

AN ANALYSIS OF THE FACTORS AFFECTING THE ROYAL AIR FORCE'S  
BOMBER FORCE/BOMBER COMMAND AIRCREW OPERATIONAL TRAINING  
PIPELINE AND THE RESULTING TRAINING METHODOLOGIES ADOPTED  
BETWEEN 1922 AND 1945

By

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## ABSTRACT

This thesis examines the role that operational training played in the development of aircrew for the Royal Air Force's Bomber Force/Bomber Command between 1922 and 1945. At the core of this operational training process was the training pipeline where untrained aircrew members entered at one end and fully trained aircrew emerged at the other that were fitted to take their place in operational squadrons. Although simple in theory, this training pipeline could be disrupted by many factors that included dysfunctional management, poor leadership, a lack of resources, changing policies, evolving or new tactics, technological developments with operational aircraft or training equipment, wastage and weather. These factors will be examined through the prisms of the RAF's Staff College, Air Ministry organisation and Bomber Command's training organisation. As this thesis concludes, operational training was a transformational factor in increasing the capabilities of Bomber Command as the war progressed. Significantly though, this training pipeline could not be simply switched on and off and therefore any change to policy had a major effect that resulted in aircrew shortage or surfeit. This thesis will examine the development of this training pipeline and consider how it matured to match a growing bomber force and the increasing technological complexity of four-engine bombers compared to the biplanes and light/medium bombers of the mid-1930s. This thesis aims to galvanize the debate about the importance of training and its relationship with doctrine, leadership and technology.

## DEDICATION

To Fran

Always understanding, always there.

## ACKNOWLEDGEMENTS

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## ABBREVIATIONS

AASF	Advanced Air Striking Force
ABTF	Air Bomber Training Flights
ACAS	Assistant Chief of the Air Staff
ACRC	Air Crew Recruiting Centre
ACSB	Air Crew Selection Board
ADGB	Air Defence of Great Britain
AHB	Air Historical Branch
AM	Air Ministry
AMP	Air Member for Personnel
AMDP	Air Member for Development and Production
AMSO	Air Member for Supply and Organisation
AMT	Air Member for Training
AMWO	Air Ministry Working Order
AOC	Air Officer Commanding
AOC-in-C	Air Officer Commanding in Chief
AONS	Air Observer and Navigation School
AOS	Air Observer School
AP	Air Publication
BATF	Beam Approach Training Flight
BCATP	British Commonwealth Air Training Plan
BDTF	Bomber Defence Training Flight
CANS	Civil Air Navigation School
CAS	Chief of the Air Staff
CFS	Central Flying School
CSBS	Course Setting Bomb Sight
DCAS	Deputy Chief of the Air Staff
DE	Direct Entry
DoR	Director of Requirements
DoT	Director of Training
DR	Dead Reckoning
DS	Directing Staff
DSD	Directorate of Staff Duties
DWTT	Director of War Training & Tactics
EATS	Empire Air Training Scheme
EFTS	Elementary Flying Training School
EPM	Expansion Committee Progress Meeting
FTS	Flying Training School
GPS	Group Pool Squadron
HCF	Heavy Conversion Flight
HCU	Heavy Conversion Unit
IE	Initial Equipment
IG	Inspector General
IR	Initial Reserve
ITW	Initial Training Wing
KSA	Knowledge, Skills and Attitude
LFS	Lancaster Finishing School
MAP	Ministry of Aircraft Production

NAL	National Aerospace Library
NCO	Non-Commissioned Officer
NSTDU	Navigation Synthetic Training Development Unit
ORS	Operational Research Section
OTU	Operational Training Unit
(O)AFU	Observer Advanced Flying Unit
(P)AFU	Pilot Advanced Flying Unit
PFF	Pathfinder Force
PNB	Pilot, Navigator and Bomb Aimer
PUS	Permanent Under-Secretary
RAFHS	Royal Air Force Historical Society
RAFM	Royal Air Force Museum
RAFVR	Royal Air Force Volunteer Reserve
RFC	Royal Flying Corps
RNAS	Royal Naval Air Service
RUSI	Royal United Services Institute
SASO	Senior Air Staff Officer
SAT	Systems Approach to Training
SE	Single Engine
SFTS	Service Flying Training School
S of S	Secretary of State
SSC	Short Service Commission
STDU	Synthetic Training Development Unit
STE	Synthetic Training Equipment
STCP	Synthetic Training Committee Paper
TNA	Training Needs Analysis
TNA	The National Archives
TE	Twin Engine
UE	Unit Equipment
USAAC	United States Army Air Corps
USAAF	United States Army Air Forces
VCAS	Vice-Chief of the Air Staff
WOp	Wireless Operator
WOp/AG	Wireless Operator Air Gunner

