put into force.

A few days later Hill returned to the issue which he had raised on 24th October. Writing formally to the Air Ministry on 17th November, he pointed out that, owing to inherent limitations which would grow more stringent with the approach of winter, armed reconnaissance could not do much to keep down the German effort unless supported by other forms of offensive action. So far the bomber

¹ See pp. 393-394.

forces proper had done little directly to assist him. He himself had made some use of Spitfires equipped as fighter-bombers; but their pilots were forbidden to drop bombs where civilians might be killed or injured. He asked on the one hand that Bomber Command should be invited to give more earnest consideration to the flying-bomb and rocket objectives which he had suggested to them, on the other that more scope should be allowed to his fighter-bombers, especially as civilians were said to have been removed from those parts of The Hague which they were likely to attack. The second point, he thought, might well be discussed with our Dutch Allies.

The whole matter was considered four days later at a conference under the chairmanship of the Deputy Supreme Commander. In support of his plea for greater liberty of action for his fighter-bombers, Hill urged that the risk of injury to life and property in Holland must be weighed against the certainty of injury to life and property in London. Representatives of the Dutch Government thereupon agreed that, if bombing attacks on launching-points and storage sites were necessary and seemed likely to prove effective, they would raise no immediate objection. Hill was therefore given authority to make such attacks, even on targets near built-up areas, as long as he considered them 'reasonably discriminating'. On the other hand the Deputy Supreme Commander could not promise much assistance from the bomber forces proper, apart from that provided by the general Allied air offensive against communications, which included a programme of attacks on certain bridges carrying traffic to The Hague. On that programme the Second Tactical Air Force were currently engaged. Bomber Command were unlikely to tackle 'Cross-bow' targets unless conditions happened to be unfavourable for more important tasks.

During the last three days of November Spitfires of Fighter Command made 111 sorties over The Hague and dropped ten tons of bombs. Unfavourable weather limited their effort in December, which amounted even so to 359 sorties and the dropping of 44 tons of bombs. On Christmas Eve 33 Spitfires, each carrying one 500-pound bomb besides the usual pair of 250-pound bombs, attacked a block of flats where German troops were housed, and damaged it severely. According to a German report, one man was killed and two were wounded.

Meanwhile Hill's arguments for stronger counter-measures were reinforced by a similar request from the Home Secretary. To reduce the risk that penetration of the tunnels which carried the underground railway system under the Thames might cause heavy casualties among the many Londoners who habitually took refuge at night in tube-stations, consideration was given to the transmission of special warnings to the London Passenger Transport Board to ensure

timely closing of the floodgates.¹ But Mr. Morrison asked, too, for heavier attacks on The Hague. His plea for the direct participation of the heavy bomber force was not endorsed by the Chiefs of Staff, who argued that a major diversion of effort, coupled with much probable injury to Dutch life and property, was too big a price to pay for a temporary interruption of rocket-launchings. Their policy was still to rely largely on interruption of communications by the general air offensive; and about this time much thought was devoted to the best means of ensuring that that part of the Allied programme which aimed at interference with road and rail traffic between Germany and western Holland should make an acceptable contribution to 'Crossbow' counter-measures. The bombing of liquid-oxygen plants, or of the underground factory at Niedersachswerfen, was also considered; but these projects were so beset with difficulties and uncertainties that little came of them. Eventually a liquid-oxygen plant at Alblaserdam was bombed by the Second Tactical Air Force, and another at Loosduinen was attacked on three occasions by fighter-bombers of Fighter Command. But no permanent benefit could be expected from these ventures, since the Germans had many other sources of supply.

For the most part, therefore, Fighter Command remained dependent on its own resources, though some valuable contributions continued to be made by the Second Tactical Air Force, particularly in the form of attacks on the enemy's communications. Hitherto Hill had used three squadrons of fighter-bombers—No. 229 Squadron and Nos. 453 (Royal Australian Air Force) and 602 (City of Glasgow) Squadrons, all working under No. 12 Group, chiefly from the Coltishall sector. A fourth squadron, No. 303, made occasional contributions to the bombing, but flew chiefly without bombs. In response to a suggestion from the Air Staff that he should increase his effort, coupled with a promise that the Second Tactical Air Force would be asked to take special pains to second it, he added in January Nos. 124 and 451 Squadrons, making six in all. Fighters which did not carry bombs continued to do armed reconnaissance; but both fighters and fighter-bombers were limited to the daylight hours. Night 'intruder' squadrons, which might have made a useful contribution, were committed to operations in support of the Allied bomber offensive.

In January the weather was once more unfavourable. Fighter-bombers of Fighter Command made 210 sorties against rocket-targets,

¹ The system was introduced on 8th January, 1945. Between that date and the end of the rocket-offensive 228 warnings were given to the London Passenger Transport Board. Only eight were classed as 'false' when all data had been examined, and only three rockets fell in London without warning; but the high proportion of genuine missiles which failed to reach the capital was one of several factors which made the system unacceptable as a basis for warnings to the general public.

dropping 24 tons of bombs. The Second Tactical Air Force continued the help afforded by their general programme of attacks on the enemy's communications, and made (on 22nd January) the attack on Alblaserdam which we have already noted. According to a German report, the effects on the rocket organisation of various attacks in January included damage to one missile and destruction of one warhead; five men were killed and nine wounded, railway lines were cut in several places and several vehicles suffered damage of one kind or another.

Meanwhile a sharp increase in the number of rockets reaching the United Kingdom both justified Hill's insistence that more must be done to keep the enemy in check, and gave occasion for the Air Staff's ruling that Hill must himself do more in that direction. After rising at the end of October, the toll of 'incidents' had indeed declined towards the end of 1944; but the total for January was not far short of twice the average for the previous three months. For some weeks after the opening of the fighter-bomber offensive in late November, the accuracy of the enemy's fire—as measured by the proportion of observed rockets which fell within the London Civil Defence Region—had fallen off, and the majority of launchings had been made in darkness. Both tendencies were welcomed by the British, for casualties were generally lower at night than in the daytime; but unfortunately they were not maintained. In January half the rockets which reached the country fell in Greater London, as compared with a third in December, while the proportion of incidents occurring in daylight rose, again from a third, to between one half and two-thirds of the total. Thus the most that could be claimed for the fighter-bomber force at the end of January was that, while it did seem capable of discomfiting the enemy when conditions were favourable, in recent weeks the weather had not provided such conditions. There was no likelihood that the launching of rockets could be altogether prevented by such means; and experience had shown that even an occasional missile might do much damage. Norwich and Ipswich had been lucky; London, too, had been lucky for the first few weeks, no incident entailing heavy casualties occurring until the beginning of November.¹ Incidents comparable with those which then occurred in Camberwell and Deptford were recorded during the next few weeks in Islington, Stepney, Greenwich, Wandsworth, Bromley, Bethnal Green and Poplar; and, outside London, at Luton, Colliers Row and Chelmsford. Much worse followed on 25th November, when a rocket struck a crowded building in the New Cross Road, killing 160 people and seriously injuring 108. Between that date and the end of January no further disaster of quite that

¹ See p. 413.

magnitude was suffered, though on three occasions (at Islington, Hackney and Southwark) more than a hundred people were killed or injured by a single rocket, and on fifteen others more than twenty.

Perhaps because its approach was unseen and unheard, the rocket nevertheless aroused less apprehension among most sections of the public than that provoked at the beginning of the previous summer by the flying bomb. Before the end of Wachtel's offensive from northern France, Londoners who had sought sanctuary outside the capital were beginning to return to their former habitations. Despite the menace of the rival weapon, the trend continued during the autumn and early winter, so that by January the population of London was reckoned only some five per cent. smaller than in early June, and was rising at the rate of 10,000 a week.

Even so, a growing casualty list gave ample justification for the anxiety felt by those concerned with defence, whether military or civil; and the time was ripe for consideration of any practicable measure which promised to reduce the danger. General Pile and his staff had long been interested in the possibility of prematurely exploding long-range rockets by means of anti-aircraft fire; but early estimates of the chances of success had been unimpressive. In December the project was revived in a new form which, in Pile's opinion, held sufficient promise to warrant a practical trial. After a preliminary discussion at Hill's headquarters, Pile's staff produced a paper which envisaged the interposition of a curtain of shell-fragments at a given point on the predicted course of an approaching missile. The number of rounds fired at each missile engaged would be of the order of 150, and the chance of success was estimated at one in fifty. On 20th December Hill commended the proposal to the Air Ministry as one containing 'the germ of successful counter-measures to the rocket-attack' and therefore not to be dismissed without a trial. The War Cabinet 'Crossbow' Committee discussed the matter on 15th January, when Professor Ellis put the chance of a successful engagement at one in a hundred. Sir Robert Watson-Watt put it at one in a thousand. In the light of these figures a favourable decision was not to be expected, but the Committee asked that further work should be done on the project, and promised to consider the matter again in two months' time. In the outcome a panel of scientists reported on 26th March that, if the number of rounds fired at a given rocket were increased to 400, the chance of securing a hit might be as high as one in thirty; but a few days later the Chiefs of Staff decided against a trial, feeling that the prospects of success were still too slight to outweigh the risk of an adverse effect on the public temper. In any case, by that time the chance of seeing what the guns could do had passed with the descent of the last rocket on British soil.

Until the end of the campaign active counter-measures thus continued to be limited to a moderate amount of armed reconnaissance and bombing, backed by the general offensive against the enemy's war-potential and communications. In February better weather helped Hill's expanded fighter-bomber force to make 933 sorties—more than four times as many as in January—and to drop 192 tons of bombs, as against a total of 78 tons in the preceding ten weeks. About the middle of the month a new plan was adopted. For some days in succession attacks were concentrated on one or two localities where launching and storage were suspected, rather than spread over many. Thus on the 21st and 22nd 38 attacks were made on a wooded area called the Haagsche Bosch. The German record, though it gives no detailed account of the results, leaves little doubt that these attacks were the cause of a lull in the German offensive which lasted from dusk on the 23rd until the morning of the 26th. During that period only one rocket reached the country, on the morning of the 24th. On most other days the enemy was quite as active as in January, so that in the whole of February the number of recorded incidents was much the same as in the first month of the year. On ten occasions a single rocket killed or seriously injured more than twenty people—the numbers in fact ranging from 35 to 85—but casualties were nowhere quite as heavy as those sustained earlier at Southwark, Hackney and Islington and in the New Cross Road.

On 3rd March the Second Tactical Air Force made one of their rare attacks on an objective directly associated with the rocket organisation at The Hague. The objective chosen was the Haagsche Bosch, part of which still figured on the target-list, although there was much to suggest that recent attacks by fighter-bombers had led the Germans to move at least part of their gear outside its bounds.¹ Fifty-six Mitchell and Boston bombers were employed, and dropped 69 tons of bombs, unfortunately with results which were anything but happy. Air Marshal Coningham's crews were justly proud of their ability to bomb a chosen target without harming neighbouring buildings; but on this occasion their skill was nullified by an incorrect allowance for wind. Much of the bomb-load fell a mile away in an area densely populated by Dutch civilians, and none of it within 500 yards of the selected aiming-points. Afterwards Coningham ordered that no more attacks should be made by his medium bombers on targets at The Hague.

The fighter-bomber force continued during the first three days of

¹ Photographic reconnaissance of the Haagsche Bosch on 24th February had shown no rockets there, whereas some twenty to thirty had been seen on previous occasions. On the other hand, up to six were seen in an adjacent open space called Duindigt. In view of this and other evidence, priority was allotted on 1st March to an objective which comprised part of Duindigt and that part of the Haagsche Bosch which lay next to it. The rest of Duindigt came next on the list.

March to devote much of its attention to parts of the Haagsche Bosch; thereafter the emphasis shifted for some time to the adjacent Duindigt, though a number of other targets were attacked as well. By the middle of the month Duindigt was heavily pitted with craters, and the Germans were said to have abandoned it. On 7th March—though this was not known in the United Kingdom at the time—the German rocket-organisation in Holland reported its casualties since air attacks began as 51 dead, 117 wounded, and 58 lorries and cars, 11 oxygen-trucks and 48 missiles damaged.

In mid-March the situation as it presented itself at Hill's headquarters was that the Germans had apparently been driven out of their important launching and storage areas at the Haagsche Bosch and Duindigt, and also out of a wood at Ravelijn (about a mile from Duindigt), where rockets had been photographed earlier in the month. Fluctuations in the German scale of attack, coupled with a renewed tendency for most launching to take place at night, suggested that the recent strengthening of the fighter-bomber offensive had not been without effect. Less satisfactory was a scarcity of further targets of known value which could be tackled without undue risk to Dutch civilians. Thereafter Fighter Command was driven in consequence to devote most of its effort to railways along which supplies were known or thought to pass. A few more attacks were, however, made on Duindigt and Ravelijn as an insurance against the return of the rocket-units; the latter in particular was closely covered by armed reconnaissance after the receipt of evidence that launchings (but not storage) had been resumed there. In addition, attacks were made on a large building suspected of providing living accommodation and administrative quarters for the rocket-organisation, and on a garage said to house the special vehicles used for carrying missiles to the launching-sites. Favoured by improving weather, and often refuelling in Belgium, as they had done occasionally in earlier months, the fighter-bombers flew more sorties in March than in the previous four months put together, and dropped more than three times the weight of bombs delivered in February. The effects could not, and cannot, be easily distinguished from those of the Allied air offensive as a whole; but various signs were thought to testify to difficulties experienced by the enemy in bringing up supplies.

Despite a rather lower total of rockets launched, the number that reached London in March was only two fewer than in February. Casualties were swollen by a number of unlucky hits. On the 8th a missile which struck Smithfield Market in the middle of the morning killed 110 people and seriously injured 123; on the 21st and 25th two others at Heston and Enfield each accounted for more than a hundred dead or seriously wounded; at West Ham, Deptford, Poplar and Leyton there were incidents entailing respectively 39, 84,

64 and 41 serious casualties. Finally, at 7.21 a.m. on the 27th a rocket fell on a block of flats in Stepney, killing 134 people and seriously injuring another 49. Just under nine-and-a-half hours later the last rocket of the campaign—and the one thousand, one hundred and fifteenth to fall in the United Kingdom or close offshore—descended at Orpington, in Kent. In the whole course of the campaign about 2,700 people had been killed and 6,500 seriously injured by rockets, approximately nine-tenths of them in London and its outskirts.¹

After launching their last rocket on 27th March, the rocket-units at The Hague were withdrawn, with the rest of *Gruppe Nord*, to Germany, where the greater part of them, with most of *Gruppe Süd*, surrendered on 9th May to the United States 9th Army. The decision to withdraw the units was based on a number of grounds, of which perhaps the most important was fear of capture. On 3rd April Hill discontinued fighter-bomber attacks on western Holland and substituted armed reconnaissance patrols, which were continued as a precautionary measure until the 25th. Meanwhile, as we have seen in Chapter XXIV, the flying-bomb offensive from ramps near Rotterdam, The Hague and Delft had also come to an end. On 13th April radar stations ceased their watch for rockets; a week later the special rules which had restricted the movement of aircraft over areas where guns were deployed against flying bombs were cancelled. Finally, after receiving a report from their Joint Intelligence Subcommittee to the effect that there was no further risk of attack with flying bombs, and only a very slight chance of attack with rockets, the Chiefs of Staff agreed on 2nd May to the discontinuance of all counter-measures.

Operations against the United Kingdom by piloted aircraft had ceased some time before, after a brief revival during the late winter. At an earlier stage of the war the Germans had had some success with what were called on the British side 'intruder' patrols.² After a long intermission, apparently due to Hitler's poor opinion of such ventures, plans for an elaborate series of attacks on returning British bombers and their bases were laid in February, 1945. Until the third week of the month, no piloted German aircraft had been reported over the United Kingdom since August, 1944, and only one or two since June. On the night of the 21st a single German aircraft was tracked over the country; and on that of 3rd March about 140 set off to visit British aerodromes from Northumberland to Oxfordshire. Some eighty to a hundred crossed the East Coast, bombed fourteen

¹ For more precise figures see Appendix L, which also gives the numbers of casualties inflicted throughout the war by orthodox bombing, by flying bombs and by cross-Channel guns.

² See pp. 274-275 and 317-318.

aerodromes and attacked others with machine-guns and cannon fire, and shot down about a score of British bombers near their bases. Similar raids were launched, on a much smaller scale, on the next night and on those of the 17th and 20th. About twenty German aircraft succumbed to the defences on the four nights. Thereafter no more of these raids were made, largely, it would seem, because the Führer grudged the effort spent on attempts to shoot down British aircraft in places where his compatriots could not be heartened by witnessing their fall. When the descent of the last flying bomb on British soil followed the launching of the last rocket, the United Kingdom thus had nothing more to fear from either piloted aircraft or long-range missiles.

The risk of invasion or of raids by seaborne or airborne forces, long admitted to be slight, had meanwhile grown still slighter as the Anglo-American armies advanced to the gates of Germany and consolidated the positions they had won. By the early part of 1945 no threat was held to remain except, perhaps, to the south-east coast and to the country's principal naval bases, which might conceivably become objectives for some venture launched as a final desperate gamble. At that time, therefore, certain reductions, over and above those approved in the spring of 1944 and extended later in the year, were put in hand, and some coast defence formations, now mostly composed of older men, were reorganised as Garrison Regiments and sent abroad. With the final collapse of Germany and the end of the fear that intransigent elements might seek to carry on the war by guerrilla methods, even that risk disappeared. The war in the Far East was not yet over, but Japan was even now within sight of defeat. In any case, no direct assault need be feared from a quarter so remote. Accordingly, in June the last of the remaining coast defence batteries was relegated to 'care and maintenance'. Thereafter such formations concerned with home defence, at sea, on land or in the air, as still remained in being turned to unfamiliar tasks of retrenchment and reorganisation. The freedom from tension seemed strange after more than seven years of imminent or present danger; and doubly strange to many who, while never doubting that peace with victory must come at last, had hitherto looked upon it as an almost unattainable deliverance.

CHAPTER XXVI

A SUMMING-UP

SOMETIMES in detail and sometimes in broad outline, we have now traced through twenty-five chapters the rise of the home defences from the trough where retrenchment left them after the First World War to the peak attained about the end of 1942. We have also noted their subsequent curtailment—partly offset by growing experience and improved equipment—in the interests of offensive action. We have watched their response to the threat of invasion or lesser raids by seaborne or airborne troops, and to the reality of bombardment by a variety of missiles. We have glanced—perhaps more briefly than the relevance of the subject to our theme may seem to warrant, since the war at sea is the province of other volumes in this series—at the struggle to maintain the sea communications linking an island kingdom with the outer world and one home port with another. What conclusions, if any, can be drawn from our account of events which brought to the people of Great Britain not only the most obvious threat to their security since the Spanish Armada appeared off Plymouth, but also the most poignant tribulations suffered by large numbers of them since the devastations wrought by the vast epidemics of the past?

In the first place, clearly any such conclusions can be only tentative. Military history is not an exact science; and military operations are frequently unscientific. Moreover, any judgement attempted at the present stage must needs be coloured by the deceptive glow which emanates from the live embers of controversy. When the fire has burnt out, when time has blurred an outline too sharply fretted with absorbing detail to reveal the essential structure, posterity—should the popular estimate of posterity's sagacity prove just, and should posterity find leisure and inclination for such studies—may perhaps deliver a less partial verdict.

A further difficulty is that such an enquiry must either lead us beyond the limits assigned to the present volume, or ignore much that may seem relevant. Ultimately the state of the home defences before the war was governed by the views of statesmen whose deepest motives could not always be disclosed. To sift those motives is outside our province; to pass them over may mislead. If much that follows seems critical of those who shaped the national policy during the last years of peace, it should be remembered that the circumstances of the time left room for a sincere conviction that another great war,

irrespective of its outcome, might be disastrous to the interests of the nation and the Commonwealth. On that ground alone, the risk of unpreparedness might well seem more acceptable than that arising from any action thought likely to precipitate hostilities.

One thing is certain. If war, and the threat of war, found the national defences less than ready, the fault did not lie in any failure to consider the problems which those contingencies would bring. In the Committee of Imperial Defence and its sub-committees the country possessed a well-trying instrument for the discussion of such issues; and it is hard to think of any important aspect of readiness for war which was not in fact discussed by some part of that body between 1919 and 1939. Time and again, however, limitations imposed by governmental policy either robbed discussion of reality, or marred the implementation of conclusions reached. Some critics have argued that the leaders of the fighting services ought to have insisted, to the point of resignation, on greater readiness; but that, too, is an issue we are not called upon to consider. We need only recall that—mainly in consequence of such restrictions, although unresolved technical and professional issues also played some part—the failure of the disarmament policy in the 'thirties found the air defences weak and the coast defences weaker; the country unable to maintain its traditional policy of keeping a possible aggressor at a distance by helping to secure the Low Countries; and the navy scarcely in a position to perform its customary tasks. There was still time to repair these weaknesses; but much of it was lost by the refusal of the Government, on financial grounds, to adopt the plan drawn up by its advisers. When war did come, the navy and the air defences, though still lacking much, were usefully strong; an Expeditionary Force was ready for despatch to the Continent, but the decision to send it had been so long delayed that friends and potential enemies alike may well have wondered whether we meant to fight at all; and the coast defences soon demanded such additions that their earlier neglect can scarcely be reckoned an economy.

We have said that virtually every major aspect of national defence received attention during the two decades which preceded the Second World War. It would, however, be too much to expect that, even where dangerous political assumptions did not militate against sound thinking, the conclusions reached by the Committee of Imperial Defence and the staffs of the fighting services should always have stood the test of practice. In so unpredictable a field, human liability to prejudice and error, financial and other barriers to realistic experiment, and perhaps reluctance to make trials which might prove misleading, were bound to produce some false assessments. For example, the notion that a potential disturber of the peace could be deterred by plans to build a British bomber force of 43, 70, 73 or

even 85 squadrons would doubtless have seemed less attractive to statesmen if professional opinion had not overestimated the results that bombing by methods then contemplated could achieve. When war came, experience soon showed that, even at its planned strength, the bomber force would not have been equal to all the tasks envisaged for it by the Air Staff. Ultimately bombing became a potent weapon of Allied strategy; but only after methods of navigation, target-finding and damage-assessment had been radically altered to meet conditions very different from those expected. Fortunately the claims made by extreme adherents of the bomber school were not allowed to check the growth of the purely defensive system which, in practice, alone prevented the enemy from gaining air superiority over southern England at the crucial moment.

Again, much pre-war thinking about the risks and possibilities of invasion may seem questionable in the light of subsequent experience. The assumption that invasion was unlikely while the Low Countries and the Channel ports remained in friendly or neutral hands was reasonable enough; the belief that, if it were attempted, the invader could be bombed or shelled to destruction by obsolete coast defences, an inexperienced bomber force and a navy not assured of adequate warning seems harder to justify. On the other hand—and notwithstanding the lesson of Norway—there was much in the argument that an invader, even if not intercepted, could be defeated by disruption of his communications. Yet we have seen that, when war came—and long before the Low Countries or the Channel ports were in German hands—the Government felt bound to revise their assessment of the risk and to approve new measures which, in turn, were found far short of apparent needs when Holland, Belgium and then France fell with unexpected swiftness. The reader may wonder, perhaps, how far implicit assumptions about the security of the Low Countries and the Channel ports were ever justified in view of facts apparent to many travellers, but not reflected in a grand strategy postulating stern resistance to a ruthless enemy by countries notoriously unwilling to commit themselves to war, or torn by social conflict.

