'Despised and Neglected'? - British Fighter Defence, 1922-1940

By Group Captain John Alexander[1]

Seventy-five years after the Battle of Britain, the conventional wisdom remains that the Battle was won by the innovation of the 'Dowding system', which integrated radar and eight-gun fighters, and the skill and courage of the RAF's fighter pilots. This article examines the design of the London Air Defence Area in 1917-18, the formation of the Home Defence Air Force in 1922-23 and the reorientation of Britain's air defences to face Germany in 1934 to demonstrate that Britain continuously developed strategic air defence from 1922 to 1940 because of the alignment of both political imperative, defence strategy and the RAF's institutional air defence expertise. While successive Chiefs of the Air Staff favoured strategic bombing, the RAF, formed in 1918 to prevent German raids on London, had many air defence experts and advocates. Therefore, while strategic bombing was largely unproven and its impact exaggerated, air defence was based on lessons from the First World War, and increasingly on science, operational research and operational evaluation. Furthermore successive British governments, not just Chamberlain's, pursued a deliberate defensive strategy, recognising Britain's strategic vulnerability to the bomber and public anxiety, while seeking to use Britain's technical, industrial and air strength in a long war and avoiding a bloody continental commitment. This combination ensured victory in the Battle of Britain but also contributed to the Fall of France, without which the Battle of Britain would not have been fought.

> It was the universal belief that there was no defence against attack from the air. Baldwin expressed this when he said: 'The Bomber will always get through'. It was expected that every great city would be levelled to the ground immediately [...] The only answer was supposed to be 'the deterrent' of a bomber force as large as the enemy's. [...] All these calculations turned out to be wrong. The Germans never planned for independent bombing. Their bomber-force was an auxiliary for the army on the ground, and they had to improvise the air-attack on Great Britain in the summer of 1940. The Germans were answered and defeated not by British bombing, but by fighter-command, *which had been despised and comparatively neglected before the war*. [...] The pre-war years ran their course under the shadow of hideous misapprehension.[2]

Seventy-five years after the Battle of Britain the conventional wisdom remains that it was an unexpected victory, won by a miracle of innovation: the 'air defence system that Dowding had built' with its radar and eight-gun fighters, as well as by the skill and courage of the Few.[3] According to the military historian Terraine, it had needed 'a miracle to bend RAF thinking to the notion that bombers must not get through, and could be prevented from doing so'.[4] Historians continue to attribute this miracle to the intervention of scientists and Air Chief Marshal Sir Hugh Dowding's creation of 'the world's first fully integrated air defence system'.[5] According to Murray, writing in 2011, 'within the RAF's conception of air war, there was little role for air defence'.[6] Yet both the RAF's official narrative and history acknowledge the legacy Britain's 1940 air defences owed to developments before the formation of Fighter Command in 1936.[7]

In contrast the historiography of British inter-war defence strategy and the appeasement of Germany have been subject to substantial revision. The initial judgements of British defence strategy were highly critical and immediate. *The Guilty Men* - written between the Fall of France and the Battle of Britain – charged Neville Chamberlain and leading figures of the National Government with causing Britain's near defeat by failing to stop Hitler's aggression or to rearm sufficiently.[8] Post-war memoirs, most influentially Churchill's *The Gathering Storm*, also denounced Chamberlain and his policy of appeasement.[9] Taylor's *Origins of the Second World War*, quoted above, was a forerunner of a revisionist interpretation which sees Chamberlain as a strong-willed and capable leader whose widely-supported foreign and defence policies were based upon a realistic assessment of Britain's economic and military weakness, and its declining power and influence in the world.[10] These weaknesses included Britain's vulnerability to air attack, the declining British aircraft industry's inability to build a deterrent bomber force, and the public's fear of the bomber.[11] More recently a counter-revisionist interpretation criticises Chamberlain's wholly defensive military strategy, which neither defended Britain or her ally France, nor deterred Hitler, despite Britain's industrial strength.[12] By 1940 Britain had mobilised its economy for a long war, and was the world's largest aircraft producer, out producing German aircraft production by fifty per cent.[13]

This article challenges A. J. P. Taylor's assertion that Fighter Command was 'despised and relatively neglected before the war' by examining the alignment of successive British

governments' defensive strategy and its independent air force formed to ensure the strategic air defence of Great Britain. It also addresses the political scientists who cite of the development of Britain's fighter defences to explain theories of military innovation and adaptation. Posen argues militaries favour offensive and civilian leadership defensive doctrines, hence the British government's imposition of a defensive strategy upon the RAF, initiating the development of radar from 1934 'as almost nothing of any use had been done before' and prioritising fighters from 1937. Dowding, he suggests, was an outsider and innovator who countered the RAF's preference for strategic bombing.[14] In contrast, Rosen argues the evolutionary development of air defence had the support of the RAF leadership from 1923 onwards.[15] The historian Ferris goes further, arguing that the RAF's institutionalised and continuous development of air defence from 1923 onwards, based on the lessons of defending London in 1917-18, meant the Battle of Britain was a walk-over.[16]

The article focuses on three periods of change. The first is 1917-18 when in response to German air raids the War Cabinet decided to organise London's air defences under a unified command and subsequently to form an independent air service. The second is 1922-23 when successive Liberal and Conservative governments decided to form a Home Defence Air Force in response to the French air threat despite the assumption there would be no war in Europe for ten-years. Moreover the ratio of fighters and bombers in this force was carefully considered despite Chief of the Air Staff (CAS) Sir Hugh Trenchard's bomber preference. The third is 1934-35 when the government recognised the long-term threat of Germany, before Hitler dismantled the Versailles settlement, and when the RAF reoriented Britain's air defences to face Germany using scientific help. The article concludes by briefly reviewing the continuities in fighter defence development after the formation of Fighter Command in 1936.