## CHAPTER ONE

### INTRODUCTION

This thesis explores how the Royal Air Force's (RAF) operational training delivery methods and training organisation for its bomber force designated Bomber Command from July 1936, evolved to keep pace with the Service's expansion, tactical development and the introduction of more complex aircraft types between 1922 and 1945. This period has been chosen as 1922 marks the opening of the RAF Staff College in Andover leading to its subsequent impact on the RAF to 'create a bespoke school of thought.' It ends in 1945 with the culmination of the Second World War and the contraction of operational training that began in late 1944.<sup>1</sup> The RAF's training policy in 1922 was largely derived from its experiences during the First World War so this thesis will also examine that period to analyse the training legacy created by that conflict.

As will be discussed when examining the bomber force's historiography, since the end of the Second World War the main focus of attention has been on operations, squadron histories and technical aspects such as aircraft and weapons. More recent academic studies have broadened this approach to include areas such as doctrine, leadership, the morality of strategic bombing and Bomber Command's culture. However, operational training has largely been ignored and so it is training that is the focus of this thesis. In many ways this omission is surprising given that much of the coverage of the bomber force has fallen on its inability to navigate and operate at night, as well as the failure of its self-defending bomber formation tactics

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<sup>1</sup> F. Monahan, 'The Origins of Organisational Culture of the Royal Air Force' (PhD Thesis, University of Birmingham, 2018), p.199.

that were promoted during the interwar years and disastrously demonstrated during early operations in the Second World War.<sup>2</sup> This has fed the ongoing debate concerning the disjoint between the RAF's stated doctrine and its ability to fulfil the delivery of that doctrine. Although the answer to these issues was a requirement for better training, this has not been addressed or meaningfully examined and this has left a significant gap in the historiography and the general holistic study of the bomber force. This thesis addresses this academic shortfall by answering the following research question; how did the bomber force/Bomber Command operational training evolve between 1922 and 1945 and what drove that process? Furthermore, this thesis will also answer the subsidiary question; was that training evolution an improvement on what went before and if so, how?

## **Scope**

The evolution of operational training will first be examined by considering the RAF's legacy that was created from its experiences during the First World War. In assessing how this operational training knowledge base was developed, this thesis examines the intellectual input from the RAF Staff College; organisational and management structures that managed operational training; what aircrew training processes and methodologies were used as well as the use of innovative approaches to training such as the adoption of Synthetic Training Equipment (STE). By answering these questions, this thesis will show that training was a fundamental factor in improving Bomber Command's operational effectiveness and helped to resolve some of the earlier issues concerning poor levels of navigation, learning to operate effectively at

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<sup>2</sup> M. Middlebrook and C. Everitt, *The Bomber Command War Diaries* (Leicester: Midland Publishing Ltd, 1996), p.27.

night as well as a growing ability to integrate more technologically complex aircraft. This was not a simple linear process of taking the lessons learned during the First World War and developing them in readiness for the next global conflict as many of these lessons had been forgotten or ignored in the inter-war years. An example was the need for 'control of the air' or air superiority that was established before and during the First World War but had been disregarded during Bomber Command's daylight attacks on shipping in northern Germany during 1939-40.<sup>3</sup>

The importance of training and its relationship with air power was highlighted during the inaugural meeting of the Aircrew Training Conference held in London that took place during January 1942 when the Parliamentary Under Secretary of State for Air, H.H. Balfour, told delegates '...that training is and must continue to be one of the main foundations upon which air power is built.'<sup>4</sup> Given this importance, training has been underexplored in its own right within the context of air power studies and this historiographical gap needs to be filled, as by examining training, academics get new and original insights into broader debates about the development of Bomber Command and, more widely, strategic bombing. The lack of academic research afforded to operational training will be examined in this chapter's analysis of the bomber force's historiography. To keep this thesis within manageable boundaries, it will not include operational training conducted by the light bomber striking force (2 Group), the Pathfinder Force (PFF), Mediterranean Allied Air Forces (MAAF) or the light bomber Mosquito force, concentrating instead on the main bomber force.

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<sup>3</sup> J. Pugh, 'The Conceptual Origins of the Control of the Air: British Military and Naval Aviation, 1911-1918' (PhD Thesis, University of Birmingham, 2012).

<sup>4</sup> TNA AIR 20/1344, Minutes of the first Aircrew Training Conference held on 23 January 1942.

This introductory chapter will address four key themes. The doctrinal and technological background of the RAF's bombing force will be provided to highlight the context in which training had to be delivered to both individuals and crews; the latter being referred to as collective training. The chapter will then move on to discuss the historiography of the bomber force, and more specifically, operational training within that force, before setting out the methodology, content and structure of this thesis. The chapter will conclude by looking at archival sources and how they have been used within this thesis.