Other examples of incomplete foresight are not lacking. If, in general, the effectiveness of bombing was overestimated, the threat which air attack would present to shipping, including naval vessels, was at times assessed too lightly. The dangers of submarine attack, with all its consequences for home defence, were obscured by undue confidence in a counter-measure which proved valuable but not invincible. Adequate arrangements for air reconnaissance and the interpretation of air photographs were not made until the eleventh hour or later. Maritime defence, in its twin aspects of trade defence and defence against invasion, called for special air units available

only in derisory numbers, or not at all, on the outbreak of hostilities. The dangers of air attack with incendiary bombs were painstakingly considered, but the special case of the building normally unoccupied at night seems unaccountably to have had less than its due share of attention. The Expeditionary Force's need of fighter aircraft to clear a way for its tactical bombers and reconnaissance machines, if not overlooked, was at any rate so inadequately met that attempts to repair the omission threatened at one stage fatally to weaken the home front. Finally the events of 1940 revealed what seem manifest defects in the tactical and strategic doctrines on which the training and equipment of troops available for home defence were grounded. Admittedly the immediate causes of many shortages at home were the preference justly given to the Expeditionary Force, and the abandonment by that force of much of its equipment; but the very fact that, until a crisis seemed imminent, units not only deficient in anti-tank guns and modern field guns, and with little armour to support them, but generally lacking in mobility and inadequately schooled in offensive tactics, should apparently have been considered good enough for home defence, reveals the vastness of the gap between the threat which appeared in 1940, and previous estimates of the form that such a contingency might take.

Despite such lapses, the dominant emotion left by study of the multitudinous records which commemorate the work of countless staff officers, civil servants and others who laboured in the field of national defence between the wars is one of admiration for their skill and diligence. Often with little practical support from statesmen who begrudged the cost of testing or implementing their proposals, always with the knowledge that the bulk of their fellow-citizens, if aware of their activities, would be as ready to condemn them in peacetime for wasting the country's time on academic issues as to upbraid them in wartime if those issues proved not to have been studied, they struggled manfully with material often baffling in its vagueness, toiling obscurely to distil an ounce of truth from a hog's-head of hypothesis. That—to change the metaphor—they sometimes took the wrong path through the maze of assumption, misinformation, false inference and conjecture in which their feet were often set need not surprise us. The historian may feel it his duty to call attention to their lapses; the citizen may still be grateful that so much was done, and not a little astonished that so much was thought of. A similar tribute is due to many regimental officers, scientists and others whose labours in the field provided the staffs and committees with some of their best data. The public, generally critical of the work of the defence services in peacetime, little realises, perhaps, how much it owes to such experiments as those made with acoustic mirrors, which, if they led to no positive outcome, at least showed

that some better method of detecting the approach of unauthorised aircraft was required.

So much for a tentative judgement—framed, as it must be, in the light of after-knowledge, but tempered by an effort to discount factors which the authorities could not be expected to foresee—of some of the broader aspects of pre-war planning. It remains to recapitulate the salient events of the next few years, and to see what further lessons can be drawn from them. In such a review some repetition of points already made can scarcely be avoided.

The first few months of war brought many threats to our sea communications, including the magnetic mine, the submarine and air attack. None of these was altogether unforeseen; but counter-measures to the magnetic mine had been crowded out by more urgent preoccupations, the seriousness of the problem of air attack on shipping had been recognised too late for full provision against it to be made in pre-war plans of air expansion, and the true extent of the underwater menace was not yet apparent. Personal skill and courage, readiness to experiment, refusal to be daunted by orthodox objections, and the navy's accumulated technical experience, assisted by the enemy's mistakes, all played their parts in overcoming the first danger. The other two were held in check but would soon recur in more acute form. Convoy escort made heavy demands on the relatively few ships and aircraft available for the purpose, and protection of coastwise shipping—whether by escort or otherwise—saddled the air defences with an unwelcome burden.

Another lesson soon learnt was that the Home Fleet's principal base at Scapa Flow was not secure against air and submarine attack. Furthermore, the system of air reconnaissance devised before the war was found incapable of preventing excursions from the North Sea by German commerce-raiders. At the same time, attempts by British bombers to sink or damage German warships proved extremely disappointing. The consequences included temporary removal of the Home Fleet to less convenient stations; wide dispersal of Allied naval forces for the purpose of hunting down ships which had escaped our vigilance; and a new estimate of the chances of invasion.

The much-feared 'knock-out blow' from the air was not attempted by the Germans, who still hoped to reach an accommodation with this country, and whose aims would have been little forwarded by such a blow in the absence of plans to follow it up by military occupation. The air defences made good use of the respite to add to and improve their technical equipment; but the threat to coastwise shipping and home ports, including Scapa Flow, and the just claims of the growing Expeditionary Force in France to additional air support, compelled the Air Ministry to form new fighter squadrons at some detriment to their plans for expansion of Bomber Command.

Reports that the Luftwaffe contemplated additions to its anti-*shipping* force and extension of its activities to more distant waters provided further arguments for enlargement of the air defences. In the early part of 1940 the Air Staff sanctioned substantial additions to Fighter Command's ground organization, and faced, with some dismay, a strong case for the creation of yet more fighter squadrons. Meanwhile the commander of the air defences, never doubting that sooner or later he would have to fight a major battle, was insistent in his demand that attention to his needs should not be prejudiced by the claims of a bomber force and an Expeditionary force which could do nothing to restore the country's fortunes if he failed to win it.

The lesson of Norway for home defence was plain enough. Norwegian waters in early spring were a battleground which might have been expected to favour the Royal Navy, with its long tradition of expert seamanship and indifference to bad weather; yet Hitler was able to land troops in Norway, and supply them, in the teeth of superior Allied surface strength. The demonstration of German air power and its effects was formidable, but at least we had the satisfaction of knowing that the air defences of the United Kingdom were much stronger than those of Norway. Even so, the experience was a bitter draught for Britons schooled in the belief that control of the North Sea was their prerogative. The most important consequence was a change of government which assigned the leading place to a statesman uniquely qualified to strengthen and sustain the national will through much worse trials soon to come.

In May the Germans opened their offensive against France and the Low Countries. One by one, in swift succession, their remaining opponents on the European mainland were overwhelmed. In a few weeks Britain stood alone. The flower of the British Army, having narrowly escaped destruction at Dunkirk, was back in the United Kingdom; but the forces at home were woefully deficient in field guns, anti-tank guns, tanks and transport. To the ordinary citizen it might well seem that nothing could now stop the enemy from seizing the country almost when he pleased. The experts, recognising the physical magnitude of the task which faced the Germans, and observing that the British fighter force was undefeated, were more hopeful; but even they feared early landings which, if they stopped short of invasion, might well lead to it.

At this juncture the qualities which enabled the Prime Minister to instil into his countrymen something of his own courageous and defiant spirit were of incalculable value. A nation so led could not fail to resist to the utmost.

Meanwhile the Government had faced a stern choice between retention at home of enough fighter squadrons to give a reasonable chance of survival if the striking power of the Luftwaffe were turned

against this country, and compliance with a French request for ten more squadrons—over and above the equivalent of some seventeen already sent—to support a counter-attack by the Franco-British armies. Ministers were sympathetic to the claims of France; on the other hand fighters could contribute little to a counter-attack in the absence of the well-found tactical-bomber force which it would have been their business to support. It is, however, doubtful whether the last point was fully understood by all concerned. A warning from Air Chief Marshal Dowding that, even if no more squadrons went to France, continued losses at the existing rate would soon strip the better part of the fighter force of its equipment, followed by an eloquent reminder that, should the forces at home be too much weakened, defeat in France would entail the 'final, complete and irremediable defeat of this country', played the chief part in dissuading the Government from a useless sacrifice.

A retrospective judgement of the perils of the summer of 1940 is bound to differ in some respects from the contemporary view. We know to-day that virtually no preparations for a landing in this country were made by the Germans before July; and that the plan drawn up by the German Army in that month had to be radically altered before it was grudgingly accepted by the German Navy. This knowledge was not shared by contemporary observers. We also know that a successful landing was held by the enemy to be impossible unless the Luftwaffe could first win a major triumph in the air. That was, indeed, a reasonable assumption at the time; but not all British strategists were satisfied that other possibilities could be excluded. An attempted landing might not follow, but accompany, a bid for air superiority; and certainly that course might reasonably have been expected to appeal to an enemy who had shown himself willing to take risks in the interests of surprise. Thus it is understandable that some things were done during those months of trial which might have been safely left till later, or perhaps not done at all.

On the whole, however, it can scarcely be said that the precautions taken by the Government were excessive. The response to a hypothetical situation of a leader notoriously guided by intuition must needs be unpredictable; but nothing in the evidence leads us to suppose that Hitler would not have carried out the invasion plan if the stipulated air superiority had been achieved. For the Germans the crucial period began at the end of the first week in September, after the premature abandonment of attacks on sector-stations; and the historian has no reason to dissent from the prevailing view that the decisive factor was the series of actions fought by Air Vice-Marshal Park on the 15th of that month. The reception given to German bombers and escorting fighters on that day can have left the enemy with little room for illusions fostered by partial success on the

7th, 11th and 14th. Two days later an adverse verdict by the Führer, ending a period of hesitation, cost him his chance of landing on the one remaining day before October when moon and tide were favourable.

Thus the forecast of the Chiefs of Staff that survival might well turn on the air defences, and especially on the fighter force, proved justified. The deliverance was due largely to the skill and gallantry of fighter-pilots, the excellence of their machines, the hard-won achievements of anti-aircraft gunners often handicapped by poor equipment, and the devotion to duty of countless soldiers, airmen, and members of the Women's Auxiliary Air Force, the Auxiliary Territorial Service and other organisations which contributed patient labour or special knowledge. But these alone would not have ensured success. The great strength of the air defences lay in the ability of group commanders and controllers to draw conclusions from an early-warning system based essentially on radar. Had the system been less efficient, had its predictions proved less reliable, or too obscure for swift interpretation at times when every moment counted, the rest might have gone for very little. Accordingly we shall not be far wrong if we conclude that radar was possibly the best investment ever made by a British government.

Against the night attacks of September, 1940, to May, 1941, the air defences proved less effective. But the decision to give first place to measures of defence not specially applicable to night fighting was deliberately taken and was surely sound. The night 'Blitz' caused much hardship and injury to life and property; the day attacks of 1940, if not effectively repelled, would have brought disaster. Moreover, any substantial neglect of the 'chain home' radar stations in favour of the special devices designed to counter the night-bomber would have entailed weaknesses in the early-warning system fatal at all hours. As it was, the ineffectiveness of the night defences was no more than relative. If they failed to bring down many bombers while the offensive was at its peak, they did much to mar the accuracy of the attack by forcing the enemy to fly at awkward heights. Anti-aircraft guns, balloons and, to a smaller extent, night-fighters, all contributed to this tendency; and a combination of decoy-fires and counter-measures to German radio beams also saved much property and many lives by leading bombers away from their allotted targets.

During the summer and autumn of 1940, while his group commanders were busy with the daylight battle, Air Chief Marshal Dowding devoted much of his time to development of the special devices needed by fighters and anti-aircraft guns for dealing with the night bomber. His successor, Air Marshal Douglas, inherited a task which Dowding was forced to leave unfinished. Success, in the form of substantial losses inflicted on the attackers, remained elusive until

the 'Blitz' was almost over; thereafter night raids cost the enemy casualties which, though not prohibitive, limited him to favourable conditions and profoundly influenced his choice of targets. The 'Baedeker' raids of 1942, with the series of night attacks which followed in 1943, not only emphasised the protective value of anti-aircraft guns and balloon-barrages; they also showed how restricted was the class of objective which the German bomber force could now afford to tackle. Raids on London and other well-defended targets were indeed still made from time to time; but on most of these occasions either they were not pressed home, or casualties suffered by the attackers were uncomfortably heavy. Finally, in the 'Baby Blitz' of 1944, the defences inflicted punishment which brought the German striking force in the west to the verge of bankruptcy on the eve of the Allied landing in Normandy. Daylight 'tip-and-run' attacks in 1942 and 1943 set problems which taxed the ingenuity of the defenders and were never altogether solved; but such blows, aimed chiefly at seaside towns, were not, and could never have become, a major threat to the security of the United Kingdom.

Meanwhile the Government faced attempts to disrupt the country's sea communications by submarine and air attacks on shipping, accompanied at one stage by the raids on West Coast ports, and the general disturbance of distribution and supply, entailed by the closing phase of the 'Blitz'. The convoy system, already modified to meet conditions arising from the fall of France, now met a severe test. For home defence in the narrower sense which alone concerns us here, the most important issue after the security of the West Coast ports and the Port of London was the protection of coastwise convoys; for without this traffic a great part of the population would have gone short of commodities whose aggregate weight and bulk exceeded the capacity of roads and railways alone to carry. A fifteen-fold increase in the number of fighter sorties flown for the protection of shipping near the coast over the period November, 1940, to June, 1941, was followed by a marked decline in the number of ships sunk in daylight; but the problem of protection at night proved more stubborn. In any case the task imposed on the fighter force long spells of uneventful flying, which were uneconomic inasmuch as they made few demands on the initiative and high performance which the training of its pilots and the design of its machines envisaged. Although the patrols were certainly not wasted, the disproportionate amount of flying-time which they consumed lends some support to the argument of certain German officers that their superiors failed to grasp the opportunity which enlargement of their anti-shipping operations offered them. In the outcome, air attacks on coastwise convoys dwindled markedly as the Führer and his circle grew increasingly preoccupied with the campaign on the Eastern

Front; and by 1943 the commander of the Luftwaffe's anti-shipping forces in the west could complain, with some justification, that lack of support from above was depriving him of golden chances.

Effectively the threat of invasion was removed in October, 1940, when the enemy was forced to conclude that the postponements of September—to say nothing of the Luftwaffe's failure to win air superiority—had made a landing that year impossible. Revival of the project in the spring or early summer of 1941 was not ruled out, at any rate ostensibly. But by January, at the latest, Hitler's eyes were firmly fixed on Russia, whose subjugation would seem on the evidence of his published statements always to have been his main ambition. Within a few weeks of opening their attack in June the Germans were clearly so embroiled on the new front that an immediate invasion of the United Kingdom could be discounted. Failing to achieve their aims that summer, the German Army and the Luftwaffe suffered unexpected hardships during the ensuing winter; and when, in the following spring and summer, their hope of a swift advance to the Caucasus likewise faded, it was a fair assumption that large-scale landings in this country need not be expected for at least some twelve or eighteen months to come. Thereafter troops in the United Kingdom found themselves increasingly concerned with preparations for campaigns elsewhere, and particularly in making ready for the Allied assault on 'Fortress Europe'.

Apart from the ever-present threat to our sea communications, not only in home waters but in almost every quarter of the globe, the United Kingdom still faced the risk of air attack and of bombardment with new weapons. Night attacks on this country by orthodox bomber forces in 1943 accomplished little; and although the Luftwaffe resolved to try once more with the 'Baby Blitz' of 1944, it was natural that, as the desire to retaliate for Allied air attacks on German cities and factories grew more insistent, the enemy should turn with quickening hope to the newer instruments of long-range bombardment which his technicians and scientists were striving to perfect.

Alike to the strategist and to the humanitarian, the flying bomb must seem repugnant by virtue of an imprecision which made it suitably only for indiscriminate attacks on large centres of population such as London; even so, its ingenuity, simplicity and ease of manufacture compel reluctant admiration. For many reasons, the weapon failed to redeem more than a small part of its promise. In the first place, surprise was not secured, largely because of the skill of Allied photographic interpreters and the pertinacity of Allied secret agents, some of whom risked their lives repeatedly with little or no thought of personal gain. Thus the authorities were ready with a plan of defence, admittedly incommensurate with the situation which

developed, but susceptible of rapid modification and enlargement under the orders of a commander prompt to act and willing to shoulder responsibility for his decisions. Secondly, a defect unforeseen (and perhaps scarcely foreseeable) by the designers of the weapon reduced its speed and made it far more vulnerable than had been expected. Thirdly, the introduction of the missile was delayed by difficulties of development and production, augmented by certain fortuitous effects of the Allied air offensive against German industry. A programme of bombing expressly designed to hamper the completion of launching-sites for the bomb was successful inasmuch as it led to the abandonment of the sites; but this gain was offset by the enemy's early decision to build and use sites of another kind, which were not attacked until the flying-bomb campaign was under way. Had the weapon been ready earlier the enemy would not only have reaped such benefits as might have arisen from its use while the finishing touches were being put to Allied preparations to land in Normandy, but would probably have lost fewer bombs to the defences. The American-made radar set, the S.C.R. 584, which helped the anti-aircraft guns to do such good work from July onwards, did not begin to reach this country until the end of June, and probably its arrival could not in any circumstances have been much accelerated. As it was, nearly two-fifths of the bombs launched by the Germans were brought down by anti-aircraft fire, fighters or balloons, and fewer than a quarter reached Greater London.

The *A-4* rocket was a much more complex and expensive weapon. Some thirteen years of close experiment with long-range rockets preceded its introduction to active service in 1944; and even then its performance proved far from satisfactory. Of 1,403 rockets directed at this country, 288 failed to arrive within sight of our shores; and of 1,359 aimed at a point in Central London, only 517 descended within the huge area of the London Civil Defence Region. The poverty of these results was due almost wholly to technical defects or imperfect aiming; for effectively the only direct counter-measures taken by ourselves consisted of armed reconnaissance and bombing, which cannot have had much influence on the accuracy of the enemy's fire except insofar as they may have affected the second of these factors. Attempted destruction of the missiles by anti-aircraft fire was indeed suggested, but—perhaps regrettably from the point of view of technical interest—was not sanctioned by the Government in view of unpromising scientific estimates of the prospects of success. Even so, it would be quite wrong to conclude that the *A-4* rocket was a weapon to which the Allies had no answer. On the contrary, the air superiority which they commanded gave them the power of intervening effectively against the storage sites which the enemy would have needed to sustain a scale of attack substantially larger

than he in fact attempted. In the absence of such objectives, and while the rocket-offensive remained the hand-to-mouth affair which it always was, they would not have been justified in diverting much of their air effort from other tasks, perhaps at the cost of prolonging the war for days or weeks, and thus incurring casualties much heavier than those inflicted by the relatively few rockets fired with success. Or so at least the authorities maintained; and, although it may still be argued that a bigger effort against such objectives as offered themselves would have been worth making, it is fair to add that some of those whose immediate responsibilities led them to press most strongly for a bigger effort agreed afterwards that there was much to be said on the other side.

The termination of the flying-bomb and long-range rocket offensives in March, 1945, brought to the inhabitants of these islands relief from an ordeal so prolonged that at times an existence free from bombardment, or the immediate threat of it, had seemed hard to imagine. For years past no part of the population had been immune from the fear that death and destruction might suddenly shatter the accustomed order of home or work-place, parting a mother from her children or leaving a man to eke out the remainder of his days as a helpless cripple. Some corners of the kingdom had indeed been more exposed than others; Londoners in particular, enduring a much greater weight of bombing than any other city, and bearing the brunt of the *V-1* and *V-2* offensives, were at an obvious disadvantage. But no-one was quite safe, and all knew it.

Much has been written about the fortitude with which these dangers were borne; and perhaps to later generations, accustomed to the idea, if not to the reality, of more destructive weapons than any hitherto used against this country, some of it may seem exaggerated. The fact remains that the hardships (and not least the discomforts) of life under constant or intermittent fire were met with remarkable stoicism, and on the whole with remarkable cheerfulness, by men and women deprived of the traditional comfort of comradeship in arms, and often alternating laborious days with almost sleepless nights. The prediction of some publicists that subjection to air attack would soon lead ordinary men and women to urge their governments to sue for peace at any price was completely falsified. Much was due, no doubt, to confidence in the growing power of the air defences to hold the threat in check, and of Bomber Command to discomfit the opponent; much to the knowledge that an omnipresent Civil Defence service could be relied upon for speedy aid and succour; much to the wisdom of a governmental policy which did not seek to ignore or understate the hardships of the time, but to alleviate them where it could, and in any case to foster a spirit which would make them bearable. But the common man is yet entitled to

his word of praise. To allegations that more resolute statesmanship on the part of one British government or another while the issue of peace or war was yet in the balance might have averted a calamity whose effects are still felt in almost every European country, it has been retorted that popular feeling during the years of crisis was opposed to the measures which alone could have strengthened our diplomacy; but it cannot be said that, when faced with the consequences, the people of Britain were found wanting.