The London Air Defence Area, 1917-18

The Naval and Army air services' inability to prevent the German Gotha bomber raids of 1917 resulted in both the creation of the world's first integrated air defence system and independent air service. Before the First World War various Zeppelin scare stories like H. G. Wells' 1908 *The War in the Air* had foreseen destructive air raids would threaten Britain's sense of strategic invulnerability and cause panic.[17] The public outcry following a Gotha daylight raid on London on 13 June 1917 which killed 162 people and injured 432 led the War Cabinet to appoint a two-man committee on 11 July consisting of the Prime Minister David Lloyd George and the South African Lieutenant General Jan Smuts to examine air defence and the organization of the air services.[18]

Their report on air defence just eight days later established the key principle of unified command of fighters and ground based air defences, a principle that applies to this day.[19] By 31 July Major General E. B. Ashmore, an ideal choice as both an artilleryman and pilot, was appointed to command all of London's air defences. He established a belt of anti-aircraft guns twenty-five miles east of London, with a fighter zone behind it. He also improved landline communications between ground observers and his operations centre to reduce fighter

response times, and used wireless equipped aircraft to track the raids. Following these improvements two further raids in August were turned back and the Gothas, like the Zeppelins previously, switched to night raids. In response, Ashmore moved his guns further out, deployed barrage balloons and more searchlights, and started equipping fighters with wireless. On 19 May 1918 the defences shot down six Gothas (three to fighters and three to guns) and the night raids stopped.[20] Ashmore's concept, adapted to the geometry of detection ranges, aircraft speeds and response times, remains the model of an integrated air defence system.

Smuts had been convinced of the theory of independent air power. The second report of 17 August 1917 concluded:

> *As far as can be foreseen, there is absolutely no limit to the scale of its future independent war use. And the day may not be far off when aerial operations with their devastation of enemy lands and destruction of industrial and populous centres on a vast scale may become the principle operations of war.*[21]

In an example of what the historian Edgerton calls 'liberal militarism', the report also noted the need to use 'mechanical power' in war in order to get the maximum fighting power from Britain's limited manpower resources. On 24 August 1917 the Cabinet accepted the report's recommendation to form a separate Air Ministry, to combine the Navy and Army air forces into one service, and to form the Independent Force for the strategic bombing of Germany. Despite the subsequent troubled beginnings of the Air Ministry, with Trenchard's resignation as CAS, his replacement by Frederick Sykes and Trenchard's subsequent conversion to the doctrine of strategic air attack,[22] the War Cabinet's direct intervention resulted in the formation of an independent air service to both defend London from air attack and to conduct strategic bombing.

The Home Defence Air Force, 1922-23

The Ten-Year Rule of August 1919 concluded 'that the British Empire will not be engaged in any great war during the next ten-years' and led to a period of disarmament until repealed in 1932.[23] Despite Smuts' apparent foresight, the immediate post-war period was uncertain for the RAF, reducing from 22,000 aircraft to 200 and from 240,000 men and women to 30,000 men in the five months from November 1918.[24] Lloyd George appointed Winston Churchill, uniquely, as both Secretary of State for War and for Air in January 1919, perhaps, some thought, to disband the RAF. Churchill sacked Sykes as CAS and reappointed Trenchard, liking his prudent proposals for a small, part-cadre, peacetime RAF.[25] Both Churchill and Trenchard saw the Ten-Year Rule and its requirement to police the empire 'making the utmost use of mechanical contrivances' to save manpower as an opportunity to exploit their faith in the 'morale effect' of bombing and to give the RAF a peacetime role.[26] By 1922 eight flying squadrons and two armoured cars companies had replaced two Army divisions in Iraq, much to the General Staff's disgust.[27] Trenchard used his limited resources to literally build the foundations of an independent service – a college for officers and another for apprentices –

rather than easily disbanded squadrons. By 1922 the home defence force had been reduced to just twenty-four aircraft and all of London's anti-aircraft guns and searchlights withdrawn.[28] Meanwhile the RAF was telling military and public audiences how the Independent Force's night raids had terrorised Germany.[29]

The Twenty-three Squadron Home Defence Force

The Government's realisation that a superior air force within striking range could threaten London led to the creation of a home defence air force despite both the Ten-year Rule and Government committees continuing to scrutinize both expenditure and the need for a separate Air Service. Former Prime Minister Lord Balfour's 1922 committee on imperial defence recommended the RAF retained its autonomy and also highlighted increasing French air power at a time of Anglo-French tensions over the Versailles settlement and the Middle East.[30] As a result Lloyd George's government decided in August 1922, just before it fell from power, to form a twenty-three squadron home defence force.

The Fifty-two Squadron Home Defence Air Force

Lloyd George's successor as Prime Minister, Bonar Law, primed by Sykes, his son-in-law and former CAS, was minded to abolish the RAF and withdraw from Iraq.[31] His Secretary of State for Air, Samuel Hoare, later named as one of the 'Guilty Men', convinced Bonar Law to appoint a committee under Lord Salisbury to reconsider the decision. Salisbury's committee also highlighted the threat of the 600-aircraft French strategic bomber force, said to be able to drop in one day the same weight of bombs as dropped on London in the whole war.[32] In a phrase reminiscent of the Royal Navy's two-power standard of 1889 which required it to be as large as the next two biggest navies combined, the government decided that the RAF must be 'of sufficient strength to adequately protect us against Air attack by the strongest Air Force within striking distance of this country'.[33] As a result, in June 1923, the Cabinet decided, with 'melancholy necessity', to form a fifty-two squadron home defence air force. The decision, made despite the Ten-Year Rule, secured the RAF's independence.[34]