APPENDIX I

British Naval Forces in Home Waters

31st August, 1939

	<i>Capital Ships</i>	<i>Aircraft Carriers</i>	<i>Cruisers</i>	<i>Destroyers</i>
HOME FLEET				
(Admiral Sir Charles Forbes)				
Main Fleet				
Scapa Flow	<i>Nelson</i> <i>Rodney</i> <i>Royal Oak</i> <i>Royal Sovereign</i> <i>Ramillies</i> <i>Hood</i> <i>Repulse</i>	<i>Ark Royal</i>	<i>Aurora</i> <i>Sheffield</i> <i>Edinburgh</i> <i>Belfast</i> <i>Effingham</i> <i>Emerald</i> <i>Cardiff</i> <i>Dunedin</i> <i>Diomedé</i> <i>Dragon</i> <i>Calypso</i> <i>Caledon</i>	17
Rosyth		<i>Furious</i>		
Humber Force				
Humber			<i>Southampton</i> <i>Glasgow</i>	9
Channel Force				
Portland	<i>Resolution</i> <i>Revenge</i>	<i>Courageous</i> <i>Hermes</i>	<i>Ceres</i> <i>Caradoc</i> <i>Cairo</i>	9
ROSYTH COMMAND				
(Vice-Admiral C. G. Ramsey)				
Rosyth				8
NORE COMMAND				
(Admiral Sir Studholme Brownrigg)				
Dover				9
PORTSMOUTH COMMAND				
(Admiral Sir William James)				
Portsmouth				12
WESTERN APPROACHES COMMAND				
(Admiral Sir Martin Dunbar-Nasmith, V.C.)				
Plymouth				32

APPENDIX II

Equipment and Location of Coastal Command Squadrons 31st August, 1939

<i>Squadron</i>	<i>Equipment</i>	<i>War Station</i>
NO. 18 GROUP, DONIBRISTLE (ROSYTH)		
(Air Vice-Marshal C. D. Breese)		
201	London	Lerwick
209	Stranraer	Invergordon
240	London	Invergordon
224	Hudson	Leuchars
233	Anson	Montrose
269	Anson	Thornaby
608 (Auxiliary)	Anson	Thornaby
42	Vildebeeste	Thornaby
NO. 16 GROUP, CHATHAM		
(Air Commodore R. L. G. Marix)		
206	Anson	Bircham Newton
220	Anson	Bircham Newton
48	Anson	Thorney Island
500 (Auxiliary)	Anson	Detling
NO. 15 GROUP, MOUNT BATTEN (PLYMOUTH)		
(Air Commodore R. G. Parry)		
217	Anson	Warmwell
204	Sunderland	Mount Batten
502 (Auxiliary)	Anson	Aldergrove
210	Sunderland	Pembroke Dock
NON-OPERATIONAL SQUADRONS		
612 (Auxiliary)	Anson	—
22	Vildebeeste	—
228	London	—

NOTE

Standard establishments in terms of initial equipment (I.E.) and immediate reserve (I.R.) were:

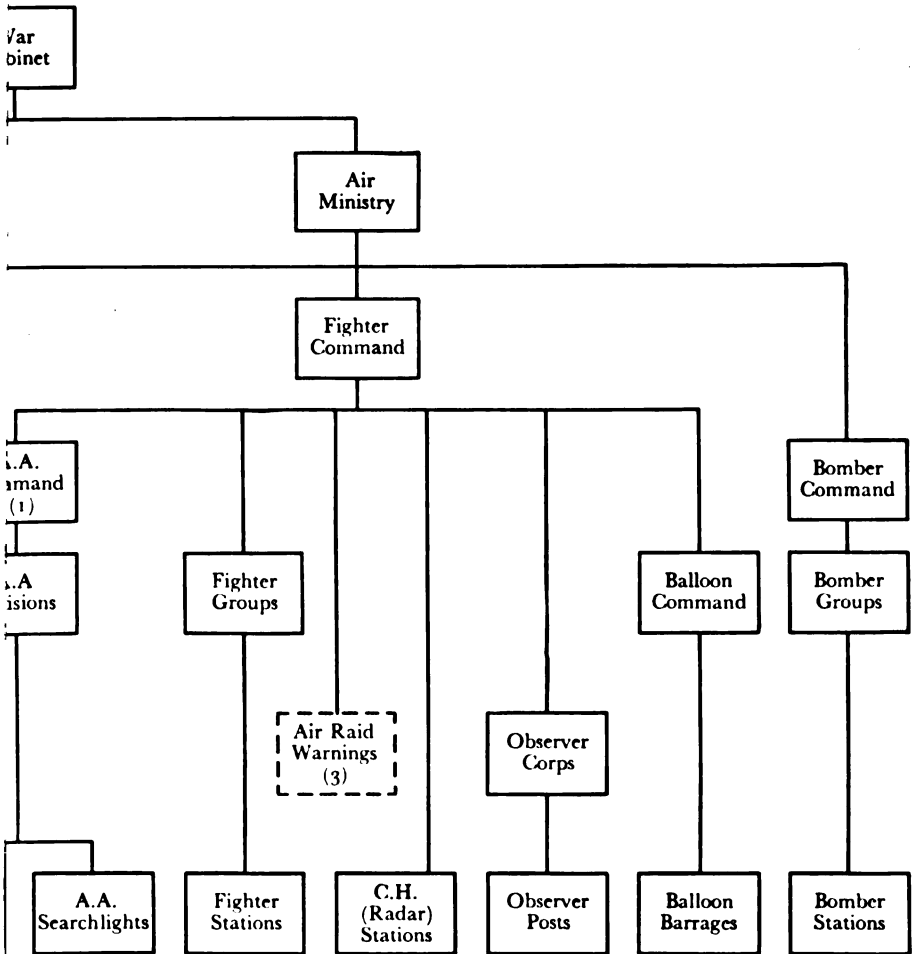
	<i>I.E.</i>	<i>I.R.</i>
General reconnaissance squadrons (Anson and Hudson)	18	6
Flying-boat squadrons (Sunderland, London and Stranraer)	6	2
Torpedo-bomber squadrons (Vildebeeste)	12	4

DIX III

Command, September 1939

STORY NOTE

Organisations concerned with substantially 'non-military' aspects of defence—such as censorship, propaganda and supply—have been omitted, as have a number of units which do not rigidly define relative status as between formations of different services, or



...ered by Fighter Command through No. 22 (Army Co-operation) Group.
...cellations disseminated through civil channels.

APPENDIX IV

British Capital Ships, 1st June, 1940

(Small capitals denote effective ships available in home waters; brackets denote temporary location)

	<i>Base</i>	<i>Remarks</i>
Home Waters		
RODNEY	Scapa Flow	Flagship
VALIANT	Scapa Flow	—
RENOWN	Scapa Flow	—
REPULSE	Scapa Flow	—
<i>Resolution</i>	Scapa Flow	Ordered to Western Approaches Command
<i>Nelson</i>	(Portsmouth)	Refitting
<i>Barham</i>	(Liverpool)	Refitting
<i>Hood</i>	(Liverpool)	Under repair and ordered abroad
Mediterranean Fleet		
<i>Warspite</i>	Alexandria	Flagship
<i>Malaya</i>	Alexandria	—
<i>Ramillies</i>	Alexandria	—
<i>Royal Sovereign</i>	Alexandria	—
Halifax Escort Force		
<i>Revenge</i>	Halifax	Left Clyde 30th May

APPENDIX V

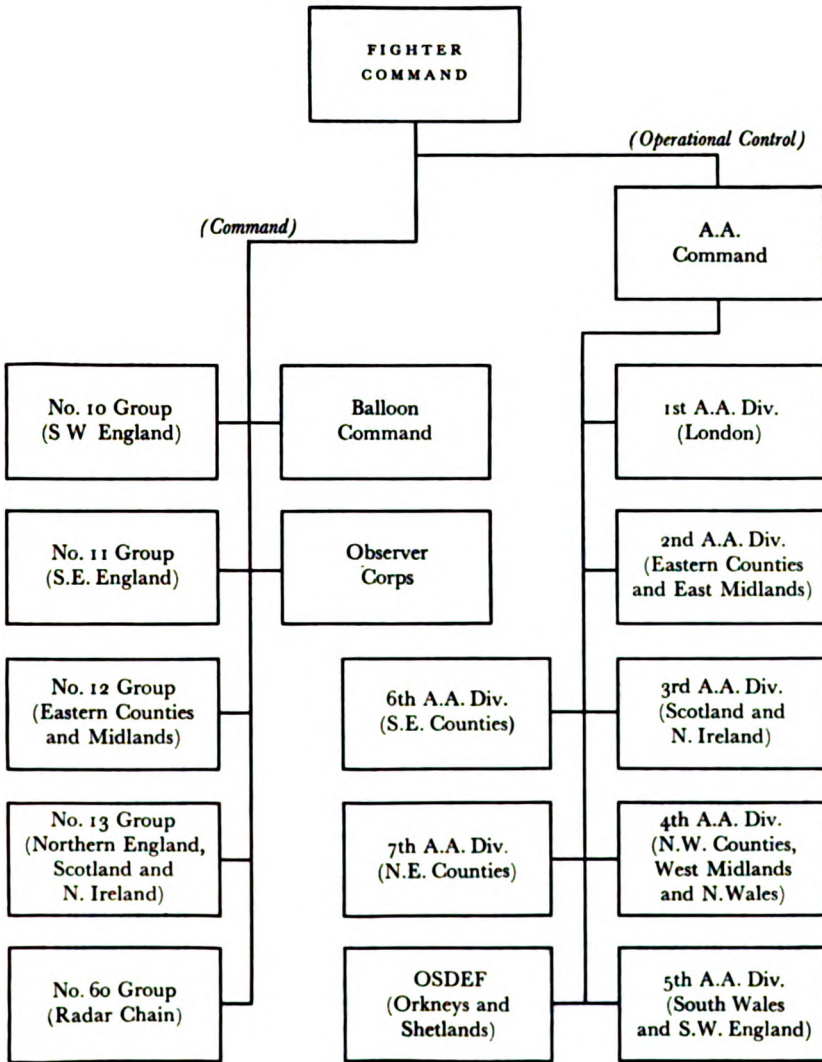
British Naval Forces in Home Waters, 1st July, 1940

(Brackets denote temporary location. The 12 destroyers at the Tyne included 10 of the Escort Force)

	<i>Capital Ships</i>	<i>Aircraft Carrier</i>	<i>Cruisers</i>	<i>Destroyers</i>
HOME FLEET				
(Admiral of the Fleet Sir Charles Forbes)				
Main Fleet				
Scapa Flow	<i>Nelson</i>		<i>Sussex</i>	9
	<i>Rodney</i>		<i>Norfolk</i>	
	<i>Renown</i>		<i>Southampton</i>	
	<i>Repulse</i>			
(Liverpool)	<i>Barham</i>			
Rosyth			<i>Birmingham</i>	
			<i>York</i>	
Iceland		<i>Argus</i>		2
Escort Duties				5
ROSYTH COMMAND				
(Vice-Admiral C. G. Ramsey)				
Tyne			<i>Coventry</i>	12
NORE COMMAND				
(Admiral the Hon. Sir R. Plunkett-Ernlé-Drax)				
Humber			<i>Newcastle</i>	7
			<i>Manchester</i>	
			<i>Sheffield</i>	
Harwich				9
Sheerness			<i>Cardiff</i>	3
DOVER COMMAND				
(Vice-Admiral Sir Bertram Ramsay)				
Dover				5
PORTSMOUTH COMMAND				
(Admiral Sir William James)				
Portsmouth				5
WESTERN APPROACHES COMMAND				
(Admiral Sir Martin Dunbar-Nasmith, V.C.)				
Escort Duties			<i>Galatea</i>	23

APPENDIX VI

Organisation of the Air Defences, Summer 1940



APPENDIX VII

Equipment and Location of British Fighter Squadrons 9th July, 1940

<i>Squadron</i>	<i>Equipment</i>	<i>War Station</i>
NO. 10 GROUP, RUDLOE, NR. BATH		
(Air Vice-Marshal Sir Quintin Brand)		
<i>Pembrey Sector</i>		
92	Spitfire	Pembrey
<i>Filton Sector</i>		
87	Hurricane	Exeter
213	Hurricane	Exeter
<i>St. Eval Sector</i>		
234	Spitfire	St. Eval
NO. 11 GROUP, UXBRIDGE		
(Air Vice-Marshal K. R. Park)		
<i>Middle Wallop Sector</i>		
609 (West Riding)	Spitfire	Middle Wallop
238	Hurricane	Warmwell
501 (County of Gloucester)	Hurricane	Warmwell
<i>Tangmere Sector</i>		
43	Hurricane	Tangmere
145	Hurricane	Tangmere
601 (County of London)	Hurricane	Tangmere
<i>Kenley Sector</i>		
64	Spitfire	Kenley
615 (Auxiliary)	Hurricane	Kenley
111	Hurricane	Croydon
<i>Biggin Hill Sector</i>		
32	Hurricane	Biggin Hill
610 (County of Chester)	Spitfire	Biggin Hill
79	Hurricane	Hawkinge
604 (County of Middlesex)	Blenheim	Gravesend
<i>Hornchurch Sector</i>		
65	Spitfire	Hornchurch
74	Spitfire	Hornchurch
600 (City of London)	Blenheim	Manston
54	Spitfire	Rochford

<i>Squadron</i>	<i>Equipment</i>	<i>War Station</i>
<i>Northolt Sector</i>		
1	Hurricane	Northolt
257	Hurricane	Northolt
<i>North Weald Sector</i>		
56	Hurricane	North Weald
151	Hurricane	North Weald
25	Blenheim	Martlesham Heath
NO. 12 GROUP, WATNALL, NR. NOTTINGHAM (Air Vice-Marshal T. L. Leigh-Mallory)		
<i>Debden Sector</i>		
85	Hurricane	Debden
17	Hurricane	Debden
<i>Duxford Sector</i>		
19	Spitfire	Duxford
264	Defiant	Duxford
<i>Coltishall Sector</i>		
66	Spitfire	Coltishall
242	Hurricane	Coltishall
<i>Wittering Sector</i>		
266	Spitfire	Wittering
229	Hurricane	Wittering
23	Blenheim	Wittering
<i>Digby Sector</i>		
611 (West Lancashire)	Spitfire	Digby
46	Hurricane	Digby
29	Blenheim	Digby
<i>Kirton-in-Lindsey Sector</i>		
222	Spitfire	Kirton-in- Lindsey
253	Hurricane	Kirton-in- Lindsey
NO. 13 GROUP, NEWCASTLE-ON-TYNE (Air Vice-Marshal R. E. Saul)		
<i>Church Fenton Sector</i>		
73	Hurricane	Church Fenton
616 (South Yorkshire)	Spitfire	Leconfield
249	Hurricane	Leconfield

APPENDIX VII

<i>Squadron</i>	<i>Equipment</i>	<i>War Station</i>
<i>Catterick Sector</i>		
41	Spitfire	Catterick
219	Blenheim	Catterick
<i>Usworth Sector</i>		
72	Spitfire	Acklington
152	Spitfire	Acklington
<i>Turnhouse Sector</i>		
245	Hurricane	Turnhouse
603 (City of Edinburgh)	Spitfire	Turnhouse and Montrose
141	Defiant	Turnhouse
602 (City of Glasgow)	Spitfire	Drem
605 (County of Warwick)	Hurricane	Drem
<i>Wick Sector</i>		
3	Hurricane	Wick
504 (County of Nottingham)	Hurricane	Wick

NON-OPERATIONAL SQUADRONS

(Forming or re-equipping)

238	Hurricane	Middle Wallop
1 (Royal Canadian Air Force)	Hurricane	Middle Wallop
607 (Auxiliary)	Hurricane	Usworth
263	Hurricane	Grangemouth

NOTE

The normal establishment of a fighter squadron comprised 26 pilots, an initial equipment of sixteen aircraft, and a small immediate reserve (usually from three to five aircraft). When operating as a tactical formation a squadron flew normally at a strength of twelve aircraft. Alternatively a squadron might operate as two flights each of six aircraft, or as four sections each of three aircraft. As an emergency measure four aircraft were added to the establishment of each of 30 Hurricane and six Spitfire squadrons in the early summer of 1940. In theory this should have enabled each of the augmented squadrons to put an additional section into the air at moments of crisis; in practice their ability to do so was governed by the supply of pilots.

APPENDIX VIII

Equipment and Location of Balloon Squadrons, 31st July, 1940

<i>Squadron</i>	<i>Equipment</i>	<i>Location</i>
NO. 30 (BALLOON BARRAGE) GROUP, LONDON		
(Group Captain W. J. Y. Guilfoyle)		
<i>No. 1 Balloon Centre, Kidbrooke</i>		
901	45 balloons	Abbey Wood
902	45 balloons	Kidbrooke
952	40 balloons (32 waterborne)	Sheerness
961	24 balloons (8 waterborne)	Dover
<i>No. 2 Balloon Centre, Hook, Surrey</i>		
903	45 balloons	Forest Hill
904	45 balloons	Clapham
905	45 balloons	Kensington
<i>No. 3 Balloon Centre, Stanmore</i>		
906	45 balloons	Hampstead
907	45 balloons	Woodberry Down
956	24 balloons	Colnbrook
<i>No. 4 Balloon Centre, Chigwell</i>		
908	45 balloons	Metropolis
909	45 balloons	East Ham
910	45 balloons (3 waterborne)	Dagenham
928	24 balloons (10 waterborne)	Harwich
NO. 31 (BALLOON BARRAGE) GROUP, BIRMINGHAM		
(Air Commodore J. C. Quinnell)		
<i>No. 5 Balloon Centre, Sutton Coldfield</i>		
911	48 balloons	West Bromwich
913	40 balloons	Sutton Coldfield
<i>No. 6 Balloon Centre, Wythall</i>		
914	40 balloons	Northfield
915	40 balloons	Rowkeath
916	32 balloons	Coventry
917	24 balloons	Coventry

APPENDIX VIII

<i>Squadron</i>	<i>Equipment</i>	<i>Location</i>
	<i>No. 7 Balloon Centre, Alvaston, Derby</i>	
918	32 balloons	Alvaston
	<i>No. 8 Balloon Centre, Fazakerley</i>	
919	52 balloons (12 waterborne)	Birkenhead
	<i>No. 9 Balloon Centre, Warrington</i>	
922	32 balloons	Cuerdley
923	32 balloons	Runcorn
949	32 balloons	Crewe
	<i>No. 10 Balloon Centre, Manchester</i>	
925	40 balloons	Manchester and Bowlee
926	40 balloons	Bowlee
	NO. 32 (BALLOON BARRAGE) GROUP, ROMSEY (Air Commodore A. A. Walser)	
	<i>No. 11 Balloon Centre, Bristol</i>	
912	24 balloons	Brockworth
927	32 balloons	Bristol
935	24 balloons	Filton
951	40 balloons	Bristol
957	24 balloons	Yeovil
	<i>No. 12 Balloon Centre, Fareham</i>	
924	24 balloons	Eastleigh
930	50 balloons (10 waterborne)	Southampton
932	32 balloons	Portsmouth
933	24 balloons	Gosport
	<i>No. 13 Balloon Centre, Plymouth</i>	
934	24 balloons	Plymouth
	<i>No. 14 Balloon Centre, Cardiff</i>	
953	39 balloons (7 waterborne)	Cotterell
	NO. 33 (BALLOON BARRAGE) GROUP, SHEFFIELD (Air Commodore S. W. Smith)	
	<i>No. 15 Balloon Centre, Newcastle</i>	
936	40 balloons (4 waterborne)	Benton
937	32 balloons (3 waterborne)	South Tyne
938	48 balloons	Billingham

<i>Squadron</i>	<i>Equipment</i>	<i>Location</i>
<i>No. 16 Balloon Centre, Sheffield</i>		
939	40 balloons	Sheffield
940	32 balloons	Rotherham
<i>No. 17 Balloon Centre, Sutton-on-Hull</i>		
942	42 balloons (24 waterborne)	Hull
943	32 balloons	Hull
NO. 34 (BALLOON BARRAGE) GROUP, EDINBURGH (Group Captain H. R. Busted)		
<i>No. 18 Balloon Centre, Glasgow</i>		
929	24 balloons (7 waterborne)	South Queensferry
945	40 balloons	Glasgow
946	48 balloons	Renfrew
947	32 balloons	Glasgow
948	24 balloons	Rosyth
<i>Under Group Command</i>		
920	16 balloons (11 waterborne)	Kyle of Lochalsh
950	32 balloons	Lyness
NON-OPERATIONAL SQUADRONS (FORMING AS MOBILE SQUADRONS)		
958	(32 balloons)	Cardington
959	(24 balloons)	Cardington

NOTE

The foregoing figures represent the authorised establishment (initial equipment) of the operational squadrons, and total 1,865 balloons. In fact, the operational squadrons held 1,466 balloons.

APPENDIX IX

Disposition of Anti-aircraft guns, 11th July, 1940

(HAA = heavy anti-aircraft guns; LAA = light anti-aircraft guns, including some 3-inch guns employed in that role; AA LMGs = Lewis and Hispano machine-guns employed against aircraft.)

	<i>HAA</i>	<i>LAA</i>	<i>AA LMGs</i>
1ST AA DIVISION			
(Major-General F. L. M. Crossman)			
London	92		
Langley (Slough)	28		
Hounslow	4		
Stanmore	4		
Aerodromes, vital points, etc.		34	183

2ND AA DIVISION			
(Major-General M. F. Grove-White)			
Leighton Buzzard	4		
Nottingham	16		
Derby	40		
Sheffield	23		
Humber	38		
Mobile Battery	8		
Aerodromes	20		
Aerodromes, vital points, etc.		82	788

3RD AA DIVISION AND OSDEF			
(Major-General L. R. Hill)			
Belfast	7		
Clyde	28		
Ardeer	4		
Kyle of Lochalsh	4		
Aberdeen	4		
Scapa Flow	88		
Shetlands	12		
Aerodromes	8		
Aerodromes, vital points, etc.		119	368

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APPENDIX IX

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HAA LAA

AA LMGs

4TH AA DIVISION

(Major-General C. A. E. Cadell)

Liverpool	52	
Manchester	20	
Crewe	8	
Birmingham	64	
Coventry	44	
Ringway Aerodrome	4	
Aerodromes, vital points, etc.	52	376

5TH AA DIVISION

(Major-General R. H. Allen)

Cardiff	12	
Newport	4	
Brockworth	36	
Bristol	36	
Falmouth	8	
Plymouth	18	
Portland	6	
Holton Heath	8	
Southampton	43	
Portsmouth	44	
Bramley	8	
Aerodromes	20	
Aerodromes, vital points, etc.	136	560

6TH AA DIVISION

(Major-General F. G. Hyland)

Dover	18	
Thames and Medway South	70	
Thames and Medway North	46	
Harwich	17	
Aerodromes	37	
Aerodromes, vital points, etc.	101	437

7TH AA DIVISION

(Major-General R. B. Pargiter)

Leeds	20	
Tees	30	
Tyne	54	
Aerodromes	14	
Aerodromes, vital points, etc.	50	321

APPENDIX X

The Battle of Britain: The Preliminary Phase Summary of Operations, 10th July to 12th August, 1940

<i>Date</i>	<i>Main Events</i>	<i>Day sorties by Fighter Command</i>	<i>British fighter losses (24 hours)</i>	<i>German losses (24 hours)</i>
10th July	Rather heavy attacks on shipping.	609	6	13
11th July	Rather heavy attacks on ports and shipping.	432	4	20
12th July	Attacks on ports and shipping.	670	6	7
13th July	Attacks on shipping.	449	1	7
14th July	Attacks on shipping.	593	4	2
15th July	Numerous attacks on shipping.	470	1	3
16th July	Bad weather; little activity.	313	2	3
17th July	Indifferent weather; some attacks on shipping and other targets.	253	1	2
18th July	Attacks on ports and shipping.	549	3	4
19th July	Attacks on Dover, leading to fierce combats in which Defiants of No. 141 Squadron suffered heavily.	701	8	2
20th July	Attacks on shipping at and off Dover and in Lyme Bay.	611	3	9
21st July	Attacks on shipping.	571	6	9
22nd July	A few attacks on ports and shipping.	611	—	1
23rd July	A few attacks on shipping and other targets.	470	—	3
24th July	Attacks on shipping; lively combats.	561	3	8
	<i>(Carried forward)</i>	7,863	48	93

APPENDIX X

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<i>Date</i>	<i>Main Events</i>	<i>Day sorties by Fighter Command</i>	<i>British fighter losses (24 hours)</i>	<i>German losses (24 hours)</i>
	<i>(Brought forward)</i>	7,863	48	93
25th July	Heavy and repeated attacks on shipping off Dover. British fighters frequently outnumbered.	641	7	18
26th July	Few attacks, but some lively combats.	581	2	4
27th July	Repeated attacks on shipping at and off Dover.	496	1	4
28th July	Few attacks, but some lively combats.	794	5	18
29th July	Rather heavy attacks on shipping at Dover and in Channel.	758	3	8
30th July	Attacks on shipping.	688	—	5
31st July	Attacks on shipping and on balloons at Dover.	395	3	5
1st August	Attacks on shipping.	659	1	9
2nd August	Attacks on shipping.	477	—	4
3rd August	Attacks on shipping.	415	—	4
4th August	Attacks on shipping.	261	—	—
5th August	Attacks on shipping.	402	1	6
6th August	Attacks on shipping.	416	1	1
7th August	Attacks on shipping.	393	—	2
8th August	Heavy attacks on shipping.	621	20*	31
9th August	Attacks on shipping.	409	4*	5
10th August	Attacks on shipping.	336	—	—
11th August	Heavy attacks on shipping, Portland and balloons at Dover.	679	32	38
12th August	Widespread attacks on shipping, radar stations, aerodromes and other targets.	732	22	31
		Totals 18,016	150	286

NOTE * Includes one at night.

APPENDIX XI

Strength and Serviceability of Luftwaffe Units deployed for Use against the United Kingdom, 10th August, 1940

	<i>Strength</i>	<i>Serviceable Aircraft</i>
<i>Luftflotten 2 and 3</i>		
Long-range bombers	1,232	875
Dive-bombers	406	316
Single-engined fighters	813	702
Twin-engined fighters and fighter-bombers	282	227
Long-range reconnaissance	65	45
<i>Luftflotte 5</i>		
Long-range bombers	138	123
Twin-engined fighters	37	34
Long-range reconnaissance	48	33

NOTE

In addition *Luftflotten 2* and *3* disposed of some 90 short-range reconnaissance machines; *Luftflotte 5* of 85 single-engined fighters for local defence.

APPENDIX XII

Equipment and Location of British Fighter Squadrons, 8th August, 1940

<i>Squadron</i>	<i>Equipment</i>	<i>War Station</i>
NO. 10 GROUP, RUDLOE, NR. BATH		
(Air Vice-Marshal Sir Quintin Brand)		
<i>Pembrey Sector</i>		
92	Spitfire	Pembrey
<i>Filton Sector</i>		
87	Hurricane	Exeter
213	Hurricane	Exeter
<i>St. Eval Sector</i>		
234	Spitfire	St. Eval
247	Gladiator	Roborough
(One flight only)		
<i>Middle Wallop Sector (formerly in No. 11 Group)</i>		
238	Hurricane	Middle Wallop
609 (West Riding)	Spitfire	Middle Wallop
604 (County of Middlesex)	Blenheim	Middle Wallop
152	Spitfire	Warmwell
NO. 11 GROUP, UXBRIDGE		
(Air Vice-Marshal K. R. Park)		
<i>Tangmere Sector</i>		
43	Hurricane	Tangmere
601 (County of London)	Hurricane	Tangmere
145	Hurricane	Westhampnett
<i>Kenley Sector</i>		
615 (Auxiliary)	Hurricane	Kenley
64	Spitfire	Kenley
111	Hurricane	Croydon
<i>Biggin Hill Sector</i>		
32	Hurricane	Biggin Hill
610 (County of Chester)	Spitfire	Biggin Hill
501 (County of Gloucester)	Hurricane	Gravesend
600 (City of London)	Blenheim	Manston

APPENDIX XII

<i>Squadron</i>	<i>Equipment</i>	<i>War Station</i>
<i>Hornchurch Sector</i>		
54	Spitfire	Hornchurch
65	Spitfire	Hornchurch
74	Spitfire	Hornchurch
41	Spitfire	Hornchurch
<i>Northolt Sector</i>		
1	Hurricane	Northolt
257	Hurricane	Northolt
<i>North Weald Sector</i>		
151	Hurricane	North Weald
56	Hurricane	Rochford
25	Blenheim	Martlesham
<i>Debden Sector (formerly in No. 12 Group)</i>		
17	Hurricane	Debden
85	Hurricane	Martlesham
NO. 12 GROUP, WATNALL, NR. NOTTINGHAM (Air Vice-Marshal T. L. Leigh-Mallory)		
<i>Duxford Sector</i>		
19	Spitfire	Duxford
<i>Coltishall Sector</i>		
242	Hurricane	Coltishall
66	Spitfire	Coltishall
<i>Wittering Sector</i>		
229	Hurricane	Wittering
266	Spitfire	Wittering
23	Blenheim	Colly Weston
<i>Digby Sector</i>		
46	Hurricane	Digby
611 (West Lancashire)	Spitfire	Digby
29	Blenheim	Digby
<i>Kirton-in-Lindsey Sector</i>		
222	Spitfire	Kirton-in-Lindsey
264	Defiant	Kirton-in-Lindsey and Ringway
<i>Church Fenton Sector (formerly in No. 13 Group)</i>		
73	Hurricane	Church Fenton
249	Hurricane	Church Fenton
616 (South Yorkshire)	Spitfire	Leconfield

<i>Squadron</i>	<i>Equipment</i>	<i>War Station</i>
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NO. 13 GROUP, NEWCASTLE-ON-TYNE

(Air Vice-Marshall R. E. Saul)

Catterick Sector

219	Blenheim	Catterick
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Usworth Sector

607 (Auxiliary)	Hurricane	Usworth
72	Spitfire	Acklington
79	Spitfire	Acklington

Turnhouse Sector

232 (One flight only)	Hurricane	Turnhouse
253	Hurricane	Turnhouse
605 (County of Warwick)	Hurricane	Drem
141	Defiant	Prestwick

Dyce Sector

603 (City of Edinburgh)	Spitfire	Dyce and Montrose
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Wick Sector

3	Hurricane	Wick
504 (County of Nottingham)	Hurricane	Castletown
232 (One flight only)	Hurricane	Sumburgh

Aldergrove Sector

245	Hurricane	Aldergrove
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MOVES OF SQUADRONS, 8TH-23RD AUGUST, 1940

- 9th August: No. 266 from Wittering to Hornchurch.
- 13th August: No. 602 (City of Glasgow) from non-operational to Westhampnett, exchanging with No. 145.
- 14th August: No. 74 from Hornchurch to Wittering; No. 249 from Church Fenton to Middle Wallop.
- 19th August: No. 616 (South Yorkshire) from Leconfield to Kenley, exchanging with No. 64; No. 85 from Debden Sector to Croydon, exchanging with No. 111; No. 17 from Debden to Tangmere, exchanging with No. 601 (County of London).
- 22nd August: No. 264 from Kirton-in-Lindsey to Hornchurch, exchanging with No. 266.

APPENDIX XIII

The Battle of Britain: The First Phase Summary of Operations, 13th to 23rd August, 1940

<i>Date</i>	<i>Main Events</i>	<i>Day Sorties by Fighter Command</i>	<i>British fighter losses (24 hours)</i>	<i>German losses (24 hours)</i>
13th August	'Eagle Day.' Luftwaffe flew 1,485 sorties. Co-ordinated attacks on aerodromes and other targets in South and South-East England.	700	13	45
14th August	Luftwaffe flew 489 sorties. Widespread attacks on aerodromes from Kent to Merseyside, including Manston and Middle Wallop.	494	8	19
15th August	Luftwaffe flew 1,786 sorties. Co-ordinated attacks by three <i>Luftflotten</i> on aerodromes and other targets in South, South-East and North-East England. Considerable damage at Lympne, Hawkinge, Martlesham, Driffield (Bomber Command), Middle Wallop, West Malling, and to operations room at Croydon.	974	34	75
16th August	Luftwaffe flew 1,715 sorties. Attacks on aerodromes in South and South-East England. Considerable damage at Tangmere.	776	21	45
17th August	Little activity.	288	—	3
	<i>(Carried forward)</i>	—	—	—
		3,232	76	187

APPENDIX XIII

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<i>Date</i>	<i>Main Events</i>	<i>Day sorties by Fighter Command</i>	<i>British fighter losses (24 hours)</i>	<i>German losses (24 hours)</i>
	<i>(Brought forward)</i>	3,232	76	187
18th August	Co-ordinated attacks on aerodromes in South and South-East England. Considerable damage at Kenley and at Poling radar station. No. 1 (Royal Canadian Air Force) Squadron made first operational patrol but were not in combat.	766	27	71
19th-23rd August	Minor activity.	2,416	11	32
		<u>6,414</u>	<u>114</u>	<u>290</u>

APPENDIX XIV

The Battle of Britain: The Second Phase Summary of Operations, 24th August to 6th September, 1940

<i>Date</i>	<i>Main Events</i>	<i>Sorties</i>		<i>Losses</i>	
		<i>F.C.</i>	<i>Luftwaffe</i>	<i>F.C.</i>	<i>Luftwaffe</i>
24th August	<i>Day.</i> Attacks on Ramsgate, Manston, Hornchurch, North Weald, Portsmouth. <i>Night.</i> Widespread but largely inaccurate attacks. Bombs on London, which was not among the intended targets.	936	1,030	22	38
25th August	<i>Day.</i> Attack on Warmwell. <i>Night.</i> Attacks on Birmingham and other targets.	45	170	16	20
26th August	<i>Day.</i> Attacks on Hornchurch (aerodrome missed), Debden, Portsmouth (ineffective). <i>Night.</i> Attacks on Birmingham and other targets, including Plymouth.	787	1,088	31	41
27th August	<i>Day.</i> Little activity. <i>Night.</i> Attacks on Midlands and elsewhere.	42	288	1	9
28th August	<i>Day.</i> Attacks on Eastchurch, Rochford. Fighter sweeps. <i>Night.</i> 160 bombers despatched against Liverpool-Birkenhead, 180 against other targets.	47	739	20	30
		22	340		
	<i>(Carried forward)</i>	3,430	4,369	90	138
		458			

Date	Main Events	Sorties		Losses	
		F.C.	Luftwaffe	F.C.	Luftwaffe
	(Brought forward)	3,430	4,369	90	138
29th August	Day. Fighter sweeps. Night. 176 bombers despatched against Liverpool-Birkenhead, 44 against other targets.	498	720	9	17
		28	220		
30th August	Day. Attacks on Biggin Hill, Luton, Detling. Night. 148 bombers despatched against Liverpool-Birkenhead, 112 against other targets.	1,054	1,345	26	36
		—	260		
31st August	Day. Attacks on Debden, Eastchurch, Croydon, Hornchurch, Biggin Hill. Night. 145 bombers despatched against Liverpool-Birkenhead, 25 against other targets.	978	1,450	39	41
		29	170		
1st Sept.	Day. Attacks on Tilbury, Biggin Hill, Detling. Night. Attacks on Swansea, Bristol and other targets.	661	640	15	14
		29	180		
2nd Sept.	Day. Attacks on Rochester, Lympne, Eastchurch, Detling, Hornchurch. Night. Minor activity.	751	972	31	35
		29	75		
3rd Sept.	Day. Attacks on North Weald, West Malling. Night. Attacks on Liverpool and other targets.	711	586	16	16
		34	90		
4th Sept.	Day. Attacks on Bradwell, Lympne,				
	(Carried forward)	8,232	11,077	226	297

APPENDIX XIV

<i>Date</i>	<i>Main Events</i>	<i>Sorties</i>		<i>Losses</i>	
		<i>F.C.</i>	<i>Luftwaffe</i>	<i>F.C.</i>	<i>Luftwaffe</i>
	<i>(Brought forward)</i>	8,232	11,077	226	297
4th Sept.	Eastchurch, Medway towns and Weybridge.	678	750	17	25
	<i>Night.</i> Attacks on Liverpool, Bristol and other targets.	20	197		
5th Sept.	<i>Day.</i> Attacks on Biggin Hill (ineffective), Thameshaven, Detling.	662	685	20	23
	<i>Night.</i> Attacks on Liverpool and London dock areas.	50	218		
6th Sept.	<i>Day.</i> Attacks on Weybridge, Medway towns, Thameshaven.	987	722	23	35
	<i>Night.</i> Attacks on London dock areas.	44	75		
		<u>10,673</u>	<u>13,724</u>	<u>286</u>	<u>380</u>

NOTE

Night sorties by Fighter Command include dusk and dawn patrols.

APPENDIX XV

Night Attacks on Liverpool–Birkenhead 28th to 31st August, 1940

(German Statistics)

<i>Night</i>	<i>Aircraft Despatched</i>	<i>Aircraft over Target</i>	<i>Tons of H.E.</i>	<i>Incendiary Canisters</i>
28th August	160	95	103	190
29th August	176	137	130	313
30th August	148	109	127	225
31st August	145	107	95	301
Totals	629	448	455	1,029
Averages	157	112	114	257

UNITS EMPLOYED

28th August: *KGr. 806; I, II, III/KG. 27; I/KG. 40; I, II, III/KG. 51; I, II, III/KG. 55; I, II, III/LG. 1.*

29th August: *KGr. 606; KGr. 806; KGr. 100; I, II, III/KG. 27; I/KG. 40; I, II, III/KG. 51; I, II, III/KG. 55; I, II, III/LG. 1.*

30th August: *KGr. 606; KGr. 806; KGr. 100; I, II, III/KG. 27; I/KG. 40; I, II, III/KG. 51; I, II/KG. 55; I, II, III/LG. 1.*

31st August: *KGr. 606; KGr. 806; KGr. 100; I, II, III/KG. 27; I/KG. 40; I, II, III/KG. 51; I, II, III/KG. 55; I, II/LG. 1.*

APPENDIX XVI

Coaching Mileage of the Four Main British Railway Companies, June–September, 1940

<i>Four Weeks Ending:</i>	<i>Coaching Traffic by the Thousand Miles</i>			
	<i>L.M.S.</i>	<i>L.N.E.R.</i>	<i>G.W.R.</i>	<i>S.R.</i>
13th July	1,347	996	632	867
10th August	1,351	981	613	863
7th September	1,349	977	614	847
5th October	1,298	937	619	677

APPENDIX XVII

Equipment, Strength, Serviceability and Location of Luftwaffe Units deployed for use against the United Kingdom, 7th September, 1940

(Short-range tactical-reconnaissance units excluded)

<i>Unit</i>	<i>Equipment</i>	<i>Strength</i>	<i>Serviceable aircraft</i>	<i>Location</i>
LUFTFLOTTE 2, BRUSSELS				
(Field-Marshal Kesselring)				
<i>Long-Range Bombers</i>				
<i>Stab. KG. 1</i>	Heinkel 111	7	5	Rosierès-en-Santerre
<i>I/KG. 1</i>	Heinkel 111	36	22	Montdidier and Clairmont
<i>II/KG. 1</i>	Heinkel 111	36	23	Montdidier and Nijmegen
<i>III/KG. 1</i>	Junkers 88	9	—	Rosierès-en-Santerre
<i>Stab. KG. 2</i>	Dornier 17	6	6	Saint-Leger
<i>I/KG. 2</i>	Dornier 17	19	12	Cambrai
<i>II/KG. 2</i>	Dornier 17	31	20	Saint-Leger
<i>III/KG. 2</i>	Dornier 17	30	20	Cambrai
<i>Stab. KG. 3</i>	Dornier 17	6	5	Le Culot
<i>I/KG. 3</i>	Dornier 17	29	25	Le Culot
<i>II/KG. 3</i>	Dornier 17	27	23	Antwerp/Deurne
<i>III/KG. 3</i>	Dornier 17	28	19	Saint-Trond
<i>Stab. KG. 4</i>	Heinkel 111	5	5	Soesterberg
<i>I/KG. 4</i>	Heinkel 111	37	16	Soesterberg
<i>II/KG. 4</i>	Heinkel 111	37	30	Eindhoven
<i>III/KG. 4</i>	Junkers 88	30	14	Amsterdam/Schipol
<i>Stab. KG. 26</i>	Heinkel 111	6	3	Gilze-Rijen
<i>I/KG. 26</i>	Heinkel 111	25	7	Moerbeke and Courtrai
<i>II, KG. 26</i>	Heinkel 111	26	7	Gilze-Rijen
<i>Stab. KG. 30</i>	Junkers 88	1	1	Brussels
<i>I/KG. 30</i>	Junkers 88	10	1	Brussels
<i>II/KG. 30</i>	Junkers 88	30	24	Gilze-Rijen
* <i>Stab. KG. 40</i>	Junkers 88	2	1	Bordeaux
<i>Stab. KG. 53</i>	Heinkel 111	5	3	Lille
<i>I/KG. 53</i>	Heinkel 111	23	19	Lille
<i>II, KG. 53</i>	Heinkel 111	29	7	Lille
<i>III KG. 53</i>	Heinkel 111	19	4	Lille
<i>Stab. KG. 76</i>	Dornier 17	6	3	Cormeilles-en-Vexin
<i>I/KG. 76</i>	Dornier 17	26	19	Beauvais/Tille
	(Carried forward)	581	344	

Unit	Equipment	Serviceable		Location
		Strength	aircraft	
	(Brought forward)	581	344	
II/KG. 76	Junkers 88	27	21	Creil
III/KG. 76	Dornier 17	24	17	Cormeilles-en-Vexin
Stab. KG. 77	Junkers 88	1	1	Laon
I/KG. 77	Junkers 88	36	31	Laon
II/KG. 77	Junkers 88	32	25	Asch (Nord)
III/KG. 77	Junkers 88	30	19	Laon
		<hr/>	<hr/>	
		731	458	
KGr. 126 (Minelayers)	Heinkel 111	33	26	
		<hr/>	<hr/>	
		764	484	

Dive-Bombers and Ground-Attack Aircraft

Stab. St.G. 1	Ju. 87 and Do. 17	7	5	Saint-Pol
II/St.G. 1	Junkers 87	43	29	Pas-de-Calais
Stab. St.G. 2	Ju. 87 and Do. 17	11	9	Tramecourt
II/St.G. 2	Junkers 87	27	22	Saint-Omer and Saint-Trond
IV (St.) LG. 1	Junkers 87	42	28	Tramecourt
*II (Schlacht) LG. 2	Messerschmitt 109	33	27	Saint-Omer
		<hr/>	<hr/>	
		163	120	

Single-Engined Fighters

Stab. JG. 1	Messerschmitt 109	4	3	Pas-de-Calais
Stab. JG. 3	Messerschmitt 109	3	3	Pas-de-Calais
I/JG. 3	Messerschmitt 109	23	14	Pas-de-Calais
II/JG. 3	Messerschmitt 109	24	21	Pas-de-Calais
III/JG. 3	Messerschmitt 109	25	23	Pas-de-Calais
Stab. JG. 26	Messerschmitt 109	4	3	Pas-de-Calais
I/JG. 26	Messerschmitt 109	27	20	Pas-de-Calais
II/JG. 26	Messerschmitt 109	32	28	Northern France
III/JG. 26	Messerschmitt 109	29	26	Northern France
Stab. JG. 27	Messerschmitt 109	5	4	Etaples
I/JG. 27	Messerschmitt 109	33	27	Etaples
II/JG. 27	Messerschmitt 109	37	33	Montreuil
III/JG. 27	Messerschmitt 109	31	27	Sempy
Stab. JG. 51	Messerschmitt 109	5	4	Saint-Omer
I/JG. 51	Messerschmitt 109	36	33	Saint-Omer and Saint-Inglevert
II/JG. 51	Messerschmitt 109	22	13	Saint-Omer and Saint-Inglevert
III/JG. 51	Messerschmitt 109	44	31	Pas-de-Calais
	(Carried forward)	<hr/>	<hr/>	
		384	313	

Unit	Equipment (Brought forward)	Strength	Serviceable		Location
			aircraft		
		384	313		
Stab. JG. 52	Messerschmitt 109	2	1		Laon/Couvron
I/JG. 52	Messerschmitt 109	21	17		Laon/Couvron
II/JG. 52	Messerschmitt 109	28	23		Pas-de-Calais
III/JG. 52	Messerschmitt 109	31	16		Pas-de-Calais
Stab. JG. 53	Messerschmitt 109	2	2		Northern France
II/JG. 53	Messerschmitt 109	33	24		Wissant
III/JG. 53	Messerschmitt 109	30	22		Northern France
Stab. JG. 54	Messerschmitt 109	4	2		South Holland
I/JG. 54	Messerschmitt 109	28	23		South Holland
II/JG. 54	Messerschmitt 109	35	27		South Holland
III/JG. 54	Messerschmitt 109	29	23		South Holland
I/JG. 77	Messerschmitt 109	42	40		Northern France
		<u>669</u>	<u>533</u>		
<i>Twin-Engined Fighters (Night-Fighters Excluded)</i>					
Stab. ZG. 2	Messerschmitt 110	1	—		...
I/ZG. 2	Messerschmitt 110	20	10		Amiens and Caen
II/ZG. 2	Messerschmitt 110	28	10		Guyancourt/Caudran
Stab. ZG. 26	Messerschmitt 110	3	3		...
I/ZG. 26	Messerschmitt 110	33	14		Abbeville and Saint-Omer
II/ZG. 26	Messerschmitt 110	25	17		Crécy-en-Ponthieu
III/ZG. 26	Messerschmitt 110	25	17		Barley and Arques
V(Z)LG. 1	Messerschmitt 110	23	19		Ligescourt and Alençon
*Gruppe 210	Messerschmitt 110 and 109	26	17		Denain
		<u>184</u>	<u>107</u>		
<i>Long-Range Reconnaissance Aircraft</i>					
1(F)/22	Do. 17 and Me. 110	13	9		Lille
1(F)/122	Junkers 88	5	3		Holland
2(F)/122	Ju. 88 and He. 111	10	9		Brussels, Melsbroek
3(F)/122	Ju. 88 and He. 111	11	10		Eindhoven
4(F)/122	Ju. 88, He. 111 and Me. 110	13	9		Brussels
5(F)/122	Ju. 88 and He. 111	11	11		Haute-Fontaine
		<u>63</u>	<u>51</u>		
<i>Coastal (Reconnaissance and Minelaying) Aircraft</i>					
1/106	Heinkel 115	10	4		Brittany
2/106	Dornier 18	9	6		Brittany
3/106	Heinkel 115	9	6		Borkum
		<u>28</u>	<u>16</u>		

<i>Unit</i>	<i>Equipment</i>	<i>Strength</i>	<i>Service- able aircraft</i>	<i>Location</i>
LUFTFLOTTE 3, SAINT-CLOUD				
(Field-Marshal Sperrle)				
<i>Long-Range Bombers</i>				
<i>Stab. LG. 1</i>	Junkers 88	3	3	Orléans/Bricy
<i>I/LG. 1</i>	Junkers 88	27	13	Orléans/Bricy
<i>II/LG. 1</i>	Junkers 88	31	19	Orléans/Bricy
<i>III/LG. 1</i>	Junkers 88	30	19	Châteaudun
<i>Stab. KG. 27</i>	Heinkel 111	7	4	Tours
<i>I/KG. 27</i>	Heinkel 111	35	13	Tours
<i>II/KG. 27</i>	Heinkel 111	32	15	Dinard and Bourges
<i>III/KG. 27</i>	Heinkel 111	20	13	Rennes
<i>*I/KG. 40</i>	Focke-Wulf 200	7	4	Bordeaux
<i>Stab. KG. 51</i>	Junkers 88	1	—	Orly
<i>I/KG. 51</i>	Junkers 88	33	13	Melun
<i>II/KG. 51</i>	Junkers 88	34	17	Orly
<i>III/KG. 51</i>	Junkers 88	34	27	Etampes
<i>Stab. KG. 54</i>	Junkers 88	1	—	Evreux
<i>I/KG. 54</i>	Junkers 88	30	18	Evreux
<i>II/KG. 54</i>	Junkers 88	26	14	St. André-de-l'Eure
<i>Stab. KG. 55</i>	Heinkel 111	6	6	Villacoublay
<i>I/KG. 55</i>	Heinkel 111	27	20	Dreux
<i>II/KG. 55</i>	Heinkel 111	30	22	Chartres
<i>III/KG. 55</i>	Heinkel 111	25	20	Villacoublay
<i>KGr. 100</i>	Heinkel 111	28	7	Vannes
<i>KGr. 606</i>	Dornier 17	33	29	Brest and Cherbourg
<i>KGr. 806</i>	Junkers 88	27	18	Nantes and Caen/ Carpiquet
		527	314	
<i>Dive-Bombers</i>				
<i>Stab. St.G. 3</i>	Do. 17 and He. 111	7	6	Brittany
<i>I/St.G. 3</i>	Junkers 87	37	34	Brittany
		44	40	
<i>Single-Engined Fighters</i>				
<i>I/JG. 53</i>	Messerschmitt 109	34	27	Brittany
<i>*Stab. JG. 2</i>	Messerschmitt 109	3	2	Beaumont-le-Roger
<i>*I/JG. 2</i>	Messerschmitt 109	29	24	Beaumont-le-Roger
<i>*I/JG. 2</i>	Messerschmitt 109	22	18	Beaumont-le-Roger
<i>*III/JG. 2</i>	Messerschmitt 109	30	19	Le Havre
		118	90	

<i>Unit</i>	<i>Equipment</i>	<i>Strength</i>	<i>Service- able aircraft</i>	<i>Location</i>
<i>Twin-Engined Fighters (Night-Fighters Excluded)</i>				
<i>Stab. ZG. 76</i>	Messerschmitt 110	2	2	...
<i>II/ZG. 76</i>	Messerschmitt 110	27	12	Le Mans and Abbeville
<i>III/ZG. 76</i>	Messerschmitt 110	19	8	Laval
		48	22	

Long-Range Reconnaissance Aircraft

<i>7(F)/LG. 2</i>	Messerschmitt 110	14	9	...
<i>4(F)/14</i>	Me. 110 and Do. 17	12	9	Normandy
<i>3(F)/31</i>	Me. 110 and Do. 17	9	5	St. Briec
<i>3(F)/121</i>	Ju. 88 and He. 111	10	6	North-West France
<i>4(F)/121</i>	Ju. 88 and Do. 17	13	5	Normandy
<i>1(F)/123</i>	Ju. 88 and Do. 17	10	7	near Paris
<i>2(F)/123</i>	Ju. 88 and Do. 17	10	8	near Paris
<i>3(F)/123</i>	Ju. 88 and Do. 17	12	9	Buc
		90	58	

LUFTFLOTTE 5, KRISTIANSUND

(General Stumpff)

Single-Engined Fighters

<i>II/JG. 77</i>	Messerschmitt 109	44	35	South Norway
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Long-Range Reconnaissance Aircraft

<i>2(F)/22</i>	Dornier 17	9	5	Stavanger
<i>3(F)/22</i>	Dornier 17	9	5	Stavanger
<i>1(F)/120</i>	He. 111 and Ju. 88	13	2	Stavanger
<i>1(F)/121</i>	He. 111 and Ju. 88	7	2	Stavanger and Aalborg
		38	14	

Coastal (Reconnaissance and Minelaying) Aircraft

<i>1/506</i>	Heinkel 115	8	6	Stavanger
<i>2/506</i>	Heinkel 115	8	5	Trondheim and Tromsø
<i>3/506</i>	Heinkel 115	8	6	List
		24	17	

NOTES

The following notes apply to units marked with an asterisk:

- KG. 40* Used wholly or mainly for co-operation with naval units.
- II (Schlacht) LG. 2* Ground-attack unit.
- Gruppe 210* Twin-engined fighter-bombers and single-engined escort fighters.
- JG. 2* Interchangeable between *Luftflotten 2* and *3*.