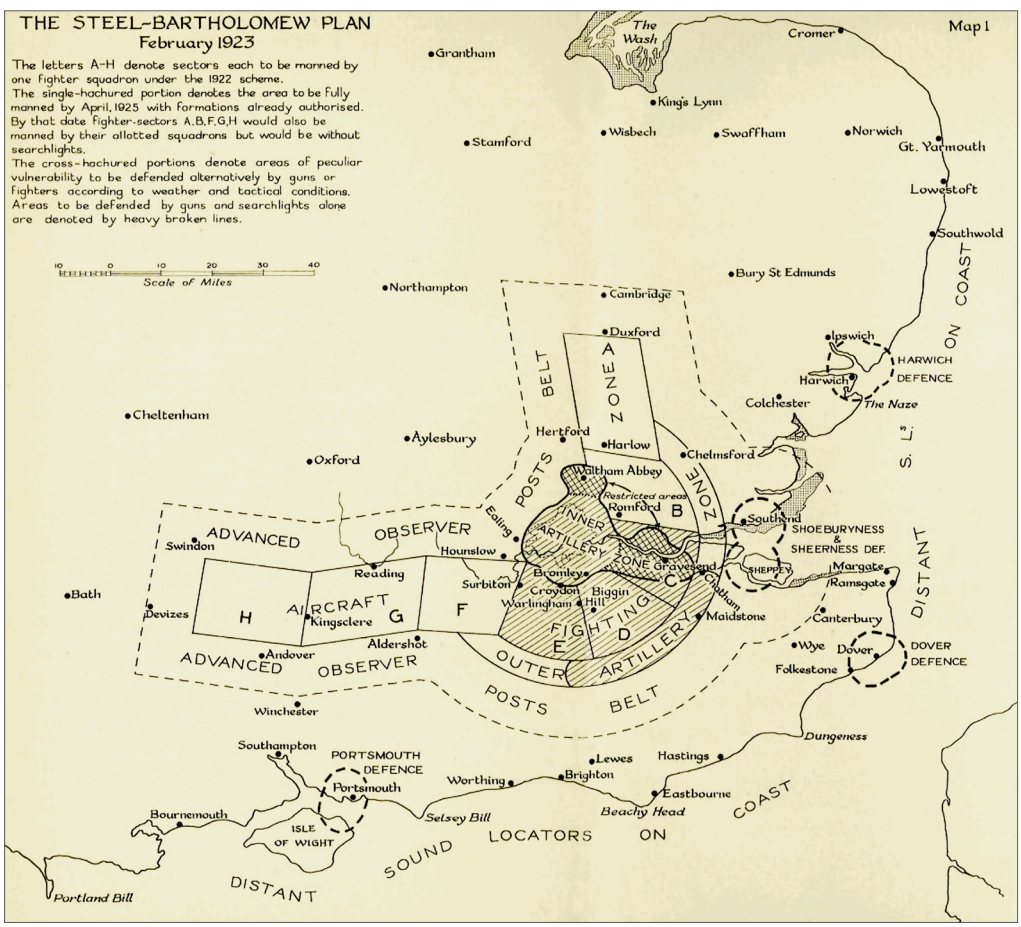
The Steele-Bartholomew Plan

If the decision to form a Home Defence Air Force demonstrated successive governments' recognition of the need for air defence, Army and RAF planning showed the lessons of the First World War were not forgotten. According to Smith, Trenchard's bomber doctrine meant that he 'initially put the ratio at two bombers for every fighter. This was arbitrary, to say the least, and was difficult to square with experience, limited though that was.'[35] But this was not the case in 1922 when Air Commodore J. M. Steel and Colonel H. W. Bartholomew's joint Air Ministry and War Office committee devised a defence scheme for the 1922 twenty-three squadron force with a ratio of fourteen bomber and nine fighter squadrons. The critical consideration was the number of fighter squadrons required to protect London.[36]

The calculations were precise. Based on Ashmore's 1917 integrated air defence system, the Steel-Bartholomew scheme required:

the necessary warning of attack to allow defending fighters to reach fighting height before the arrival of the enemy, anti-aircraft guns for the protection of vital points; and the speedy collation and dissemination of information and intelligence regarding the movement of friendly and enemy aircraft.[37]

Shown at Map 1 (below), the scheme's fifteen-mile deep Aircraft Fighting Zone was divided into nine squadron areas, running parallel to the coast from Cambridgeshire to Wiltshire, and lit by searchlights for night fighting. An Outer Artillery Zone allowed anti-aircraft guns to indicate approaching aircraft and attempt to break-up formations. An Inner Artillery Zone defended London, and guns protected ports such as Portsmouth and Dover.[38] The scheme required 264 anti-aircraft guns and 672 search-lights which the War Office had in store but could not man.



Map 1 – The Steel-Bartholomew Plan February 1923.[39]

The Bomber-Fighter Ratio

To plan the fifty-two squadron scheme, Trenchard held a series of meetings in July 1923. According to historians Hyde and Smith this is when Trenchard started imposing his bomber preference on the RAF.'[40] But the minutes of these meetings (by a young Charles Portal, a future CAS) show Trenchard was prepared to listen to his air defence advocates. His original proposal was for twenty-four day bomber squadrons plus fifteen of night bombers, and only thirteen fighter squadrons, a much higher preponderance of bombers than the 1922 scheme.[41] Though Trenchard accepted fighters were more effective in defence than anti-aircraft guns alone, there was, he thought:

> *A tendency to tackle the problem of air defence in the wrong way, in that provision was made for the defensive element without first taking into account the needs of the offensive. The correct way was to decide on the proportion of the force required for attack, and to use the remainder for defence.*[42]

He equated bombing with a football match, saying the sides that just defended their goal could not win and could not stop the bombing. He also thought the French would 'squeal before we did' in a bombing duel. Fighter escorts for bombers were discounted.[43]

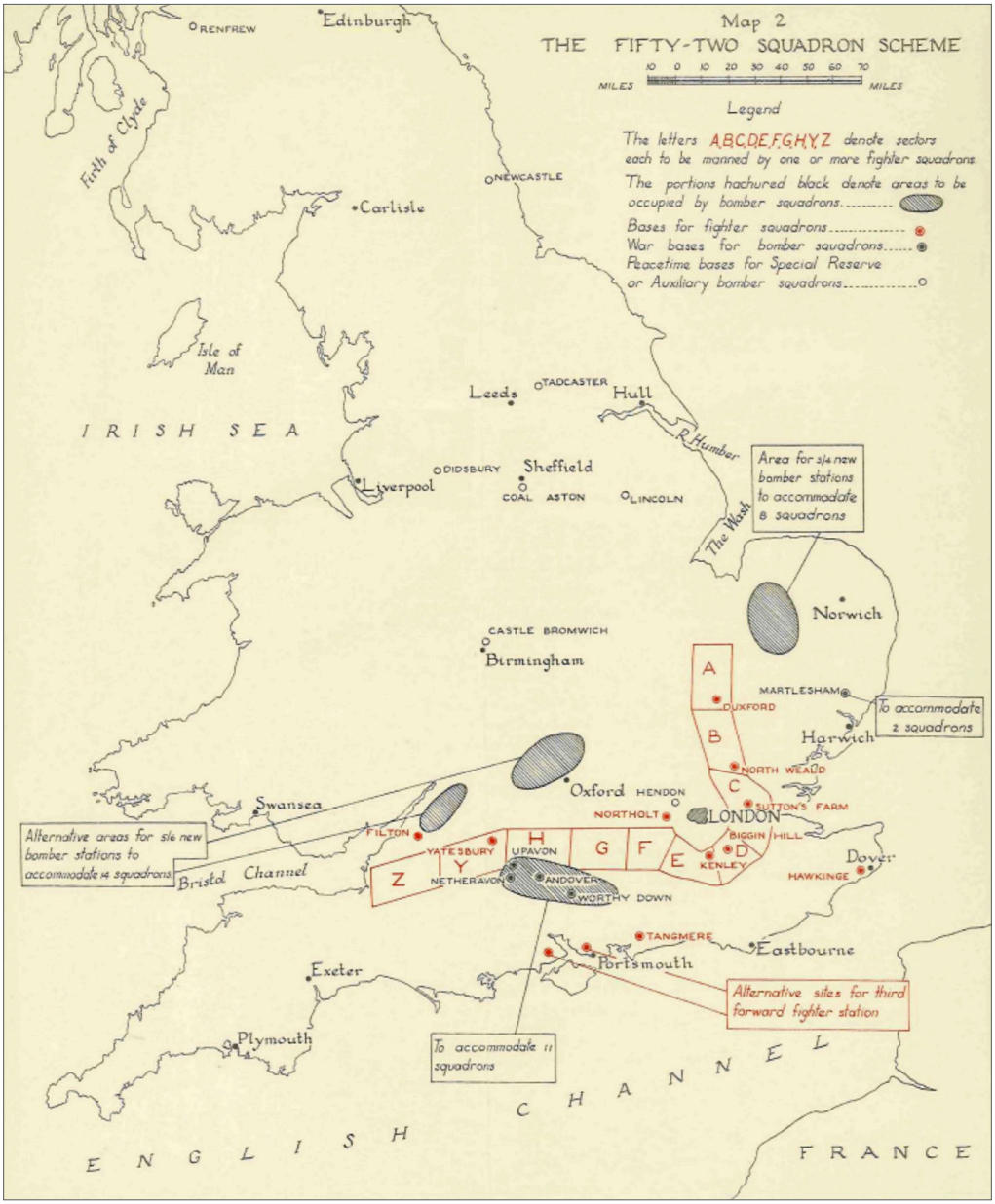
Trenchard was persuaded by his four UK-based air vice marshals, despite the rhetoric, that the ratio should be two-to-one in order to provide adequate fighter coverage. H. R. M. Brooke-Popham of the RAF Staff College, said by one historian to be institutionally pro-bombing,[44] proposed thirty-eight bomber squadrons and fourteen fighter; Vyvyan, Air Officer Commanding (AOC) Coastal Area, thirty-six and sixteen; J. F. A. Higgins, Ashmore's deputy in 1917-18 and now AOC Inland Area, thirty-three and nineteen; Steel, Deputy Chief of Air Staff, former naval air service and co-author of the 1922 scheme, thirty-two and twenty. Trenchard's decision was thirty-five bomber and seventeen fighter squadrons.[45] In practice the proportion of fighters was higher as the fighters squadrons were manned by regulars whereas thirteen bomber squadrons were to be part-manned by reserves. Also, fighter squadrons formed first because they were easier to man, equip and base. Hence the first eighteen squadrons formed were nine each of fighters and bombers.[46]