APPENDIX XVIII

Equipment and Location of Squadrons available in Nos. 16 and 18 Groups, Coastal Command, for Anti-invasion Duties, 26th September, 1940

<i>Squadron</i>	<i>Equipment</i>	<i>War Station</i>
NO. 18 GROUP, DONIBRISTLE (ROSYTH)		
(Air Vice-Marshal C. D. Breese)		
201	Sunderland	Sullom Voe
204	Sunderland	Sullom Voe
248	Blenheim	Sumburgh
254	Blenheim	Dyce
21 ¹	Blenheim	Lossiemouth
57 ¹	Blenheim	Lossiemouth
220	Hudson	Thornaby
224 ²	Hudson	Leuchars
233 ²	Hudson	Leuchars
269	Hudson and Anson	Wick
42 ³	Beaufort	Wick
700 ⁴	Walrus	Sullom Voe
NO. 16 GROUP, CHATHAM		
(Air Vice-Marshal T. H. S. Thyssen)		
235	Blenheim	Bircham Newton
53 ⁵	Blenheim	Detling
59 ⁵	Blenheim	Thorney Island
206	Hudson	Bircham Newton
500 (Auxiliary)	Anson	Detling
22	Beaufort	North Coates
812 ¹	Swordfish	Thornaby
826 ⁴	Albacore	Bircham Newton

NOTES

- ¹ Lent by Bomber Command.
- ² Elements detached to Aldergrove, leaving about the equivalent of one squadron at Leuchars.
- ³ Not operational until end of September.
- ⁴ Naval squadrons.
- ⁵ Former Army Co-Operation squadrons.

APPENDIX XIX

Fixed Artillery Defences of Home Ports, November 1940

MAJOR PORTS	14"	9·2"	6"	5·5"	4·7"	4"	12- pdr.	6- pdr.	3- pdr.
Scapa Flow	—	—	9	—	3	—	18	3	—
Invergordon	—	—	6	—	—	—	—	—	—
Aberdeen	—	—	4	—	—	—	—	—	—
Dundee	—	—	4	—	—	—	—	—	—
The Forth	—	3	16	—	—	—	4	6	—
Blyth	—	—	4	—	—	—	—	—	—
The Tyne	—	1	6	—	—	—	2	—	—
Sunderland	—	—	4	—	—	—	2	—	—
The Tees and Hartlepool	—	1	6	—	—	—	2	—	—
The Humber	—	2	6	—	4	2	—	6	—
Yarmouth	—	—	4	—	—	—	2	—	—
Lowestoft	—	—	4	—	—	—	2	—	—
Harwich	—	2	6	—	—	—	2	3	—
The Thames and Medway	—	5	10	4	—	—	—	3	2
Dover	1	2	13	—	—	2	3	3	—
Newhaven	—	—	4	—	—	—	2	—	—
Portsmouth and Southampton	—	6	14	—	—	—	14	3	—
Portland	—	4	4	—	—	—	4	—	—
Dartmouth	—	—	—	—	2	—	—	—	—
Plymouth	—	6	6	—	—	—	11	—	—
Falmouth	—	—	4	—	—	—	—	—	—
Avonmouth	—	—	2	—	—	—	—	—	—
Newport	—	—	—	—	—	—	—	—	—
Cardiff and Barry	—	—	4	—	—	—	—	—	—
Swansea	—	—	2	—	2	—	—	—	—
Milford Haven	—	2	6	—	—	—	—	—	—
The Mersey	—	—	4	—	—	—	—	—	—
Barrow	—	—	4	—	—	(3-75 mm.)	—	—	—
The Clyde	—	—	4	—	2	—	1	—	—
Belfast	—	—	6	—	—	—	—	—	—
Lough Swilly	—	—	2	—	—	—	1	—	—

	1	34	168	4	13	4	70	27	2

						75 mm.			
						3			

MINOR PORTS	6"	4·7"	4"	12- pdr.
Sullom Voe	—	—	2	—
Lerwick	2	—	2	—
Wick	2	—	—	—
Peterhead	2	—	—	—
Montrose	2	—	—	—
Inverness	—	—	2	—
Buckie	—	—	—	—
Berwick	2	—	—	—
Amble	2	—	—	—
Seaham Harbour	2	—	—	—
Whitby	2	—	—	—
Scarborough	2	—	—	—
Boston	2	—	—	—
King's Lynn	2	—	—	—
East Mersea	—	2	—	—
Ramsgate	2	—	—	2
Shoreham	2	—	—	—
Littlehampton	2	—	—	—
Poole	2	—	—	—
Exmouth	—	2	—	—
Brixham	—	2	—	—
Looe	—	—	2	—
Fowey	—	2	—	—
Penzance	—	—	2	—
Padstow	—	—	2	—
Appledore	—	2	—	—
Portishead	2	—	—	—
Fishguard	2	—	—	—
Caernarvon	—	—	2	—
Holyhead	2	—	—	—
Preston	—	—	2	—
Fleetwood	—	—	2	—
Workington	—	—	2	—
Stranraer	—	—	2	—
Ardrossan	—	—	—	—
Campbeltown	—	—	—	—
Oban	—	—	—	—
Loch Ewe	—	—	—	—
Stornoway	—	—	2	—
Lamlash	—	—	—	—
Kyle of Lochalsh	—	—	—	—
Larne	2	—	—	—
Whitehaven	—	—	1	—
Fraserburgh	—	—	—	—
Bridlington	—	—	—	—
<i>(Carried forward)</i>	38	10	25	2

APPENDIX XIX

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MINOR PORTS (<i>continued</i>)	6"	47"	4"	12- pdr.
(<i>Brought forward</i>)	38	10	25	2
Foulness	1	—	—	—
Teignmouth	—	1	—	—
Torquay	—	1	—	—
Salcombe	—	—	1	—
Llanely	—	—	1	—
	<hr/> 39	<hr/> 12	<hr/> 27	<hr/> 2

APPENDIX XX

Equipment and Location of British Fighter Squadrons, 7th September, 1940

<i>Squadron</i>	<i>Equipment</i>	<i>War Station</i>
NO. 10 GROUP, RUDLOE, NEAR BATH (Air Vice-Marshal Sir Quintin Brand)		
<i>Pembrey Sector</i>		
92	Spitfire	Pembrey
<i>Filton Sector</i>		
87	Hurricane	Exeter and Bibury
213	Hurricane	Exeter
<i>St. Eval Sector</i>		
238	Hurricane	St. Eval
247 (One flight only)	Gladiator	Roborough
<i>Middle Wallop Sector</i>		
234	Spitfire	Middle Wallop
609 (West Riding)	Spitfire	Middle Wallop
604 (County of Middlesex)	Blenheim	Middle Wallop
56	Hurricane	Boscombe Down
152	Spitfire	Warmwell
NO. 11 GROUP, UXBRIDGE (Air Vice-Marshal K. R. Park)		
<i>Tangmere Sector</i>		
43	Hurricane	Tangmere
601 (County of London)	Hurricane	Tangmere
602 (City of Glasgow)	Spitfire	Westhampnett
<i>Kenley Sector</i>		
66	Spitfire	Kenley
253	Hurricane	Kenley
72	Spitfire	Croydon
111	Hurricane	Croydon
<i>Biggin Hill Sector</i>		
79	Spitfire	Biggin Hill
501 (County of Gloucester)	Hurricane	Gravesend

<i>Squadron</i>	<i>Equipment</i>	<i>War Station</i>
<i>Hornchurch Sector</i>		
222	Spitfire	Hornchurch
603 (City of Edinburgh)	Spitfire	Hornchurch
600 (City of London)	Blenheim	Hornchurch
41	Spitfire	Rochford
<i>Northolt Sector</i>		
1 (Royal Canadian Air Force)	Hurricane	Northolt
303 (Polish)	Hurricane	Northolt
504 (County of Nottingham)	Hurricane	Northolt
1	Hurricane	Heath Row
<i>North Weald Sector</i>		
249	Hurricane	North Weald
46	Hurricane	Stapleford Abbots
<i>Debden Sector</i>		
17	Hurricane	Debden
257	Hurricane	Martlesham and North Weald
25	Blenheim	Martlesham
73	Hurricane	Castle Camps
NO. 12 GROUP, WATNALL, NEAR NOTTINGHAM (Air Vice-Marshal T. L. Leigh-Mallory)		
<i>Duxford Sector</i>		
19	Spitfire	Duxford
310 (Czechoslovakian)	Hurricane	Duxford
<i>Coltishall Sector</i>		
242	Hurricane	Coltishall
616 (South Yorkshire)	Spitfire	Coltishall
266	Spitfire	Coltishall and Wittering
<i>Wittering Sector</i>		
23	Blenheim	Wittering
229	Hurricane	Wittering and Bircham Newton
<i>Digby Sector</i>		
151	Hurricane	Digby
611 (West Lancashire)	Spitfire	Digby
29	Blenheim	Digby
<i>Kirton-in-Lindsey Sector</i>		
74	Spitfire	Kirton-in-Lindsey
264	Defiant	Kirton-in-Lindsey

<i>Squadron</i>	<i>Equipment</i>	<i>War Station</i>
	<i>Church Fenton Sector</i>	
85	Hurricane	Church Fenton
302 (Polish)	Hurricane	Church Fenton
64	Spitfire	Church Fenton and Ringway

NO. 13 GROUP, NEWCASTLE-ON-TYNE
(Air Vice-Marshal R. E. Saul)

	<i>Catterick Sector</i>	
54	Spitfire	Catterick
219	Blenheim	Catterick
	<i>Usworth Sector</i>	
607 (Auxiliary)	Hurricane	Usworth
610 (County of Chester)	Spitfire	Acklington
32	Hurricane	Acklington
	<i>Turnhouse Sector</i>	
65	Spitfire	Turnhouse
141	Defiant	Turnhouse
605 (County of Warwick)	Hurricane	Drem
615 (Auxiliary)	Hurricane	Prestwick
	<i>Dyce Sector</i>	
145	Hurricane	Dyce and Montrose
	<i>Wick Sector</i>	
3	Hurricane	Castletown
232 (One flight only)	Hurricane	Sumburgh
	<i>Aldergrove Sector</i>	
245	Hurricane	Aldergrove

APPENDIX XXI

Equipment and Location of Balloon Squadrons, 31st August, 1940

<i>Squadron</i>	<i>Equipment</i>	<i>Location</i>
NO. 30 (BALLOON BARRAGE) GROUP, LONDON		
(Group Captain W. J. Y. Guilfoyle)		
<i>No. 1 Balloon Centre, Kidbrooke</i>		
901	45 balloons	Abbey Wood
902	45 balloons	Kidbrooke
952	40 balloons	Sheerness
	(32 waterborne)	
961	24 balloons	Dover
	(8 waterborne)	
<i>No. 2 Balloon Centre, Hook, Surrey</i>		
903	45 balloons	Forest Hill
904	45 balloons	Clapham
905	45 balloons	Kensington
<i>No. 3 Balloon Centre, Stanmore</i>		
906	45 balloons	Hampstead
907	45 balloons	Woodberry Down
956	24 balloons	Colnbrook
<i>No. 4 Balloon Centre, Chigwell</i>		
908	45 balloons	Metropolis
909	45 balloons	East Ham
910	45 balloons	Dagenham
	(3 waterborne)	
928	24 balloons	Harwich
	(10 waterborne)	
NO. 31 (BALLOON BARRAGE) GROUP, BIRMINGHAM		
(Air Commodore J. C. Quinnell)		
<i>No. 5 Balloon Centre, Sutton Coldfield</i>		
911	48 balloons	West Bromwich
913	40 balloons	Sutton Coldfield
962	24 balloons	Milford Haven
	(9 waterborne)	

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<i>Squadron</i>	<i>Equipment</i>	<i>Location</i>
<i>No. 6 Balloon Centre, Wythall</i>		
914	40 balloons	Northfield
915	40 balloons	Rowkeath
916	32 balloons	Coventry
917	24 balloons	Coventry
<i>No. 7 Balloon Centre, Alvaston, Derby</i>		
918	32 balloons	Alvaston
<i>No. 8 Balloon Centre, Fazakerley</i>		
919	52 balloons (12 waterborne)	Birkenhead
921	48 balloons	Fazakerley
<i>No. 9 Balloon Centre, Warrington</i>		
922	32 balloons	Cuerdley
923	32 balloons	Runcorn
949	32 balloons	Crewe
<i>No. 10 Balloon Centre, Manchester</i>		
925	40 balloons	Manchester and Bowlee
926	40 balloons	Bowlee

NO. 32 (BALLOON BARRAGE) GROUP, ROMSEY
(Air Commodore A. A. Walser)

<i>No. 11 Balloon Centre, Bristol</i>		
912	24 balloons	Brockworth
927	32 balloons	Bristol
935	24 balloons	Filton
951	40 balloons	Bristol
957	24 balloons	Yeovil
<i>No. 12 Balloon Centre, Fareham</i>		
924	24 balloons	Eastleigh
930	50 balloons (10 waterborne)	Southampton
932	32 balloons	Portsmouth
933	24 balloons	Gosport
<i>No. 13 Balloon Centre, Plymouth</i>		
934	24 balloons	Plymouth
959	24 balloons (8 waterborne)	Falmouth
964	24 balloons (6 waterborne)	Torpoint

<i>Squadron</i>	<i>Equipment</i>	<i>Location</i>
<i>No. 14 Balloon Centre, Cardiff</i>		
953	39 balloons (7 waterborne)	Cardiff
958	35 balloons (3 waterborne)	Swansea
965	16 balloons	Port Talbot
966	40 balloons	Newport
969	16 balloons	Barry
NO. 33 (BALLOON BARRAGE) GROUP, SHEFFIELD (Air Commodore S. W. Smith)		
<i>No. 15 Balloon Centre, Newcastle</i>		
936	40 balloons (4 waterborne)	Benton
937	32 balloons (3 waterborne)	South Tyne
938	48 balloons	Billingham
<i>No. 16 Balloon Centre, Sheffield</i>		
939	40 balloons	Sheffield
940	32 balloons	Rotherham
<i>No. 17 Balloon Centre, Sutton-on-Hull</i>		
942	42 balloons (24 waterborne)	Hull
943	32 balloons	Hull
NO. 34 (BALLOON BARRAGE) GROUP, EDINBURGH (Group Captain H. R. Busted)		
<i>No. 18 Balloon Centre, Glasgow</i>		
929	24 balloons (7 waterborne)	South Queensferry
945	40 balloons	Glasgow
946	48 balloons	Renfrew
947	32 balloons	Glasgow
948	24 balloons	Rosyth
967	48 balloons	Ardrossan
968	40 balloons (8 waterborne)	forming at Bishopbriggs; moved to Belfast 12.9.40.
<i>No. 20 Balloon Centre, Lyness</i>		
950	32 balloons	Lyness
960	24 balloons (16 waterborne)	Lyness

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<i>Squadron</i>	<i>Equipment</i>	<i>Location</i>
	<i>Under Group Command</i>	
920	16 balloons (11 waterborne)	Kyle of Lochalsh

NOTE

The authorised establishment (initial equipment) of 2,600 balloons was made up as follows:

Total of foregoing establishments	2,204
Additions and extensions approved but not installed	232
Reserve for unforeseen contingencies	164
	<hr style="width: 100%; border: 0.5px solid black;"/>
	2,600

APPENDIX XXII

Disposition of Anti-Aircraft Guns 21st August and 11th September, 1940

(For meaning of abbreviations see Appendix IX)

	<i>HAA</i>		<i>LAA</i>		<i>AA LMGs</i>	
	<i>21.8.40</i>	<i>11.9.40</i>	<i>21.8.40</i>	<i>11.9.40</i>	<i>21.8.40</i>	<i>11.9.40</i>
1ST AA DIVISION						
(Major-General F. L. M. Crossman)						
London	92	199				
Langley (Slough)	28	28				
Hounslow	4	4				
Stanmore	4	4				
Aerodromes, vital points, etc.			38	44	167	161
2ND AA DIVISION						
(Major-General M. F. Grove-White)						
Leighton Buzzard	4	4				
Norwich	—	4				
Nottingham	16	16				
Derby	40	32				
Sheffield	27	27				
Scunthorpe	24	—				
Humber	38	26				
Mobile battery	8	—				
Aerodromes	22	22				
Aerodromes, vital points, etc.			78	82	765	835
3RD AA DIVISION AND OSDEF.						
(Major-General L. R. Hill)						
Belfast	7	7				
Londonderry	—	4				
Clyde	27	34				
Ardeer	8	8				
Kyle of Lochalsh	4	4				
Aberdeen	4	4				
Scapa Flow	88	88				
Shetlands	12	12				
Aerodromes	8	8				
Aerodromes, vital points, etc.			122	132	378	367

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		<i>HAA</i>	<i>LAA</i>		<i>AA LM Gs</i>		
		<i>21.8.40</i>	<i>11.9.40</i>	<i>21.8.40</i>	<i>11.9.40</i>	<i>21.8.40</i>	<i>11.9.40</i>

4TH AA DIVISION

(Major-General C. A. E. Cadell)

Barrow	—	8				
Liverpool	56	58				
Manchester	20	20				
Crewe	16	8				
Birmingham	71	64				
Coventry	32	24				
Ringway Aerodrome	4	4				
Aerodromes, vital points, etc.			80	84	389	397

5TH AA DIVISION

(Major-General R. H. Allen)

Milford Haven	—	4				
Swansea	16	24				
Cardiff	26	26				
Newport	16	20				
Brockworth	24	24				
Bristol	32	32				
Falmouth	12	6				
Plymouth	46	26				
Yeovil	4	4				
Portland	14	14				
Holton Heath	8	8				
Southampton	39	31				
Portsmouth	44	40				
Bramley	8	8				
Aerodromes (including Brooklands)	20	24				
Aerodromes, vital points, etc.			181	190	547	553

6TH AA DIVISION

(Major-General F. G. Hyland)

Dover	18	14				
Thames and Medway South	72	72				
Thames and Medway North	48	48				
Harwich	15	8				
Aerodromes	35	43				
Aerodromes, vital points, etc.			133	141	415	397

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HAA		LAA		AA LMGs	
21.8.40	11.9.40	21.8.40	11.9.40	21.8.40	11.9.40

7TH AA DIVISION

(Major-General R. B. Pargiter)

Leeds	20	20			
Tees	30	30			
Tyne	50	50			
Mobile guns	4	—			
Aerodromes	14	14			
Aerodromes, vital points, etc.			62	55	270 277

APPENDIX XXIII

Some Problems and Achievements of Anti-Aircraft Gunnery during the Battle of Britain

(Report by the 6th Anti-Aircraft Division dated 2nd August, 1941;
author's interpolations in square brackets)

Abbreviations

H.A.A.	= Heavy Anti-Aircraft
L.A.A.	= Light Anti-Aircraft
G.O.R.	= Gun Operations Room
A.A.L.M.G.	= Anti-Aircraft Light Machine-Gun
V.I.E.	= Visual Indicator Equipment
G.P.O.	= Gun Position Officer
G.L.	= Radar Set for Gun-Laying
V.P.	= Vulnerable Point
F.A.S.	= Forward Area Sight
S.O.R.	= Sector Operations Room
G.D.A.	= Gun Defended Area

I. LAYOUT OF A.A. DEFENCES

- (a) The area covered by 6th A.A. Division coincided with the R.A.F. sectors Debden, North Weald, Hornchurch, Biggin Hill and Kenley (i.e., the major part of No. 11 Fighter Group, R.A.F.). Thus the coastal boundary extended from Lowestoft (exclusive) in the north to Worthing (exclusive) in the south; the internal boundary marching with that of the metropolitan area.
- (b) Distribution of A.A. defences was briefly as follows:

(i) *H.A.A. Guns*

The divisional area contained four main 'gun defended areas' at Harwich, Thames and Medway North (guns emplaced along the north bank of the Thames Estuary), Thames and Medway South (guns emplaced along the south bank of the Thames Estuary and defending Chatham and Rochester) and Dover (including Folkestone). In addition, H.A.A. guns were deployed for the defence of certain aerodromes.