The Fifty-two Squadron Scheme

The air defence plan for a fifty-two squadron scheme was also calculated and not arbitrary. As shown at Map 2 (opposite), the Aircraft Fighting Zone was extended to Bristol and divided into ten zones; the four around London manned by two squadrons of zone fighters and the others by one. In addition, three interceptor (fast day fighters) squadrons were stationed near the coast to harass enemy bombers. The thirty-five mile gap between the coast and the Aircraft Fighting Zone was dictated by the time it took ground alert fighters to take-off and climb to the 14,000 feet altitude of the attacking bombers; only more warning or faster response times would allow fighters to be based further forward for longer engagement time. Holding fighters at ground alert required fewer aircraft than continuous combat air patrols.[47]

Aircraft

Contrary to suggestions that Trenchard's legacy to the RAF was obsolete aircraft designed for imperial policing, the RAF's highest priority operational requirements were fighters designed



Map 2 – The Fifty-Two Squadron Scheme.[48]

for the scheme; as Higgins put it, 'obviating the need to design tactics to suit the machines available'.[49] In 1928 the highest priority of the sixteen-types in RAF service was the single-seat zone fighter, a necessary compromise requiring a fast rate of climb to get to fighting height quickly, but also needing a low landing speed and heavy radio for night fighting. The RAF accepted the consequent penalty that it was slower than the single-engine day bombers in service. The second highest priority was the daylight only interceptor. With a higher landing speed and no radio they could be much faster. Fighter performance continually improved. In 1918 Sopwith Snipes took over ten minutes to reach 10,000 feet. By 1931, the Hawker Fury interceptor reached 20,000 feet in under eight minutes.[50] The lowest priority operational requirement was imperial policing for which obsolete First World War Bristol Fighters and DH9As were retained until the early 1930s.[51]

The Romer Committee

The overriding principle of unity of command was confirmed by the tri-service Romer Committee of 1923. The Air Officer Commanding-in-Chief (AOC-in-C) Air Defence of Great Britain (ADGB) commanded all UK-based bomber and fighter formations and AOC Fighting Area was responsible for all fighter and Army ground based air defences. All raid intelligence, including that from the Coastguard, warships and government signals intelligence stations, was collated at ADGB Headquarters at RAF Uxbridge and disseminated to all air defences and civil defence authorities by a dedicated Post Office telephone circuit.[52] The system was routinely exercised.

Exercises

Notwithstanding Robertson's accusation of bomber bias in the exercises, RAF exercise reports comment favourably on the performance of the air defences.[53] In the 1927 exercise the defenders intercepted fifty per cent of the raids, though seventeen fighter squadrons were recognised as too few to defend the whole country. Fighters were successful when clear weather conditions and available Observer Corps allowed detection of the bombers. The bombers were successful when hidden by clouds which contained gaps to bomb through. Night bombers were intercepted on clear nights.[54] The 1928 exercise results were better still: of fifty-seven day bomber raids only nine evaded the defences. In the 1931 exercises eighty-three per cent of daylight raids and forty-six per cent of night raids on London were intercepted by fighters holding ground alert using ground controlled interceptions.[55] A widely cited contemporary account implying that bombers were classed as twice as effective as fighters in the exercises may well be a misreading of the RAF's use of Lanchester's N2 Law for 'Aircraft in Warfare' where causalities are inversely proportionate to the square root of strengths.[56] Rather than bomber bias, the model emphasised the importance of concentration and the ability to mass fighters onto bomber formations. Headquarters ADGB attributed the improved interception rates since 1917 to the improved ability to direct fighter formations onto bombers.[57]

Fighter defence development continued under the Labour and National Governments, with further adaptation by the 1929 Holt committee, but slowed following the Locarno Treaties of

1925 which seemed to secure the post-war territorial settlement in Western Europe and again in 1932 in anticipation of the World Disarmament Conference.[58] By 1932 a total of forty-two home defence squadrons had been formed with completion of all fifty-two planned for 1938.[59] Nevertheless, from 1925 Britain possessed the world's only integrated air defence system as a result of the government recognising the need for air defence and the RAF's retained institutional expertise.

'The Bomber will always get through'

Given the interception rates achieved in exercises, Baldwin was being disingenuous when he famously said in 1932 'it is as well for the man in the street to realise that there is no power on earth that can protect him from being bombed. Whatever people may tell him, the bomber will always get through'.[60] It would have been more accurate to say some bombers would always get through. However the statement was intended to energise aerial disarmament negotiations at Geneva. Baldwin was also reflecting the official Air Staff view, explaining the impracticality of total air defence, given the area of space that needed defending. Hence, according to RAF doctrine the best defence was offence. Baldwin subsequently pledged if disarmament failed he would 'see to it that in air strength and air power this county shall no longer be in a position inferior to any country within striking distance of our shores'.[61] In restating the pledge originally made in 1923, Baldwin was reflecting the particular grip fear of the bomber and London's vulnerability had on Britain.[62] According to one historian 'belief in the Luftwaffe's potency was probably the single most important determinant of appeasement in the 1930s'.[63] Air parity with Germany dominated defence debate though estimates of German air strength and its threat to Britain were often exaggerated.[64]

Rearmament, Expansion, Reorientation, Radar and Fighters, 1934-1935

In 1934, political imperatives, as a result of the changing international situation coupled with public fear of the bomber, led directly to the expansion and reorientation of air defence. The Government formed the Defence Requirements Sub-Committee (DRC), when, in October 1933, Germany walked out of the Geneva Disarmament Conference and the League of Nations,[65] and after Japanese aggression had already led to the suspension of the Ten-Year Rule in 1932.[66] The DRC's first report in February 1934, strongly influenced by Robert Vansittart and Warren Fisher, its Foreign Office and Treasury Officials, recommended a balanced programme of rearmament remedying the deficiencies in all three Services but also identified German air power as the most serious long-term threat.[67] The metropolitan air force's forty-two squadrons included twenty-eight bomber and thirteen fighter squadrons. However, the true bomber strength, according to the historian Jones, was much less: with only six day and five night bomber squadrons classed as first-line.[68]