Each 'gun defended area' was based on a Gun Operations Room: at Felixstowe, Vange, Chatham and Dover respectively. This G.O.R. was connected directly to No. 11 Fighter Group Operations Room at Uxbridge, from which it received plots of enemy raids, which in turn were passed down to all gun sites.

The armament of each H.A.A. site consisted of the following: 4 (sometimes 2) 4·5-, 3·7- or 3-inch guns with predictor. Appendix

A [not reproduced] shows the H.A.A. defences as at the beginning of August 1940 and the end of October 1940.

(ii) *L.A.A. Guns*

45 Vulnerable Points in the divisional area were defended by L.A.A. guns. These V.P.'s consisted of Air Ministry Experimental stations, fighter aerodromes, dockyards, oil depots, magazines, industrial undertakings and factories.

Armament consisted of the following guns: 40-millimetre Bofors (with Predictor No. 3 and Forward Area Sights), 3-inch 20-cwt. (Case I), A.A.L.M.G. and 20-millimetre Hispano. Appendix B [not reproduced] shows the V.P.'s with their armament as in August and October 1940.

(iii) *Searchlights*

Searchlights were deployed in single-light stations at approximately 6,000-yards spacing throughout the area, but with a closer spacing in certain instances along the coast and in 'gun defended areas', where the distance between lights was approximately 3,500 yds.

These lights were deployed on a brigade basis following R.A.F. sectors, and each light was connected by direct telephone line and/or R.T. [radio-telephony] Set No. 17 to Battery Headquarters via troop H.Q. and thence to an army telephone board at the R.A.F. Sector Operations Rooms.

The equipment of a searchlight site consisted of the following: 90-centimetre projector with, in most cases, Sound Locator Mark III. In some instances sites were equipped with Sound Locators Mark VIII or Mark IX. During the late summer and autumn the number of Mark VIII and Mark IX Sound Locators gradually increased, and V.I.E. equipment and 150-centimetre Projectors were introduced. Each searchlight site was equipped with one A.A.L.M.G. for use against low-flying aircraft and for ground defence.

2. ENEMY TACTICS

(a) *High-Level Bombing Attacks*

These took place *generally* between heights of 16,000 and 20,000 feet. Bombers approached their targets in close protective formations until running up to the line of bomb release, when formation was changed to line astern (if there was a definite objective to the attack). Attacks frequently occurred in waves, each wave flying at approximately the same height and on the same course. On engagement by H.A.A. guns, avoiding action was taken in three stages:

Stage 1. The bombers gained height steadily and maintained course and formation.

Stage 2. Formations opened out widely and maintained course.

Stage 3. Under heavy fire, formations split and bombers scattered

widely on different courses. It was after this stage had been reached that the best opportunity was provided for fighters to engage.

(b) *Low-Level and Dive-Bombing Attacks*

In the latter stages of the enemy air offensive numerous instances of low-level and dive-bombing attacks occurred, in particular against fighter aerodromes (Manston, Hawkinge, Lympne, Kenley). [This refers notably to Phases 1 and 2 of the main offensive as defined in the text.]

L.A.A. and H.A.A. employed in dealing with these forms of attack met with varying success, but in cases where no planes were brought down the effect of fire from the A.A. defence almost invariably disconcerted the dive-bomber so that few bombs were dropped with accuracy.

Considerable efforts were made by Me. 109's and Ju. 87's to destroy the balloon barrage at Dover, and, though at times they partially succeeded, excellent targets were provided for the Dover H.A.A. and L.A.A. guns.

3. PART PLAYED BY H.A.A. GUNS

Targets of all types presented themselves to H.A.A. sites, ranging from solid bomber formations to single cloud-hopping- or dive-bombers, balloon-strafters or hedge-hoppers, all of which were successfully engaged by appropriate methods of fire.

The action of the defence achieved success in the following ways:

(a) The actual destruction or disablement of enemy aircraft (see Appendix C). [Not reproduced; but see Section 7, below.]

(b) The breaking up of formations, thus enabling the R.A.F. to press home attacks on smaller groups of bombers.

(c) Destroying the accuracy of their bombing by forcing the enemy aircraft to take avoiding action [and in general to fly higher than they would otherwise have flown.]

(d) By pointing out to patrolling fighters the whereabouts of enemy formations by means of shell bursts.

The following methods of fire were in operation at this period:

(a) *Seen Targets*

(i) Each gun site was allotted a zone of priority, and responsibility for opening fire on a target rested with the G.P.O.

(ii) Targets could be engaged by day if identified as hostile beyond reasonable doubt or if a hostile act was committed. By night, failure to give recognition signals was an additional proviso.

(iii) It was the responsibility of the G.P.O. to cease fire when fighters closed to the attack.

(b) *Unseen Targets*

Unseen firing at this time was in its infancy and considerable initiative was displayed in evolving methods for engaging targets unseen by day or by night.

The following methods were employed:

(i) *Geographic Barrages*

Many forms of barrage were used by different G.D.A's, but all were based on obtaining concentrations at a point, on a line, or over an area, through which the enemy aircraft must fly.

Suitable barrages for lines of approach and heights were worked out beforehand. Approach of enemy aircraft was observed by G.L. and, by co-ordination at G.O.R's, the fire from each site could be controlled to bring a maximum concentration of shell bursts at the required point.

(ii) *Precision Engagements*

Method A. Due to poor visibility or wrong speed-settings searchlight intersections were often made without actual illumination of the aircraft. By obtaining slant range from G.L. and following the intersection on the predictor, sufficient data were available to enable shells to burst at or near the intersection.

Method B. This provided for engagement without searchlight intersections. Continuous bearings and slant ranges from the G.L. were fed into the predictor and engagement of target [was] undertaken on the data thus provided. For sites which were not equipped with G.L. the appropriate information was passed down from G.O.R.

It will be appreciated that procedure varied with different Gun Zones, according to circumstances and the equipment available. It should be remembered that all engagements of unseen targets were subject to the express permission of the Group Controller at Uxbridge [acting for, and sometimes under the immediate supervision of, the Group Commander], so that danger of engaging friendly aircraft was obviated.

(c) *Anti-Dive-Bombing Barrage*

Special barrages against dive-bombers were organised round the following V.P.'s: Harwich Harbour, Thameshaven Oil Installations, Tilbury Docks, Chatham Dockyard, Sheerness Dockyard, Dover Harbour, Purfleet Oil and Ammunition Depots.

This barrage [i.e., any of these barrages] could be employed at any time at the discretion of the G.P.O. when he considered that other and more accurate methods were unlikely to be effective. The barrage [i.e., each barrage] was designed for a height of 3,000 feet and assumed a dive angle of 60°. It was based on a barrage circle round each gun site, which was divided into four quadrants in which the barrages were placed.

The maximum effort from H.A.A. guns was required from the 19th August to the 5th October, during which time the crews had little rest, continuous 24 hours manning being required at Dover, a 'duty gun station' system being worked in all areas.

Evidence is available to show how time and again enemy bombers would not face up to the heavy and accurate fire put up by gun stations. Particularly worthy of mention are two attacks on Hornchurch aerodrome, when on both occasions fighters were on the ground for refuelling. A.A.

fire broke up the formation and prevented *any damage to the station buildings and aircraft on the ground.*

4. PART PLAYED BY L.A.A. GUNS

The targets which offered themselves to L.A.A. guns were in the main small numbers engaged in dive-bombing or low-level attacks on V.P.'s. Opportunity usually only offered fleeting targets, and quickness of thought and action was essential to make fullest use of the targets which presented themselves.

Success against targets by L.A.A. guns was achieved in the following ways:

- (a) The destruction or disablement of enemy aircraft (see Appendix C). [Not reproduced; but see Section 7, below.]
- (b) The prevention of accurate bombing causing the bombers to pull out of their dive earlier than they intended.

Methods of firing employed by L.A.A. guns [were] as follows:

(i) *Bofors*

Fire was directed by No. 3 Predictor or by Forward Area Sights; some Bofors were not equipped with the predictor, when the latter method only could be used.

The predictor-equipped guns require a 130-volt A.C. electric supply which was provided either from engine-driven generators or from the mains. Shooting with the predictor achieved very great accuracy and the results and destruction of aircraft and the average ammunition expenditure proved the efficiency of this equipment (see Appendix C). [Not reproduced; but see Section 7, below.] The F.A.S. method permitted quick engagements of targets although without the accuracy afforded by the predictor.

(ii) *3-inch 20-cwt. Guns (Case I)*

Some V.P.'s were equipped with the 3-inch 20-cwt. gun without predictor, which was fired from deflection sights; shrapnel was normally used. H.E., however, was used for targets at greater height.

(iii) *A.A.L.M.G.*

Lewis guns on A.A. mountings proved extremely effective in attacking low-flying enemy aircraft. These guns were mounted in single, double or quadruple mountings and were fired by the Hosepipe method using tracer ammunition.

(iv) *Hispano 20-millimetre Equipment*

A few of these weapons only were deployed and, owing to shortage of ammunition and lack of tracer, were not found very effective.

5. PART PLAYED BY SEARCHLIGHTS

(a) *Day*

Owing to the close spacing of searchlight sites they formed a valuable source of intelligence, and rapid reports were able to be made upwards of

casualties to friendly and enemy aircraft, pilots descending by parachute and other incidents of importance. In addition, they have been able to provide valuable reports of isolated enemy aircraft, trace of which had been lost by the Observer Corps.

The value of the A.A.L.M.G. with which each site was equipped cannot be too highly stressed. [The report adds that, according to claims made and accepted at the time, 23 enemy aircraft were destroyed by A.A.L.M.G.'s at searchlight sites during the four months under review, this number including a few in whose reported destruction A.A.L.M.G.'s at H.A.A. sites also had a hand. Prisoner-of-War reports showed that it was not generally known by German Air Force pilots that searchlight sites were equipped with A.A. defence.]

(b) *Nights*

Tactical employment of searchlights at night was by either:

- (i) 3-beam rule, in which 3 sites only engaged the target; or
- (ii) by the Master-beam system, in which one Master-beam per three sites exposed and was followed by the remaining two beams acting under the orders of the Master-beam.

The decision to engage was the responsibility of the Detachment Commander, and no direct tactical control was exercised from Battery Headquarters.

In the early stages of the Battle of Britain night activity was on a small scale and searchlights had few raids to engage. Some illuminations were effected, but throughout it was difficult, by ground observations, to assess the actual numbers. Frequently illuminations were reported by sites not engaging the targets. The difficulty of illumination was increased as the number of night raids increased, owing to the difficulty of sites selecting the same target.

There is evidence to show that searchlight activity, whilst being difficult to measure, forced enemy aircraft to fly at a greater height than they would otherwise have done. Bombs were frequently dropped when enemy aircraft were illuminated, which were possibly intended to discourage searchlights from exposing. Evasive tactics by the enemy consisted of changing height and speed continuously to avoid being illuminated, rather than a violent evasive action upon illumination.

6. G.L. EQUIPMENT

At the beginning of August experiments had just been completed to determine whether G.L. equipment could satisfactorily be used as a Ships Detector. Apart from the results of this experiment three other facts emerged:

(a) The G.L. principle was of considerable value when used in conjunction with searchlights.

(b) That G.L. sets sited in an anti-ship role, i.e., on the top of a cliff, were of considerable value in detecting low-flying aircraft.

(c) It showed the value of small R.D.F. [radar] detectors within the main R.A.F. chain, in plotting enemy aircraft direct to sectors.

At the beginning of the Battle of Britain, 21 G.L. sets were in use by the 6th A.A. Division, and by October this number had been increased by another 14.

(i) *G.L. at Gun Stations*

The main function of these equipments was to provide data for unseen target engagements as described above. One other function of these sets is worth special mention.

Two sets were specially sited on the cliffs at Dover to pick up targets at low level. These sets were able to register aircraft taking off from the aerodromes immediately behind Calais, thereby obtaining information considerably earlier than it could be provided by the main R.D.F. station on the coast. This information was reported back to Uxbridge Operations Room by a priority code message which indicated the approximate number of aircraft which had taken off and their position. This report was received some five to six minutes before it could be received through the usual R.D.F. channels, and therefore enabled the Controller to order his fighters off the ground correspondingly earlier than would otherwise have been the case. [Moreover the sets were particularly useful on occasions when they escaped the jamming by the enemy which affected R.A.F. radar stations in the neighbourhood.]

This system, which was also adopted somewhat further along the coast in the neighbourhood of Beachy Head, was of all the more value as the enemy were heavily bombing the R.D.F. stations, which were consequently sometimes out of action. [Attacks on radar stations, though infrequent, did sometimes have this effect. Particularly in the preliminary phase of the battle, stations also closed down sometimes while their equipment was being modified or calibrated.]

(ii) *G.L. Stations with Searchlights*

During the latter stages of the offensive, when the night raids on London commenced, it was realised that the G.L. would be of considerable assistance to night-fighters. An 'elevation' attachment to the equipment was produced and this enabled height to be obtained, which in conjunction with a plotting scheme at S.O.R., enabled searchlight beams to be directed more accurately on a target to assist night-fighters. The results obtained from this were not completely satisfactory, but they showed the way to the development of the present system.

(iii) *Mine-laying Aircraft*

It was found that the experiments conducted in the ship-detector role could be very satisfactorily applied to detecting mine-laying aircraft which flew in at a height too low to be picked up by the C.H. Stations. It enabled accurate tracks of these aircraft to be kept which were afterwards passed to the naval authorities, who were then able to sweep up the mines which had been laid by these aircraft.

7. STATISTICS

[Section 7 of the Report, and Appendix C to it, record claims to the destruction by the 6th Anti-Aircraft Division, during the period July–October 1940, of 203 enemy aircraft by day and 18 at night. Further statistics in the appendix show that, during the first fourteen months of the war, Bofors light anti-aircraft guns of the division fired 200 rounds for each aircraft claimed as destroyed, heavy anti-aircraft engaging seen targets 298, and heavy anti-aircraft guns engaging unseen targets or employing barrage fire 2,444; and that throughout Anti-Aircraft Command as a whole, the numbers of rounds fired by guns of all classes for each aircraft claimed as destroyed were 344 in July 1940, 232 in August and 1,798 in September.

The numbers of enemy aircraft in fact destroyed by anti-aircraft fire during these periods are not known. Losses sustained by the Luftwaffe in various actions and in the several phases of the Battle of Britain have been assessed by analysis of German administrative records, and are given elsewhere in this volume; those believed to have been sustained by the Italian Air Force during its brief intervention against this country have been taken from an Italian source, and are also given. But (except in a few cases) the German and Italian records do not—and clearly could not—distinguish between losses inflicted by anti-aircraft artillery and those suffered in other ways.

Comparison of claims made by or on behalf of our defences as a whole with losses recorded by the Luftwaffe—not for purposes of propaganda but for administrative ends—shows clearly that, while such claims were often accurate or modest in relatively quiet times, during periods of great activity the punishment taken by the enemy was nearly always exaggerated, sometimes grossly. Irrespective of nationality, the same is broadly true of claims made by or on behalf of air forces or air defence systems in all campaigns which have come within the author's notice, and where material exists for a comparison with recorded losses.]

8. GROUND DEFENCE

Preparations were made by all A.A. defences to assume a secondary ground-defence role; Bofors were provided with anti-tank ammunition, and sited to cover approaches to aerodromes, V.P.'s etc. Certain 3·7-inch guns suitably sited were given an anti-ship role, and preparations were made for barrages to be put on certain beaches. Under the immediate threat of invasion in May 1940, mobile columns of A.A. troops were formed, but these troops reverted to their A.A. role before the Battle of Britain began.

9. LESSONS LEARNT

(a) The outstanding lesson learnt from this intensive air attack was undoubtedly the soundness and suitability of the organisation and arrangements of the control and direction of the anti-aircraft defences. These measures, devised in peacetime and perfected during the earlier and quieter period of hostilities, stood the severe test with amazing resilience and adaptability. No major alterations in the system were indicated or,

indeed, were made subsequent to these operations. [A footnote in the original points out that this statement applied only to the higher organisation, and did not mean that no improvements were made in the control and direction of anti-aircraft gunnery.] The way in which the activities of the anti-aircraft linked in and were capable of co-ordination with the major partners in the venture—R.A.F. Fighter Command, No. 11 Fighter Group, and sector commands—is perhaps worthy of special note.

(b) Other lessons learnt are by comparison of minor import. Chief among them was the great vulnerability of aircraft if caught by accurate H.A.A. fire when in close formation. A good instance of this occurred in an action on the 8th September, when a *Geschwader* of 15 Do. 17's, flying in formation at 15,000 feet [in fact half a *Gruppe*; the establishment of a *Geschwader* was about 90 aircraft] approached a gun site south of the river Thames. The opening salvo from the four 3·7-inch guns brought down the three leading aircraft, the remaining machines turning back in disorder, scattering their bombs on the countryside in their flight to the coast.

The value of H.A.A. fire as a means of breaking up bomber squadrons to enable them to be more easily dealt with by our fighters was demonstrated on numerous occasions in the Thames Estuary.

The importance of A.A. shell bursts as a 'pointer' to fighters, even though the guns cannot themselves effectively engage the enemy, was also frequently demonstrated.

(c) A somewhat negative lesson was the inability of A.A. guns, however well served, completely to deny an area to penetration by determined air attack. Evidence, however, was overwhelming that accurate fire, apart from causing casualties, did impair the enemy's aim, and thus avoid, or at least mitigate, the damage to precise targets. [Moreover even the bare knowledge that certain objectives were defended by anti-aircraft guns tended to relegate the enemy to relatively safe heights, thus imposing on all but the boldest of the attackers a limitation which made accurate bombing harder, narrowed down the problem of defence, and sometimes increased the difficulty of co-operation between day bombers and their escort.]

(d) A rather unexpected result was the high proportion [about one-tenth, according to a calculation based on claims] of planes brought down by A.A.L.M.G. fire. It is doubtful, however, whether with the increased armour now carried by enemy aircraft this lesson still obtains.

(e) The value of training in recognition was repeatedly emphasised throughout these operations. Fortunately, very few instances of friendly aircraft being engaged occurred. Apart from the accuracy of the information as to movement of aircraft furnished to gun sites, this was no doubt due to a reasonable standard in recognition having been attained.

It was, and still is, continually brought home to the A.A. gunner that, before all else, he must not engage a friendly aircraft. With this thought firmly impressed on the G.P.O., some instances of late engagement or failure to engage perforce occurred. In some cases, had the standard of training been higher, to permit the earlier recognition of a machine as 'hostile beyond reasonable doubt', the number of machines destroyed would have been increased.

APPENDIX XXIV

The Battle of Britain: The Last Phase Summary of Operations, 7th September to 31st October, 1940

<i>Date</i>	<i>Main Events by Day</i>	<i>Losses (24 hours)</i>	
		<i>F.C.</i>	<i>Luftwaffe</i>
7th Sept.	More than 300 bombers despatched against Greater London. Big fires in dockland and down-river.	28	41
8th Sept.	Minor raids.	2	15
9th Sept.	More than 200 bombers despatched against Greater London, but only about 90 reached the neighbourhood of their objectives. Lively air actions over Kent and the south-western suburbs.	19	28
10th Sept.	Minor raids.	1	4
11th Sept.	Attacks on Greater London and the outskirts of Southampton.	29	25
12th Sept.	Minor raids.	—	4
13th Sept.	Minor raids.	1	4
14th Sept.	Attacks on London: opposition not very effective.	14	14
15th Sept.	More than 200 bombers despatched against Greater London and some 30 against Portland and the outskirts of Southampton. Luftwaffe flew some 700 fighter sorties. Fighter Command fought notably successful actions over Kent and London.	26	60
16th Sept.	Minor raids.	1	9
17th Sept.	Minor raids.	5	8
18th Sept.	About 70 bombers despatched against Greater London in three waves; stiff opposition.	12	19
19th–24th Sept.	Minor raids.	22	59
	<i>(Carried forward)</i>	160	290

APPENDIX XXIV

<i>Date</i>	<i>Main Events by Day</i>	<i>Losses (24 hours)</i>	
		<i>F.C.</i>	<i>Luftwaffe</i>
	<i>(Brought Forward)</i>	160	290
25th Sept.	Damaging attack on Bristol Aeroplane Factory at Filton. Plymouth and Portland also attacked.	4	13
26th Sept.	Damaging attack on Supermarine Aircraft Factory near Southampton.	9	9
27th–29th Sept.	Minor raids (but see text for 27th).	49	73
30th Sept.	Attack on Westland Aircraft Factory at Yeovil defeated by fighters and cloudy sky.	20	48
		<u>242</u>	<u>433</u>
1st–31st October	Minor raids on Greater London and other targets, fighter-bombers providing much of the striking-power. (See text.)		