Vansittart and Fisher advocated a further twenty-five squadrons to strengthen the air defences of the South East and Midlands,[69] though surprisingly the Chiefs of Staff resisted, warning of the 'limited power of expansion of the Royal Air Force working under normal peace conditions'

and the 'great reluctance' of the Air Ministry to accept 'emergency conditions' of expansion.[70] Furthermore, in agreeing the knock-out blow was the most serious threat, Sir Edward Ellington, by many accounts the least impressive CAS between the wars, wanted to strengthen his bomber force, believing the fighter defence to be adequate:

> *I want to be quite clear that I will not agree to any increase of forces allocated to the Defence at the expense of the offense until 52 Squadrons are completed. The offensive portion has been already unduly weakened by the inclusion of so high a proportion of non-regular squadrons. As a line to cover London and as far as the Wash from the direction of Germany is a considerably shorter one than the original lay-out, and as the German menace for some years must be considerably less potentially than the French, I do not see that there is any necessity for increasing the number of fighter squadrons over the 17 allowed in the original scheme.*[71]

Chamberlain's Intervention

Yet the Cabinet, at Neville Chamberlain's bidding as chancellor, overruled both DRC and Air Ministry recommendations.[72] He argued that Japan could be appeased and therefore risk could be taken in equipping the Fleet to operate in the Far East, there was no need for an Army expeditionary force to support the French, but Britain should be protected by 'an Air Force based in this country of a size and efficiency calculated to inspire respect in the mind of a possible enemy'.[73] To this end, Chamberlain radically changed the report, reducing its cost by thirty per cent, the funds allotted to the Navy by sixty per cent, the Army by fifty per cent, and increasing the RAF's by almost 100 per cent.[74] The Cabinet's subsequent interim report on air defence allowed Baldwin to 'satisfy the semi-panic conditions which existed now about the Air'.[75] Known as Expansion Scheme A, it would expand the metropolitan RAF by thirty-three squadrons to seventy-five squadrons by 1940, and retain the proportion of bombers (forty-one squadrons) to fighters (twenty-eight squadrons - nineteen zone, six interceptor and three for the Field Force - at below two-to-one).[76] Contrary to Baldwin's earlier assertion of the impracticality of air defence and the Air Staff's bomber preference, the government marginally increased the proportion of fighters in an expanded RAF to reflect, as Baldwin told the Commons, Britain's new frontier on the Rhine, address public anxiety, and maintain affordable deterrence without continental commitment.[77] But this was done at the cost of a Navy that could protect British and Empire interests in the Far East and an Army that could support France.

Facing the German Threat

Chamberlain's report also directed work to adapt the air defence scheme to face the German threat. Air Marshal Sir Robert Brooke-Popham was appointed to chair a joint Air Ministry and War Office committee.[78] A former AOC Fighting Area, as AOC-in-C ADGB in 1933 he had recommended a review of the ten-year old scheme and proposed using combat air patrols or basing the faster interceptors in the Aircraft Fighting Zone to address the inability of Observer Corps' early warning to cope with the increasing speed of day-bombers.[79] He had already held

a conference to consider the problem of air defence from first principles. Its wide and active participation, including two future AOCs-in-C Bomber Command – Edgar Ludlow-Hewitt then Deputy CAS and Arthur Harris, the Deputy Director of Plans – speaks of a service able to deploy its air defence expertise free from bomber dogma.

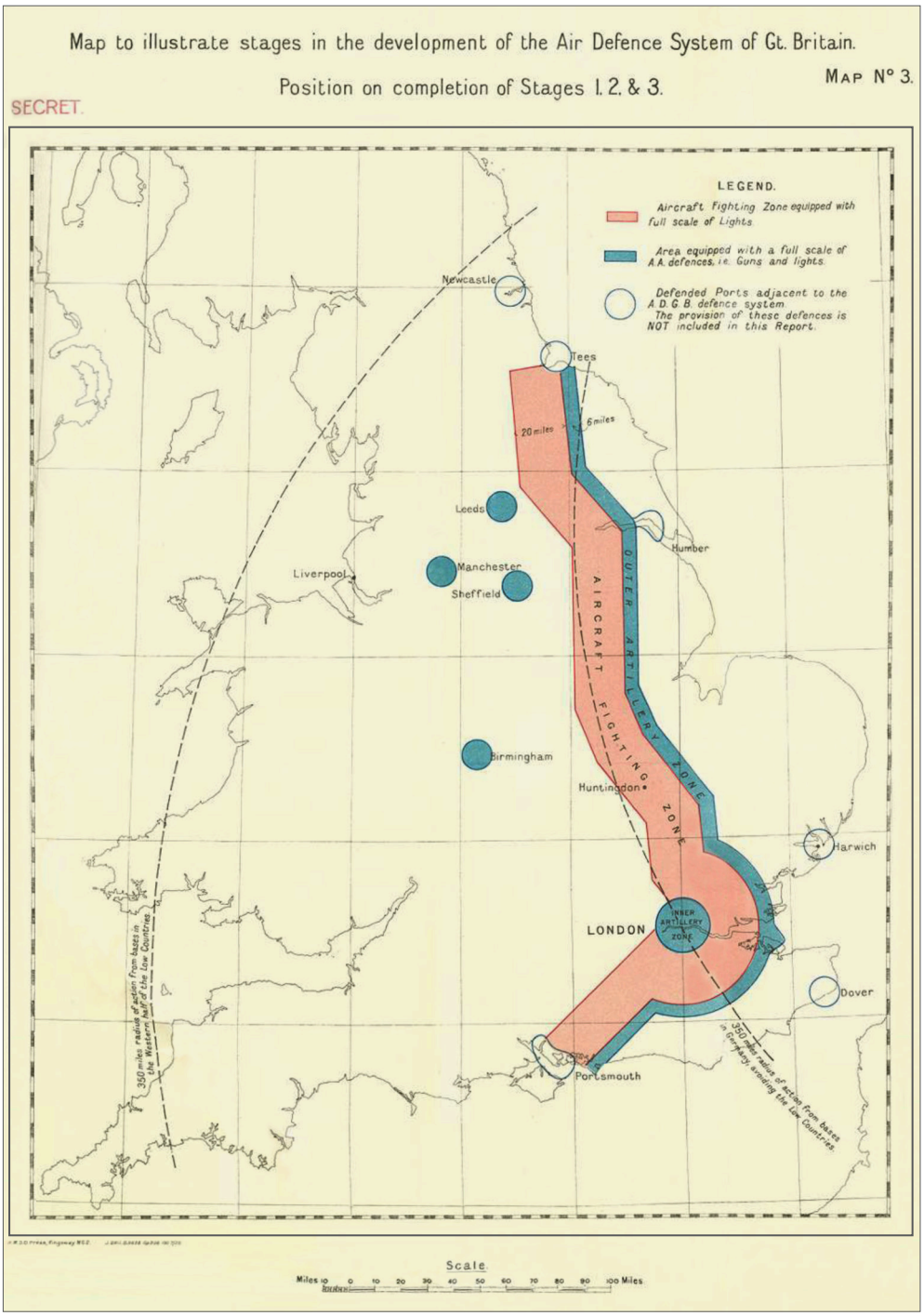
The conference concluded the Air Fighting Zone should be widened to allow more time for zone fighters to engage fast day bombers. However the zone could only be pushed forward if the enemy was detected before crossing the coast. This could not be guaranteed as trials of acoustic mirrors – 200-foot long sound detectors – had only limited success in the 1933 air defence exercise. Therefore the only solution was to reduce reaction times and also allow fighters to pursue enemy bombers into the Inner Artillery Zone to extend engagement times. Faster enemy night bombers also meant extending the searchlight illuminated zone.[80]

Brooke-Popham's Report

Brooke-Popham's Committee assumed war with Germany, alliance with France, and German aircraft either overflying or based in the Low Countries. Greater London was the primary target, but other important industrial areas in the Midlands and north of England would need protection. Also it would be 'necessary to provide visible protective measures for the maintenance of public morale'.[81] Meanwhile forces allocated to air defence were to be the 'minimum compatible with an adequate degree of protection'. In January 1935 the Committee's interim report recommended a continuous defended zone from Portsmouth, around London, to the Tees shown at Map 3 (Next page). This consisted of an Outer Artillery Zone of guns and searchlights six-miles deep, and an Aircraft Fighting Zone twenty-miles deep – increased from fifteen miles - with searchlights to illuminate enemy night bombers. London was defended by an Inner Artillery Zone with a twenty-mile diameter with other cities protected by anti-aircraft guns and lights.[82] The Cabinet's main concern was cost, particularly of the ground defences, an increased Observer Corps and low-level air defence guns for airfield defence, agreeing to completion of the first stage by 1940 only.[83]

Scientific Input

Brooke-Popham's Committee provides evidence of the RAF's ongoing scientific support to improve air defence. According to A. P. Rowe, assistant to the Air Ministry's Director of Research, his review of Air Ministry's files following a visit to an acoustic mirror in October 1934 with Dowding, then Air Member for Supply and Research, found there had been no co-operation with scientists to solve the problem of early warning. He recommended the formation of a scientific committee to consider air defence, subsequently known as the Tizard committee after its chairman. But Henry Tizard, aware of the need to improve detection, had already visited Brooke-Popham's headquarters in October 1934 and discussed possible 'electrical' methods of early warning.[84] Furthermore, Churchill's scientific advisor, Professor Lindemann had also advocated a Committee of Imperial Defence (CID) science sub-committee in August 1934, reminding Brooke-Popham in November of the scientific advice he had provided on anti-aircraft defences in 1928 and also of the Air Ministry's ability to



Map 3 – Reorientation of Air Defence System 1934.[85]

stifle good ideas.[86] Tizard's new committee met first on 28 January 1935, three days before Brooke-Popham's interim report recommended using science to improve warning. The Tizard committee's second meeting on 21 February, which considered Watson-Watt's paper proposing radio detection, was held at Brooke-Popham's headquarters, five days before the first demonstration of radar at Daventry. The evidence, therefore, is that use of scientists to develop fighter defences during the reorientation of air defence was an evolution rather than an innovation, albeit with greater urgency and effect.