APPENDIX XXV

Numbers of Pilots and Other Aircrew of Fighter Command who lost their Lives in Battle during the Battle of Britain, 10th July to 31st October, 1940

	<i>Pilots</i>	<i>Other Aircrew</i>
<i>Royal Air Force</i>		
British	370	32
Belgian	5	—
Czechoslovakian	7	—
Polish	29	—
<i>Royal Canadian Air Force</i>	3	—
<i>Royal New Zealand Air Force</i>	—	3
	414	35
Total	449	

APPENDIX XXVI

Night Attacks on London, 7th September–13th November 1940

(Statistics compiled from German sources)

<i>Night</i>	<i>Aircraft over London</i>	<i>Tons of H.E.</i>	<i>Incendiary Canisters</i>
September 7	247	335	440
8	171	207	327
9	195	232	289
10	148	176	318
11	180	217	148
12	43	54	61
13	105	123	200
14	38	55	43
15	181	224	279
16	170	189	318
17	268	334	391
18	300	350	628
19	255	310	533
20	109	154	79
21	113	164	329
22	123	130	476
23	261	300	611
24	223	256	384
25	219	260	441
26	180	218	224
27	163	167	437
28	249	325	303
29	246	294	136
30	218	287	104
October 1	214	250	115
2	105	130	300
3	44	61	—
4	134	190	236
5	177	242	176
6	7	8	—
7	179	211	143
8	208	257	264
9	216	263	245
(Carried forward)	5,689	6,973	8,978

<i>Night</i>	<i>Aircraft over London</i>	<i>Tons of H.E.</i>	<i>Incendiary Canisters</i>
<i>(Brought forward)</i>	5,689	6,973	8,978
10	222	269	718
11	132	213	126
12	119	148	24
13	211	249	131
14	242	304	299
15	410	538	177
16	280	346	187
17	254	322	134
18	129	172	132
19	282	386	192
20	298	356	192
21	100	115	52
22	82	98	40
23	64	65	—
24	64	75	—
25	159	193	193
26	203	253	176
27	114	127	40
28	146	176	111
29	186	236	109
30	125	178	92
31	67	48	83
November 1	181	227	130
2	102	117	126
3	—	—	—
4	157	184	16
5	119	139	—
6	192	223	4
7	193	242	9
8	125	133	—
9	125	124	—
10	171	212	7
11	23	17	16
12	126	165	92
13	25	28	—
Totals	11,117	13,651	12,586
Averages	163	201	182

APPENDIX XXVII

Night Attacks on London: British Statistics showing
Numbers of Bombs on London Boroughs and Districts
from the Night of 7th October to the Night of
6th November, 1940

<i>Borough</i>	<i>Area in Acres</i>	<i>No. of H.E.</i>	<i>No. of Oil Bombs</i>	<i>No. of Groups of Incendiaries</i>	<i>No. of Land Mines*</i>	<i>No. of H.E. per 100 acres</i>
Chelsea	660	72	8	8	—	10·91
Fulham	1,706	94	8	6	1	5·51
Hammersmith	2,283	83	9	13	—	3·64
Kensington	2,291	126	13	23	2	5·50
Westminster	2,502	269	24	13	1	10·75
Hampstead	2,265	127	18	19	—	5·61
Islington	2,720	255	14	22	—	9·38
Paddington	1,357	102	4	18	—	7·52
St. Marylebone	1,493	87	6	24	—	5·83
St. Pancras	2,694	143	7	14	—	5·31
Stoke Newington	863	44	7	7	—	5·10
Bethnal Green	759	68	5	12	—	8·96
City	673	72	4	17	3	10·70
Finsbury	587	47	8	18	—	8·01
Hackney	3,292	223	3	4	—	6·77
Holborn	405	80	4	6	—	19·75
Poplar	2,240	102	4	5	—	4·55
Shoreditch	640	107	2	18	—	16·72
Stepney	1,760	146	5	23	—	8·30
Bermondsey	1,142	92	7	11	1	5·28
Deptford	1,600	84	9	16	—	5·25
Greenwich	3,858	127	6	19	—	3·29
Lewisham	7,014	202	3	39	—	2·88
Woolwich	8,986	211	9	12	1	2·35
Battersea	2,307	98	—	25	—	4·25
Camberwell	4,480	205	19	26	—	4·58
Lambeth	4,196	220	16	21	1	5·24
Southwark	1,120	70	4	11	1	6·25
Wandsworth	9,199	292	13	47	1	3·17
Cheshunt	8,479	111	4	7	2	1·31
East Barnet	2,644	11	4	2	—	0·42
Edmonton	3,896	57	9	3	—	1·46
Enfield	12,400	160	11	1	—	1·29
Hornsey	2,872	127	16	14	—	4·42

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<i>Borough</i>	<i>Area in Acres</i>	<i>No. of H.E.</i>	<i>No. of Oil Bombs</i>	<i>No. of Groups of Incendiaries</i>	<i>No. of Land Mines*</i>	<i>No. of H.E. per 100 acres</i>
Southgate	3,764	74	12	3	2	1·97
Tottenham	3,014	104	14	16	1	3·45
Wood Green	1,608	74	9	1	—	4·60
Barnet Rural	8,339	85	5	6	—	1·02
Barnet Urban	4,290	53	1	6	—	1·24
Finchley	3,477	71	5	11	—	2·04
Friern Barnet	1,341	16	1	—	—	1·19
Hendon	10,370	184	14	47	—	1·77
Potters Bar	6,150	66	6	8	—	1·07
Acton	2,317	54	6	9	—	2·33
Bushey	3,865	26	3	—	—	0·67
Ealing	8,950	134	3	28	1	1·50
Harrow	12,558	107	15	15	—	0·85
Ruislip	6,584	83	4	15	1	1·26
Southall	2,605	38	1	2	—	1·46
Uxbridge	10,237	69	3	7	—	0·67
Wembley	6,300	143	14	13	—	2·27
Willesden	4,633	195	9	27	—	4·21
Brentford	2,450	80	9	16	—	3·27
Feltham	4,935	62	8	11	—	1·26
Hayes	5,161	73	4	5	—	1·41
Heston	7,261	66	3	10	—	0·91
Staines	8,250	32	5	3	—	0·39
Sunbury	5,689	57	—	9	—	1·00
Twickenham	7,024	123	14	14	—	1·75
Yiewsley	5,277	15	3	2	—	0·28
Barking	4,174	90	5	7	—	2·16
Chigwell	8,972	150	16	10	3	1·67
Chingford	2,868	83	8	—	—	2·89
Dagenham	6,728	145	11	6	1	2·16
East Ham	3,326	113	10	7	—	3·40
Ilford	8,435	215	32	5	2	2·55
Leyton	2,594	129	12	9	4	4·97
Waltham H.C.	10,959	119	4	5	—	1·09
Walthamstow	4,343	122	13	21	4	2·81
Wanstead	3,824	91	13	11	1	2·38
West Ham	4,706	193	3	29	—	4·10
Beckenham	5,935	172	27	23	1	2·90
Bexley	4,869	134	12	38	—	2·75
Bromley	6,519	120	12	10	2	1·84
Chislehurst	8,957	188	22	12	—	2·10
Crayford	2,700	79	7	3	—	2·93
Erith	4,607	62	3	5	—	1·35
Orpington	20,842	239	28	11	—	1·15
Penge	770	36	2	3	—	4·68
Banstead	12,821	132	9	9	—	1·03

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<i>Borough</i>	<i>Area in Acres</i>	<i>No. of H.E.</i>	<i>No. of Oil Bombs</i>	<i>No. of Groups of Incendiaries</i>	<i>No. of Land Mines*</i>	<i>No. of H.E. per 100 acres</i>
Barnes	2,651	77	13	6	—	2·90
Beddington	3,048	77	10	—	—	2·53
Carshalton	3,346	45	8	5	—	1·34
Coulsdon	11,142	165	7	21	—	1·48
Croydon	12,672	265	29	31	—	2·09
Epsom	8,427	103	7	3	—	1·22
Esher	14,847	163	18	6	2	1·10
Kingston	1,390	26	1	5	—	1·87
Malden	3,162	137	5	7	—	4·33
Merton	3,237	142	8	2	—	4·39
Mitcham	2,939	98	4	14	—	3·33
Richmond	4,243	138	8	6	—	3·25
Surbiton	4,709	63	15	9	—	1·34
Sutton	4,338	66	9	1	—	1·52
Wimbledon	3,211	115	5	15	—	3·58

NOTE: * Figures incomplete.

APPENDIX XXVIII

Summary of Operations against the United Kingdom by the Italian Air Force, October, 1940–April, 1941 (Compiled from German and Italian sources)

BOMBING OPERATIONS

<i>Date</i>	<i>Aircraft Despatched</i>		<i>Targets</i>	<i>Remarks</i>
	<i>Bombers</i>	<i>Fighters</i>		
October 25 (night)	16	—	Harwich	One aircraft crashed on take-off; two crews forced by fuel shortage to abandon aircraft on return flight.
October 29 (day)	15	73	Ramsgate	A.A. fire slightly damaged many aircraft.
November 5	8	—	Harwich	—
November 11 (day)	10	40	Harwich	Three bombers and three fighters shot down by defences; ten fighters slightly damaged by forced landings. Pilots claimed at least nine British fighters destroyed.
November 17 (night)	6	—	Harwich	—
November 20 (night)	12	—	Harwich, Ipswich	—
November 29 (night)	9	—	Ipswich, Lowestoft, Yarmouth	—
December 14 (night)	11	—	Harwich	—
December 21 (night)	6	—	Harwich	—
December 22 (night)	4	—	Harwich	—
January 2 (night)	5	—	Ipswich	—
Totals	102	113		<i>Bomb Tonnages</i> Day 9·4, Night 44·9

FIGHTER OPERATIONS

Between October, 1940, and January, 1941, Italian fighters based in Belgium flew 454 offensive and 480 defensive sorties (including 113 offensive sorties detailed in the foregoing table). Thereafter until April, 1941, two squadrons remaining in Belgium flew a further 662 sorties, all defensive. Apart from the action over Harwich on November 11th the only fully authenticated encounter between British and Italian fighters occurred on the 23rd of that month, when 29 Italian fighters making an offensive sweep were engaged near the South Foreland and lost two aircraft. Pilots concerned claimed the destruction of at least five British fighters.

STATISTICAL SUMMARY

	Sorties			Operational Casualties		
	Bombers	Fighters	Recon- naissance	Bombers (Destroyed)	Fighters	Personnel (Killed or Missing)
<i>Offensive Operations:</i>						
Day	25	454	5	3	5	20
Night	77	—	—	—	—	—
Abortive	35	—	—	—	—	—
<i>Defensive Operations:</i>						
Day	—	1,142	—	—	—	—
Totals	<u>137</u>	<u>1,596</u>	<u>5</u>	<u>3</u>	<u>5</u>	<u>20</u>

APPENDIX XXIX

Equipment and Location of British Night-fighter Squadrons, September–November, 1940

<i>Squadron</i>	<i>Equipment</i>	<i>War Station</i>
7TH SEPTEMBER, 1940		
<i>No. 10 Group</i>		
87 ('B' Flight)	Hurricane	Bibury
604 (County of Middlesex)	Blenheim	Middle Wallop
<i>No. 11 Group</i>		
141 ('B' Flight)	Defiant	Biggin Hill
600 (City of London)	Blenheim	Hornchurch
25	Blenheim	North Weald and Martlesham
<i>No. 12 Group</i>		
23	Blenheim	Wittering
29	Blenheim	Digby
264	Defiant	Kirton-in-Lindsey
<i>No. 13 Group</i>		
219	Blenheim	Catterick
141 ('A' Flight)	Defiant	Turnhouse

NOTE

In addition, one section of the Fighter Interception Unit was available for active operations at Tangmere (No. 11 Group).

3RD NOVEMBER, 1940

<i>No. 10 Group</i>		
87 ('B' Flight)	Hurricane	Bibury
604 (County of Middlesex)	Blenheim	Middle Wallop
<i>No. 11 Group</i>		
23	Blenheim	Ford
219	Blenheim and Beaufighter	Redhill
141	Defiant	Gatwick
264	Defiant	Rochford
25	Blenheim and Beaufighter	Debden
73	Hurricane	Castle Camps

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<i>Squadron</i>	<i>Equipment</i>	<i>War Station</i>
	<i>No. 12 Group</i>	
29	Blenheim	Wittering and Digby
151	Hurricane	Digby
85	Hurricane	Kirton-in-Lindsey and Caistor
	<i>No. 13 Group</i>	
600 (City of London)	Blenheim	Catterick and Drem

NOTE

In addition, elements of the Fighter Interception Unit were available for active operations at Tangmere (No. 11 Group).

APPENDIX XXX

Notable Night Attacks on United Kingdom Cities, 14th November, 1940–16th May, 1941

(Statistics compiled from German sources)

<i>Night</i>	<i>Target Area</i>	<i>Aircraft over Target Area</i>	<i>Tons of H.E.</i>	<i>Incendiary Canisters</i>
Nov. 14	Coventry	449	503	881
15	London	358	414	1,142
16	London	87	104	68
17	{Southampton	159	198	300
	{London	49	60	64
19	Birmingham	357	403	810
20	Birmingham	116	132	296
22	Birmingham	204	227	457
23	Southampton	121	150	464
24	Bristol	134	160	333
27	{Plymouth	107	110	170
	{London	57	60	—
28	Liverpool–Birkenhead	324	356	860
29	London	335	380	820
30	Southampton	128	152	598
Dec. 1	Southampton	123	147	586
2	Bristol	121	122	615
3	Birmingham	51	55	448
4	Birmingham	62	77	184
5	Portsmouth	74	88	148
6	Bristol	67	78	158
8	London	413	387	3,188
11	Birmingham	278	277	685
12	Sheffield	336	355	457
15	Sheffield	94	80	600
20	Liverpool–Birkenhead	205	205	761
21	Liverpool–Birkenhead	299	280	940
22	Manchester	270	272	1,032
23	Manchester	171	195	893
27	London	108	111	328
29	London	136	127	613
Jan. 2	Cardiff	111	115	392
3	Bristol	178	154	1,488
4	Avonmouth	103	82	752
9	{Manchester	143	111	735
	{London	67	66	470

<i>Night</i>	<i>Target Area</i>	<i>Aircraft over Target Area</i>	<i>Tons of H.E.</i>	<i>Incendiary Canisters</i>
Jan. 10	Portsmouth	153	148	1,409
11	London	137	144	598
12	London	141	155	823
13	Plymouth-Devonport	50	21	749
15	Derby	49	59	41
16	Avonmouth	126	124	1,480
17	Swansea	88	89	901
19	Southampton	62	57	325
29	London	36	58	72
Feb. 19	Swansea	61	54	537
20	Swansea	64	58	554
Mar. 3	Cardiff	47	52	406
4	Cardiff	61	48	563
8	London	125	130	693
9	London	94	97	464
10	Portsmouth	238	193	1,291
11	Birmingham	135	122	830
12	Liverpool-Birkenhead	316	303	1,782
13	{ Glasgow-Clydeside	236	272	1,650
	{ Liverpool-Birkenhead	65	58	122
	{ Hull	78	at least 39	125
14	{ Glasgow-Clydeside	203	231	782
	{ Sheffield	117	83	328
15	London	101	103	397
16	Bristol-Avonmouth	162	166	940
18	Hull	378	316	2,140
19	London	479	467	3,397
20	Plymouth-Devonport	125	159	881
21	Plymouth-Devonport	168	187	1,003
April 3	Bristol-Avonmouth	76	79	248
4	Avonmouth	83	80	546
7	{ Glasgow-Clydeside	179	204	722
	{ Liverpool-Birkenhead	43	65	376
8	Coventry	237	315	710
9	{ Birmingham	237	285	1,110
	{ Tyneside	116	152	1,396
10	Birmingham	206	246	1,183
11	Bristol-Avonmouth	153	193	969
15	Belfast	180	203	808
16	London	685	890	4,200
17	Portsmouth	249	346	1,280
19	London	712	1,026	4,252
21	Plymouth-Devonport	120	139	1,000
22	Plymouth-Devonport	125	146	994
23	Plymouth-Devonport	109	118	574
25	Sunderland	57	80	263
26	Liverpool-Birkenhead	92	113	426

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<i>Night</i>	<i>Target Area</i>	<i>Aircraft over Target Area</i>	<i>Tons of H.E.</i>	<i>Incendiary Canisters</i>
April 27	Portsmouth	38	69	198
28	Plymouth-Devonport	124	159	820
29	Plymouth-Devonport	162	210	531
May 1	Liverpool-Birkenhead	43	48	112
2	Liverpool-Birkenhead	65	105	167
3	Liverpool-Birkenhead	298	363	1,380
4	Belfast	204	237	2,667
	Barrow-in-Furness	55	81	312
5	Liverpool-Birkenhead	53	57	321
	Glasgow-Clydeside	386	351	1,300
6	Glasgow-Clydeside	232	271	1,140
7	Liverpool-Birkenhead	166	232	807
	Hull	72	110	268
8	Nottingham	95	137	189
	Hull	120	157	540
	Sheffield	34	53	802
10	London	507	711	2,393
16	Birmingham	111	160	58

APPENDIX XXXI

Tons of High Explosive aimed at United Kingdom Cities in Major Night Attacks from Night of 7th September, 1940, to Night of 16th May, 1941

(From German sources)

<i>Target Area</i>	<i>No. of Major Raids</i>	<i>Tonnage</i>
London (whole period)	71	18,800
London (after 14 November)	14	5,149
Liverpool-Birkenhead	8	1,957
Birmingham	8	1,852
Glasgow-Clydeside	5	1,329
Plymouth-Devonport	8	1,228
Bristol-Avonmouth	6	919
Coventry	2	818
Portsmouth	3	687
Southampton	4	647
Hull	3	593
Manchester	3	578
Belfast	2	440
Sheffield	1	355
Newcastle-Tyneside	1	152
Nottingham	1	137*
Cardiff	1	115

NOTE: * See text, p. 280.

APPENDIX XXXII

Night Attacks on London: Numbers of High-explosive Bombs to the Hundred Acres on some of the most Heavily-bombed Boroughs

NOTE: The following list is based on British records of the numbers of bombs (irrespective of weight) dropped on London boroughs from the night of 7th October, 1940, to the night of 5th May, 1941, and includes only those boroughs which reported a total of more than fifteen bombs to the hundred acres. For obvious reasons it gives only a rough indication of the relative density of the attacks as between one borough and another.

<i>Borough</i>	<i>Number of H.E. per 100 acres</i>
Holborn	39·75
City	29·53
Westminster	28·85
Shoreditch	23·56
Southwark	23·35
Stepney	20·02
Finsbury	19·11
Chelsea	18·51
Bethnal Green	17·26
Bermondsey	17·16
Lambeth	17·14
Deptford	15·73

APPENDIX XXXIII

Equipment and Location of British Night-fighter Squadrons, November, 1940–May, 1941

<i>Squadron</i>	<i>Equipment</i>	<i>War Station</i>
17TH NOVEMBER, 1940		
<i>No. 10 Group</i>		
✓ 87	Hurricane	Exeter and Bibury
✓ 604 (County of Middlesex)	Blenheim	Middle Wallop
<i>No. 11 Group</i>		
✓ 23	Blenheim	Ford
✓ 219	Beaufighter	Redhill
✓ 141	Defiant	Gravesend
✓ 264	Defiant	Rochford
✓ 85 (one flight)	Hurricane	Debden
<i>No. 12 Group</i>		
✓ 29	Blenheim	Wittering and Digby
✓ 151	Hurricane	Digby
✓ 85 (one flight)	Hurricane	Kirton-in-Lindsey
<i>No. 13 Group</i>		
600 (City of London)	Blenheim	Catterick

NOTE

In addition, elements of the Fighter Interception Unit were available for active operations at Tangmere (No. 11 Group).

16TH FEBRUARY, 1941

<i>No. 9 Group</i>		
✓ 96	Hurricane	Cranage
307 (Polish)	Defiant	Squire's Gate
<i>No. 10 Group</i>		
✓ 87	Hurricane	Charmy Down
✓ 604 (County of Middlesex)	Beaufighter	Middle Wallop
<i>No. 11 Group</i>		
✓ 219	Beaufighter	Tangmere
✓ 264	Defiant	Biggin Hill
✓ 141	Defiant	Gravesend
✓ 85	Hurricane and Defiant	Debden

<i>Squadron</i>	<i>Equipment</i>	<i>War Station</i>
<i>No. 12 Group</i>		
✓ 25	Blenheim and Beaufighter	Wittering
✓ 151	Hurricane and Defiant	Wittering
✓ 29	Blenheim and Beaufighter	Digby
✓ 255 (one section)	Defiant	Kirton-in-Lindsey
<i>No. 13 Group</i>		
✓ 600 (City of London)	Blenheim	Catterick and Drem

NOTE

In addition, elements of the Fighter Interception Unit were available for active operations at Tangmere (No. 11 Group). No. 23 Squadron had ceased defensive operations on undertaking offensive ('Intruder') sorties from Ford (No. 11 Group).

11TH MAY, 1941

<i>No. 9 Group</i>		
✓ 96	Defiant and Hurricane	Cranage
✓ 256	Defiant and Hurricane	Squire's Gate
✓ 68	Blenheim and Beaufighter	High Erccall
<i>No. 10 Group</i>		
✓ 87	Hurricane	Charmy Down
✓ 307 (Polish)	Defiant	Exeter
✓ 600 (City of London)	Beaufighter	Colerne
✓ 604 (County of Middlesex)	Beaufighter	Middle Wallop
✓ 93 (Aerial Minelaying)	Havoc and others	Middle Wallop
<i>No. 11 Group</i>		
✓ 219	Beaufighter	Tangmere
✓ 264	Defiant	West Malling and Nutt's Corner
✓ 29	Beaufighter	West Malling
✓ 85	Havoc	Hunsdon
<i>No. 12 Group</i>		
✓ 25	Beaufighter	Wittering
✓ 151	Defiant	Wittering
✓ 255	Defiant and Hurricane	Kirton-in-Lindsey
<i>No. 13 Group</i>		
141	Defiant	Acklington and Ayr

NOTE

In addition, elements of the Fighter Interception Unit were available for active operations at Ford (No. 11 Group).

APPENDIX XXXIV

Analysis of British Night-Fighter Effort January–May, 1941

Abbreviations:

S.E. = Single-engined fighters;
T.E. = Twin-engined fighters;
A.I. = resulting from airborne radar

<i>Month</i>	<i>Sorties</i>		<i>Detections</i>		<i>Combats</i>	
	<i>S.E.</i>	<i>T.E.</i>	<i>A.I.</i>	<i>Visual</i>	<i>A.I.</i>	<i>Visual</i>
January {	402	84	—	34	—	9
February {	421	147	—	33	—	9
March {	735	270	—	34	—	25
April {	842	342	—	45	—	39
May {	1,345	643	—	154	—	116
			204	13	74	6

APPENDIX XXXV

The Air War against British Coastal Shipping, November, 1940–December, 1941

<i>Month</i>	<i>Number of Attacks or imminent Attacks on Ships within 40 miles of a Fighter Aerodrome</i>			<i>Number of Ships Sunk</i>			<i>Number of Daylight Defensive Sorties by Fighter Command</i>	
	<i>Day</i>	<i>Night</i>	<i>Total</i>	<i>Day</i>	<i>Night</i>	<i>Total</i>	<i>Total</i>	<i>To Protect Ships</i>
1940								
November	81	11	92	..	..	11	14,154	402
December	33	—	33	4	—	4	6,843	504
1941								
January	31	5	36	2	—	2	3,836	350
February	41	16	57	7	3	10	5,736	443
March	89	19	108	21	3	24	11,672	2,103
April	124	72	196	10	11	21	16,102	7,876
May	41	60	101	7	11	18	15,812	8,287
June	40	79	119	3	20	23	12,635	7,331
July	11	68	79	1	7	8	9,924	6,475
August	17	34	51	1	2	3	8,282	5,685
September	16	47	63	—	6	6	6,444	4,416
October	8	33	41	1	4	5	6,682	4,072
November	23	38	61	1	8	9	6,631	3,952
December	6	27	33	1	2	3	5,594	3,591

APPENDIX XXXVI

The Führer's Order for the 'Baedeker' Offensive

WFST/Op(L)

FHQ. 14 April 1942

Kr-Fernschreiben an

Ob. d. L./Lw. Fü. St. Ia Robinson

Betrifft: Luftkriegführung gegen die britischen Inseln

Der Führer hat geordnet, dass der Luftkrieg gegen England in erhöhtem Masse angriffsweise zu führen ist. Hierbei sollen solche Ziele im Vordergrund stehen, deren Bekämpfung möglichst empfindliche Rückwirkungen für das öffentliche Leben mit sich bringt. Neben der Bekämpfung von Hafen- und Industrieanlagen sind hierzu auch im Rahmen der Vergeltung Terrorangriffe gegen Städte ausser London durchzuführen. Verminderungen sind zu Gunsten dieser Aufgaben einzuschränken.

OKW WFST Op

Nr. 55 672/42 Gkdos. Chefs.

(TRANSLATION)

Armed Forces Operations Staff/Ops (Air),

Führer Headquarters, 14 April 1942

Teletype message to: C.-in-C. G.A.F./Operations Staff Ia Robinson

Subject: Conduct of air warfare against the British Isles

The Führer has ordered that air warfare against England is to be given a more aggressive stamp. Accordingly when targets are being selected, preference is to be given to those where attacks are likely to have the greatest possible effect on civilian life. Besides raids on ports and industry, terror attacks of a retaliatory nature are to be carried out against towns other than London. Minelaying is to be scaled down in favour of these attacks.

Supreme Headquarters Armed Forces

Operations Staff/Ops

No. 55 672/42 Most Secret.