Aircraft Development

Meanwhile the development of fighters designed for use within the integrated air defence system continued. The characteristics of the zone and interceptor fighters merged as advances such as wing-flaps broke the link between maximum speed and landing speed, and radios became lighter. This and the need for increased fire-power to take on bomber formations resulted in operational requirements in 1934 for the RAF's last biplane fighter, the four-gun Gloucester Gladiator, and in 1935 for the eight-gun monoplane Hurricane and Spitfire.[87] It also produced the requirement for the less-successful Defiant: its four-gun turret designed to out-gun bomber formations. Operational requirements and aircraft into-service dates were integral to the Cabinet's RAF expansion scheme decisions.[88] Furthermore, the achievements of the British aircraft industry, out producing Germany by 1940, was not purely the work of a few brilliant engineers like the Spitfire's designer R. J. Mitchell but the result of consistent and methodical plans proposed in the 1920s and implemented during rearmament.[89]

Fighter Command, 1936-40

The evolutionary development in fighter defence after the formation of Fighter Command in 1936 continued apace. Chamberlain, appointed Prime Minister in 1937, became increasingly concerned that air parity was unaffordable. The solution in Sir Thomas Inskip's review of late 1937, as the newly created Minister for the Co-ordination of Defence, was to prioritise fighters to protect Britain's economy from a German knock-out blow and to build heavy bombers later.[90] This represented the high water mark of Treasury-led defence policy and British attempts to avoid a continental commitment to deploy an expeditionary force in support of France. While Smith calls Inskip's review 'the single most important document produced on defence matters in the 1930s' he thought it a gamble 'justified neither by the contemporary state of readiness of Fighter Command, nor by estimates of German strength and strike capacity'.[91] But Churchill, who sat on the CID's Air Defence Committee, though he was not in the government, recognised Britain led the world in air defence: later noting 'it was operational efficiency rather than novelty of equipment that was the British achievement'.[92]

Under Dowding's leadership the further adaptation of fighter defence continued as a joint scientist and airman effort. Many developments pre-dated Dowding's appointment as AOC-inC Fighter Command in 1936 or even as Air Member for Supply and Research in 1930. For example, work on short-wave radio direction finding – later 'Pip-Squeak' – started in 1928.

Later, Dr B. G. Dickens at RAF Biggin Hill used operational research to take the radar filtered plot and convert it into an interception course for fighters, but it was the Station Commander, Wing Commander E. O. Grenfell who came up with the 'by-eye' method still in use today.[93] In 1937 Mr E. J. C. Dixon, whose seminal operational research enabled the exploitation of radar information, worked with Warrant Officer R. M. Woodley, who had been responsible for the Fighting Area operations room since at least 1931, to develop procedures.[94]

The Munich Crisis probably occurred at the worst time for RAF expansion following, as it did, unsuccessful air defence exercises and at a time when Ludlow-Hewitt, as AOC-in-C Bomber Command, was realising the reality of his limited bomber capability.[95] But after Munich it was decided to expand Fighter Command to fifty-squadrons and the summer 1939 exercises demonstrated Fighter Command's readiness for war, notwithstanding the February 1939 decision to send fighters with expeditionary force to France. Furthermore, Fighter Command struggled to replicate the Luftwaffe's expertise in air fighting tactics. Despite forming an Air Fighting Committee and an Air Fighting Development Establishment to develop tactics, restrictive tactical formations designed for two-gun fighters were retained until the Battle of Britain.[96]

Conclusions

The evidence presented in this article is that the RAF continuously developed air defence between the wars because strategic air defence was a political priority and because air defence expertise was institutionalised within the RAF. As the 1943 RAF narrative notes: 'Fighter Command, in short, was the fortunate legatee of ten-years' experience of air defence. The pity was that its inheritance was so much the smaller as a result of ten years economy'.[97] The RAF had been formed as a strategic air force and while successive Chiefs of the Air Staff favoured strategic bombing, there was much air defence expertise and advocacy within the service. Whereas strategic bombing was largely unproven and its impact exaggerated, air defence was based on lessons from the First World War, and increasingly on science, operational research and operational evaluation. While Smith thinks Steel's move from AOC-in-C ADGB to Bomber Command rather than Fighter Command in 1936 is evidence of bomber bias, Steel had co-designed the 1922 air defence scheme and advocated a higher fighter ratio than other air marshals in 1923.[98] Furthermore, Brooke-Popham may have been an advocate of bomber doctrine as the first commandant of the RAF Staff College but he was also the first AOC Fighting Area and as AOC-in-C ADGB led the reorientation work and advocated a scientific solution to the problem of warning of attack. Yet this cross-fertilization of leadership between the RAF's fighter and bomber capabilities highlights the need for further research to explain the differences in effectiveness and apparently different cultures within Fighter and Bomber Commands.

The development of fighter defence also supports a counter-revisionist view of appeasement and Edgerton's notion of Britain's way in warfare as the 'Air Forceism' phase of liberal militarism. Six of Cato's fifteen *Guilty Men* took decisions to improve air defence during the period –

Neville Chamberlain, MacDonald, Baldwin, Hoare, Inskip and Kingsley Wood. They helped ensure that from 1925 onward British fighter defence could counter the threat it faced. Political recognition of the fear of the bomber and the need for air defence had led to the formation of the RAF and the 1923 decision to match any air striking force within range. Another factor was economic: investing in the RAF bomber deterrent was seen as a cost effective response to German rearmament until it became too expensive at which stage fighters were prioritised. Chamberlain, in particular, saw investing in air defence as a means of protecting the economy for a long war.

The flaw in Chamberlain's strategy was of course Britain's failure to support France in 1940. That Fighter Command had to fight the Battle of Britain after the fall of France and the Low Countries in 1940 was evidence that maritime and continental strategies were interconnected and not separate choices.[99] The allied defeat in France was unforeseen, had turned on a few key events and the RAF suffered proportionally greater losses in France than in the Battle of Britain.[100] But a more capable expeditionary force and air component would have reduced the risk of French defeat. The *Guilty Men* had built-up the RAF whereas the French air force was no longer the force whose threat had secured the RAF's independence in 1923.[101]

Notes

[1] john.alexander@cantab.net. I would like to thank the participants of Transformation and Innovation in the British Military Conference at the University of Birmingham on 11 April 2011 for the comments received on the draft paper and also Dr Trevor Hopper for his supervision of my Open University MA in History dissertation from which the article is drawn. Any errors are my own.
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