APPENDIX XXXVII

Principal German Night Attacks, 1942

(Compiled from British and German Sources)

1	2	3	4	5	6	7
<i>Night</i>	<i>Primary Target</i>	<i>Tonnages:</i>			<i>Col. (5) as % of Col. (4)</i>	<i>(Col. 5) as % of Col. (3)</i>
		<i>Aimed at Target</i>	<i>On Target or on Land within 50 miles</i>	<i>On Target</i>		
March 23	Dover	..	18	11	65	..
23	Portland	..	5	5	100	..
April 2	Weymouth	..	24	18	75	..
17	Southampton	..	33 ^a	7 ^a	21	..
23	Exeter	} 175 ^a {	..	1 ^a	..	} 16
24	Exeter		52 ^a	27 ^a	51	
25	Bath	210	150	92	61	44
26	Bath	115	65	43	67	37
27	Norwich	102	56	54	97	53
28	York	101	84	55	66	54
29	Norwich	90 ^a	49 ^a	45 ^a	91	50
May 3	Exeter	131	78	62	80	47
4	Cowes	162	88	69	78	43
8	Norwich	113	68	1·5	2	1
19	Hull	168	108	30	27	18
24	Poole	166	49	9	18	5
29	Grimsby	70 ^a	28 ^a	—	0	0
31	Canterbury	116	55	46	84	40
June 1	Ipswich	88	49	9	18	10
2	Canterbury	52	23	8	36	15
3	Poole	139	61	17	27	12
6	Canterbury	54	33	7	22	13
21	Southampton	133	68	25	37	19
24	Birmingham	51	20	—	0	0
26	Norwich	56	28	20	73	36
27	Weston-super-Mare	47	17	15	88	32
28	Weston-super-Mare	47	20	18	90	38
July 6	Middlesbrough	48	30	16 ^b	(53)	(33)
7	Middlesbrough	59	26	16 ^b	(63)	(27)

1	2	3	4	5	6	7	
Night	Primary Target	Tonnes:			Col. (5) as % of Col. (4)	Col. (5) as % of Col. (3)	
		Aimed at Target	On Target or on Land within 50 miles	On Target			
July	25	Middlesbrough	28	23	21 ^b	(91)	(79)
	27	Birmingham	78	36	24	67	31
	29	Birmingham	71	24	10	42	14
	30	Birmingham	49	26	— ^c	0	0
	31	Hull	46	34	3	9	7
Aug.	1	Norwich	20	10	8	80	40
	4	Swansea	13	5	—	0	0
	10	Colchester	15	10	2	20	13
	13	Norwich	8	3	1	33	13
	14	Ipswich	6	5	0·5	10	8
	20	Portsmouth	18	13	1	8	6
	26	Colchester	6	9 ^d	—	0	0
Sept.	6	Sunderland	19	10	0·3	3	2
	17	King's Lynn	7	7	5 ^e	(71)	(71)
Oct.	31	Canterbury	52	35	11	31	21

NOTE

^a Excludes incendiaries.

^b Includes Billingham.

^c 14 tons fell on Wolverhampton and Walsall.

^d Includes some bombs aimed at secondary targets.

^e Includes Yarmouth.

APPENDIX XXXVIII

Principal German Night Attacks, 1943

(Compiled from British and German Sources)

1	2	3	4	5	6	7
<i>Night</i>	<i>Primary Target (Figures in brackets show total effort on each night and number of aircraft lost)</i>	<i>Tonnages:</i>			<i>Col. (5) as % of Col. (4)</i>	<i>Col. (5) as % of Col. (3)</i>
		<i>Aimed at Target</i>	<i>On Target or on land within 50 miles</i>	<i>On Target</i>		
Jan. 17	London (118—6)	115	91	43	48	37
Feb. 13	Plymouth (28—0)	30	15	3·4	22	11
	Swansea (37—4)	27	12	6·4	55	24
March 3	London (117—6)	108	70	12	17	11
	Southampton (37—3) ^a	33	31	—	0	0
	Newcastle (51—5)	30	(93 bombs)	—	0	0
	Norwich (41—1)	36	27	3·3	12	9
	Norwich (45—2)	17	13	—	0	0
April 14	Chelmsford (91—6)	77	54	9	17	12
	London (30—6)	13·5	12	1	8	7
	Aberdeen (29—0)	58·5	54	39	72	67
May 4	Norwich (79—5)	103	55	4	7	4
	Chelmsford (85—4)	113	80	16	20	14
	Sunderland (77—2)	93	47	31	66	33
	Cardiff (89—6)	92	50	20	40	22
	Sunderland (73—3)	93	42	27	64	30
June 12	Plymouth (86—5)	75	45	23	52	31
	Grimsby (72—2)	61	27	19	70	31
	Hull (33—0)	31	19	15	79	48
July 12	Grimsby (50—1)	57	44	36	83	63
	Hull (61—4)	71	60	34	56	48
	Hull (51—4)	70	51	—	0	0
Aug. 11	Plymouth (71—1)	64	52	32	62	50
	Portsmouth (91—5)	77	37	14	37	18
	Lincoln (88—11)	28	33 ^b	—	0	0
Oct. 7	London } (75—5)	33	22	8	36	24
	Norwich }	49	34	—	0	0

1	2	3	4	5	6	7
<i>Night</i>	<i>Primary Target (Figures in brackets show total effort on each night and number of aircraft lost)</i>	<i>Tonnages:</i>			<i>Col. (5) as % of Col. (4)</i>	<i>Col. (5) as % of Col. (3)</i>
		<i>Aimed at Target</i>	<i>On Target or on land within 50 miles</i>	<i>On Target</i>		
Oct. 20	Hull	61·5	37	—	0	0
20	London } (89—1)	24	19	0·5	0·25	0·20
23	Yarmouth (39—3)	47	17	0·25	1·5	0·5
Nov. 3	Ipswich (40—0)	55	40	16	40	29
15	Plymouth (46—2)	44	27	12	44	27
Dec. 10	Chelmsford (56—4)	20	62 ^b	—	0	0

NOTES

^a Figures in Cols. 3-5 exclude small incendiaries.

^b Includes some bombs aimed at secondary targets.

APPENDIX XXXIX

Notable Day Attacks by German Fighter-Bombers, 1943

(Compiled from British and German Sources)

1	2	3	4	5	6	7
<i>Day</i>	<i>Target</i>	<i>Aircraft:</i>		<i>Bombs:</i>		<i>Col. (6) as % of Col. (5)</i>
		<i>Sent</i>	<i>Lost</i>	<i>Aimed</i>	<i>On Target</i>	
Jan. 20	London	28	3 ^a	28	22	79
March 7	Eastbourne	18	-	16	16	100
11	Hastings	27	-	27	25	93
12	London	19	- ^b	17	16	94
24	Ashford	17	1	15	14	93
April 3	Eastbourne	16	-	12	12	100
May 7	Yarmouth	20	1	19	7 ^c	37
11	Yarmouth	20 ^d	1	20	14	70
12	Lowestoft	3 ^e	-	3	1	33
12	Lowestoft	24	-	24	15	63
15	Felixstowe-Southwold	26	2	25	8	32
23	Hastings	20	2	17	15	88
23	Bournemouth	26	2	25	22	88
25	Folkestone	19 ^f	1	4	- ^g	0
25	Brighton	24	1	24	16 ^h	67
30	Frinton-Walton ⁱ	21	2	19	19	100
30	Torquay	26	5	22	18	82
June 1	Niton (I.O.W.) ^j	10	-	9	9	100
1	Margate	20	1	19	17	89
2	Ipswich-Felixstowe ^k	17	1	17	5 ^l	35
4	Eastbourne	17	1	15	14	93
6	Eastbourne	16	1	13	13	100

NOTES

- ^a Six escort fighters also lost.
- ^b Two escort fighters lost.
- ^c In addition 12 bombs fell on neighbouring villages.
- ^d In addition 8 aircraft attacked patrol-vessels.
- ^e In addition 26 aircraft attacked patrol-vessels.
- ^f Only 4 aircraft completed task.
- ^g One bomb fell in swimming-pool.
- ^h In addition 4 bombs hit land but bounced into sea.
- ⁱ Alternatives to Colchester.
- ^j Alternative to Ventnor.
- ^k Alternatives to Harwich, where balloon-barrage prevented attack.
- ^l In addition 10 bombs fell on neighbouring villages.

APPENDIX XL

Angriffsführer England: Units under Command, 30th April, 1943

OPERATIONAL

<i>Unit</i>	<i>Equipment</i>	<i>Strength</i>	<i>Aircraft Serviceable</i>
	<i>Long-Range Reconnaissance</i>		
<i>1/(F)123</i>	Junkers 88	16	6
	<i>Bombers</i>		
<i>Stab. KG. 2</i>	Dornier 217	4	3
<i>I/KG. 2</i>	Dornier 217	20	19
<i>II/KG. 2</i>	Dornier 217	23	19
<i>(less 5 Staffel)</i>			
<i>Stab. KG. 6</i>	Junkers 88	4	3
<i>I/KG. 6</i>	Junkers 88	32	22
<i>III/KG. 6</i>	Junkers 88	31	23
<i>II/KG. 40</i>	Dornier 217	21	18
		135	107
	<i>Fast (Fighter-) Bombers</i>		
<i>Stab. SKG. 10</i>	Focke-Wulf 190	6	6
<i>I/SKG. 10</i>	Focke-Wulf 190	51	44
<i>II/SKG. 10</i>	Focke-Wulf 190	40	36
<i>IV/SKG. 10</i>	Focke-Wulf 190	26	11
		123	97

NON-OPERATIONAL

(To go under command on return to active service)

<i>5/KG. 2</i>	Re-equipping with Messerschmitt 410 at Lechfeld.
<i>II/KG. 6</i>	On instructional course at Corneilles-en-Vexin.
<i>15/KG. 6</i>	Reorganising at Chartres as nucleus of <i>I/KG. 66</i> ; equipment Dornier 217.

APPENDIX XLI

Angriffsführer England: Operational Bomber and Fighter-Bomber Units under Command, 20th January, 1944

<i>Unit</i>	<i>Equipment</i>	<i>Strength</i>	<i>Aircraft Serviceable</i>
<i>Stab. KG. 2</i>	Dornier 217	3	3
<i>I/KG. 2</i>	Dornier 217	35	35
<i>II/KG. 2</i>	Junkers 188	35	31
<i>III/KG. 2</i>	Dornier 217	38	36
<i>V/KG. 2</i>	Messerschmitt 410	27	25
<i>Stab. KG. 6</i>	Junkers 88	3	3
<i>I/KG. 6</i>	Junkers 88	41	41
<i>II/KG. 6</i>	Junkers 88	39	39
<i>III/KG. 6</i>	Junkers 88	41	37
<i>II/KG. 30</i>	Junkers 88	36	31
<i>*I/KG. 40</i>	Heinkel 177	15	15
<i>Stab. KG. 54</i>	Junkers 88	3	3
<i>I/KG. 54</i>	Junkers 88	36	25
<i>II/KG. 54</i>	Junkers 88	33	33
<i>I/KG. 66</i>	Dornier 217	45	23
<i>Stab. KG. 76</i>	Junkers 88	5	4
<i>I/KG. 76</i>	Junkers 88	33	31
<i>I/KG. 100</i> <i>(less 3 Staffel)</i>	Heinkel 177	31	27
<i>I/S.KG 10</i>	Focke-Wulf 190	25	20
		524	462

NOTE : * Part only ; remainder re-equipping at Fassberg.

ANALYSIS BY TYPES

	<i>Strength</i>	<i>Aircraft Serviceable</i>
Junkers 88	270	247
Dornier 217	121	97
Heinkel 177	46	42
Junkers 188	35	31
Messerschmitt 410	27	25
Focke-Wulf 190	25	20
	524	462

APPENDIX XLII

The 'Baby Blitz'

(Notable German Night Attacks, January–May, 1944)

(Compiled from British and German Sources)

1	2	3	4	5	6	7	
<i>Night</i>	<i>Target</i>	<i>Sorties</i>	<i>Losses Monthly</i>	<i>Tonnage on U.K.</i>	<i>Tonnage on Target</i>	<i>Col. (6) as % of Col. (5)</i>	
Jan.	21	London	447	57 (7·8%)	268	32	12
	29	„	285		158	36·5	23
Feb.	3	„	240	72 (5·2%)	167	26	16
	13	„	230		161	4	2
	18	„	200		185	139	75
	20	„	200		160	118	74
	22	„	185		167	75	45
	23	„	161		114	49	43
	24	„	170		128	89	70
March	1	„	165	75 (8·3%)	166	56	34
	14	„	187		162	81	50
	19	Hull	131		92	—	0
	21	London	144		137	87	64
	24	„	143		98	52	53
	27	Bristol	139		100	—	0
April	18	London	125	75 (8·7%)	114	53	46
	20	Hull	130		49	—	0
	23	Bristol	117		62	—	0
	25	Shipping at Portsmouth	193		42	..	..
	26	„	78		30	..	..
	27	„	60		—	..	..
	28	„	58		2	..	..
	29	Plymouth	101		52	8	13
	May	14	Bristol		91	Appr. 50 (c. 10%)	83	3	4
15		Portsmouth	106	44	1·4		3
22		„	104	17	1·5		9
27		Weymouth	28	28	13		46
28		Torquay	..*	10	5		50
29		Falmouth, Portsmouth	..*	16	6		38

NOTE

* The targets quoted for the nights of May 28th and 29th are those mentioned in German broadcast claims. According to the German official report, however, the target on the 28th was Falmouth (51 sorties). The report gives no main target for the 29th.

APPENDIX XLIII

The A-4 Rocket: Technical Details

(From German Sources)

Length: 46 feet

Diameter of body: 5 feet 5 inches

Diameter over fins: 11 feet 7 inches

Dead weight without fuel: 3.9 tons

Weight of 3:1 alcohol-water mixture: approximately 4 tons

Weight of liquid oxygen: approximately 5 tons

Total weight at take-off: 12.7 tons

Weight of warhead: approximately 1 ton

Weight of explosive: approximately 1,650 lb.

Thrust at take-off: 25 tons

Acceleration at take-off: 0.9 g

Acceleration at end of combustion: approximately 5 g

Temperature of combustion inside chamber: 2,700 degrees Centigrade

Velocity of exhaust gases: 6,700 feet per second

Maximum velocity of rocket: 3,600 miles per hour

Maximum burning time (standard rocket): 65 seconds

Time to reach sonic velocity: 25 seconds

Time of vertical flight (distance shot): 4 seconds

Angle of tilt from vertical after 54 seconds (distance shot): 49 degrees

Height at end of combustion (distance shot): approximately 20 miles

Horizontal distance from launching point at end of combustion (distance shot): approximately 15 miles

Height at peak of trajectory (distance shot): 50 to 60 miles

Maximum horizontal range (standard rocket): 200 to 220 miles

Velocity at impact (measured along trajectory): 2,200 to 2,500 miles per hour

Maximum height reached (vertical shot, 67 seconds burning time): 118 miles

APPENDIX XLIV

Summary of Anglo-American Air Effort against Suspected Flying-Bomb and Rocket Installations in Northern France, 5th December, 1943, to 12th June, 1944

<i>Class of Objective</i>	<i>Bomb Tonnage</i>
<i>'Ski Sites'</i>	
Attacks on ninety-six sites	23,196
<i>'Modified' Sites</i>	
One (unsuccessful) experimental attack by fighter-bombers on one of sixty-six sites discovered	—
<i>'Supply Sites'</i>	
Two trial attacks on one of eight sites discovered	293
<i>'Large Sites' ('Bunkers')</i>	
Attacks on seven sites	8,130
Total bomb tonnage	<u>31,619</u>

APPENDIX XLV

The Flying-Bomb Offensive

(Compiled from British and German Sources; see also notes below)

	<i>Main Offensive</i>		<i>Phase 2</i>	<i>Phase 3</i>	<i>Whole Campaign</i>
	<i>12/6/44- 15/7/44</i>	<i>16/7/44- 5/9/44</i>	<i>16/9/44- 14/1/45</i>	<i>3/3/45- 29/3/45</i>	<i>12/6/44- 29/3/45</i>
<i>Numbers of bombs:</i>					
<i>1. Launched</i>					
a: from ramps	4,271 ¹	4,346	-	275	8,892
b: from aircraft	90 ²	310 ³	1,200 ⁴	-	1,600 ⁵
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
	4,361	4,656	1,200	275	10,492
<i>2. Observed by defences</i>	2,934	3,791	638	125	7,488
<i>3. Destroyed⁶</i>					
a: by fighters	924 $\frac{1}{3}$	847	71 $\frac{1}{2}$	4	1,846 $\frac{5}{8}$
b: by guns	261 $\frac{1}{3}$	1,198 $\frac{1}{2}$	331 $\frac{1}{2}$ ⁷	87 ⁸	1,878 $\frac{1}{3}$
c: by balloons	55 $\frac{1}{3}$	176 $\frac{1}{2}$	-	-	231 $\frac{5}{8}$
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
d: by all arms	1,241	2,222	403	91	3,957
<i>4. Eluding defences</i>	1,693	1,569	235	34	3,531
<i>5. Reaching London Civil Defence Region</i>	1,270 ⁹	1,070	66 ¹⁰	13	2,419 ¹¹

NOTES

- ¹ Includes 53 believed to have been aimed at Portsmouth or Southampton.
- ² All aimed at Portsmouth or Southampton.
- ³ Author's estimate; includes 21 aimed at Gloucester.
- ⁴ Author's estimate; includes about 50 aimed at Manchester.
- ⁵ Author's estimate; the total to 10th November was 1,287.
- ⁶ The figures under this head are those credited to the defences after a detailed comparison of claims with reports from Civil Defence and other sources. They do not necessarily agree with those cited in contemporary accounts.
- ⁷ Includes 10 $\frac{1}{2}$ destroyed by Royal Navy.
- ⁸ Includes one shared between Royal Navy and guns ashore.
- ⁹ In addition some 25 to 30 reached Portsmouth and Southampton.
- ¹⁰ In addition one reached Manchester.
- ¹¹ The number of reported 'incidents' in the London Civil Defence Region was 2,420.

APPENDIX XLVI

Analysis of Anglo-American Air Effort against Suspected Flying-Bomb and Rocket Targets 17th August, 1943, to 1st September, 1944

NOTE: For the purpose of this analysis hydrogen-peroxide plants, and all installations at Peenemünde attacked after mid-June, 1944, have been reckoned as flying-bomb targets; all 'large sites' as rocket targets.

	<i>Bomb Tonnages</i>	
	<i>Flying-Bomb Targets</i>	<i>Rocket Targets</i>
17th August, 1943–4th December, 1943	—	3,997
5th December, 1943–12th June, 1944	23,489	8,130
13th June, 1944–1st September, 1944	74,349	7,999
	<hr style="width: 100%;"/>	<hr style="width: 100%;"/>
	97,838	20,126
	<hr style="width: 100%;"/>	<hr style="width: 100%;"/>
	117,964	

APPENDIX XLVII

Boroughs or Districts in London Civil Defence Region reporting Thirty or more Flying-Bomb 'Incidents'

NOTES

1. 'Incidents' include those caused by bombs brought down by the defences.
2. In general each 'incident' was caused by one bomb.
3. The total number of reported 'incidents' in the London Civil Defence Region was 2,420.

<i>Borough or District</i>	<i>Number of 'Incidents'</i>
Croydon	140
Wandsworth	126
Lewisham	117
Camberwell	82
Woolwich	82
Greenwich	73
Beckenham	71
Lambeth	69
Orpington	67
Coulsdon and Purley	58
West Ham	57
Chislehurst and Sidcup	50
Mitcham	46
Barking	39
Hackney	38
Banstead	37
Poplar	37
Beddington and Wallington	36
East Ham	36
Esher	36
Ilford	36
Wimbledon	36
Merton and Morden	35
Battersea	34
Bromley (Kent)	34
Sutton and Cheam	33
Westminster	31
Bermondsey	30
Deptford	30
Stepney	30

APPENDIX XLVIII

Counties Outside the London Civil Defence Region reporting Ten or more Flying-Bomb 'Incidents'

NOTES

1. The figures for counties partly within the London Civil Defence Region relate only to 'incidents' outside that region.
2. 'Incidents' include those caused by bombs brought down by the defences.
3. In general, each 'incident' was caused by one bomb.
4. The total number of reported 'incidents' outside the London Civil Defence Region was 3,403.

<i>County</i>	<i>Number of 'Incidents'</i>
Kent	1,444
Sussex	886
Essex	412
Surrey	295
Suffolk	93
Hertfordshire	82
Hampshire	80
Buckinghamshire	27
Norfolk	13
Berkshire	12
Bedfordshire	10

APPENDIX XLIX

The Long-Range Rocket Offensive

(Compiled from British and German Sources; see also notes below)

	Phase 1 8/9/44- 18/9/44	Phase 2 ¹ 25/9/44- 12/10/44	Phase 3 ² 3/10/44- 27/3/45	Whole Campaign 8/9/44- 27/3/45
1. Launchings³				
(a) aimed at London	35		1,324	1,359
(b) aimed at Norwich or Ipswich		44		44
(c) all told	35	44	1,324	1,403
2. Arrivals				
(a) in London Civil Defence Region	16		501	517
(b) elsewhere in U.K.	9	32	496	537
(c) off-shore	2	5	54	61
(d) all told	27	37	1,051	1,115
3. Analysis of Arrivals in London Civil Defence Region and Elsewhere, by Localities and Months				

	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Totals
London C.D.R.	16	32	82	47	114	114	112	517
Essex	6	25	40	65	71	90	81	378
Kent	1	6	16	4	11	14	12	64
Hertfordshire	-	3	2	3	18	6	2	34
Norfolk	8	20	-	-	-	-	1	29
Suffolk	1	4	1	2	2	3	-	13
Surrey	-	1	-	-	2	3	2	8
Sussex	2	-	1	-	1	-	-	4
Bedfordshire	-	-	1	-	1	-	1	3
Buckinghamshire	-	-	-	-	-	2	-	2
Cambridgeshire	-	-	1	-	-	-	-	1
Berkshire	-	-	-	-	-	-	1	1
Totals	34	91	144	121	220	232	212	1,054

NOTES

¹ Includes only missiles aimed at Norwich or Ipswich.

² Includes only missiles aimed at London; those aimed at Norwich or Ipswich between 3rd and 12th October are included in the previous column.

³ Of the figures under this head, those for Phase 2 and for the whole campaign are from German sources; those for Phases 1 and 3 are the author's estimates.

APPENDIX L

Civilian Casualties caused in the United Kingdom by Bombing and by various Forms of Long-Range Bombardment

	<i>Killed</i>	<i>Seriously Injured</i>	<i>Total</i>
Bombing	51,509	61,423	112,932
Flying bombs	6,184	17,981	24,165
Rockets	2,754	6,523	9,277
Cross-Channel guns	148	255	403
Totals	<u>60,595</u>	<u>86,182</u>	<u>146,777</u>

Of these 146,777 casualties, 80,397 (including about nine-tenths of those caused by flying bombs and roughly the same proportion of those caused by rockets) occurred in the London Civil Defence Region, and 66,380 elsewhere. Casualties to service personnel are not included.

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