### **The Doctrinal Context of Training**

Before this thesis examines operational training in detail it is worth putting that training in the context of what shaped and defined the bomber force during 1922-1945. In the words of Dean, 'to tell the history of the Royal Air Force's survival in the Twenties in detail would be tedious' and an exercise that this thesis will therefore eschew. In simple terms however, those defining factors can be grouped under the four headings of politics, economics, bombing doctrine and aircraft.<sup>5</sup> As the following historiographical analysis shows, all have been examined in great depth over recent years so this contextual analysis will be necessarily brief and only synthesise those aspects having a direct bearing on the operational training pipeline. Considering the profound effect of operational training on all four factors it is surprising that training has been under-explored by academics for so long. Much has been written about the establishment and survival of the RAF, particularly concerning the opposition to the Service by the Royal Navy and Army, and Treasury parsimony, most notably by

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<sup>5</sup> M. Dean, *The Royal Air Force and Two World Wars* (London: Cassell, 1979), p.34.

Montgomery Hyde and Dean, and therefore these aspects will not be considered in detail.<sup>6</sup> A more nuanced approach has been taken by Gardner who highlighted the 'three-way competition' and the methods used by the RAF to ensure its survival and how it promoted its 'modernity' compared to the other two services.<sup>7</sup> Another contextual factor to shape the structure of the inter-war RAF was disarmament and its impact on delaying the development of both tactics and aircraft technology.<sup>8</sup>

Although beneficial in many ways in providing a clear doctrinal mission for the nascent RAF, Professor Zuckerman, the Air Ministry's operational research specialist during the Second World War, opined that: 'Ever since the First World War, the *raison d'être* for the existence of an independent air force was the belief that an enemy could be defeated by striking at his heartland over the heads of battling armies...[this was held]...as an article of faith.'<sup>9</sup> As Trenchard's post-war tenure as CAS continued, so did the RAF's emphasis on independent operations and these became 'the cornerstone of Trenchard and his Air Ministry's rhetoric for the period up to the formation of Bomber Command [in 1936].'<sup>10</sup> Trenchard's 'extremely long tenure of power' as CAS saw him first dictate and then defend this doctrine. As Higham has argued, Trenchard was 'doggedly committed [to] his own prejudices.'<sup>11</sup> This 'path to strategic air power' was not underpinned by a robust and workable training process and, as will be discussed later, this was one of the major reasons that led to a failure

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<sup>6</sup> H. Montgomery Hyde, *British Air Policy Between the Wars: 1918-1939* (London: Heinemann, 1976) and Dean, *The Royal Air Force and Two World Wars*.

<sup>7</sup> S. Gardner, 'Whitehall Warriors: The Political Fight for the Royal Air Force, 1917-1929' (PhD Thesis, University of Exeter, 2019).

<sup>8</sup> N.C. Fleming, 'Cabinet Government, British Imperial Security, and the World Disarmament Conference, 1932-1934', *War In History*, Vol. 18, Iss. 1, 2011, pp.62-84.

<sup>9</sup> Lord Zuckerman, 'Strategic Bombing and the Defeat of Germany', *JRUSI* 130:2, June 1985, p.67.

<sup>10</sup> P.W.Gray, 'The Strategic Leadership and Direction of the Royal Air Force Strategic Air Offensive against Germany from Inception to 1945' (PhD Thesis, University of Birmingham, 2009), p. 98.

<sup>11</sup> R. Higham, *The Military Intellectuals in Britain, 1918-1939* (Wesport: Greenwood Press, 1966), p.4.



of the RAF's early bombing efforts during the Second World War. This challenge was exemplified by Bomber Command's inability to prosecute the precision targeting required to attack discrete target types contained in Britain's Western Air Plans list.<sup>12</sup>

Doctrine is vitally important, as Parton has argued, because it drives, or should drive, 'the specification, and procurement of new equipment' as well as 'the training and exercising of the force', but the RAF's failure to define a clear doctrine during the inter-war years was not unique.<sup>13</sup> From a British Army perspective, the importance of doctrine leading training was also made by Murray and Millett in describing that organisation's operational performance in the Second World War. They wrote that, '[t]he real cause of such a state of affairs lay in the failure of the army leadership to enunciate a clearly thought-out doctrine and then to institute a thorough training program [*sic*] to insure its acceptance throughout the army.'<sup>14</sup> These views have been reinforced by Harrison Place who has argued that the British Army 'failed to establish and enforce a coherent and effective doctrine.'<sup>15</sup> Unfortunately, in the case of the inter-war bomber force, doctrine had become dogma so much so that the RAF believed 'the bomber will always get through' message delivered by Stanley Baldwin in 1932.<sup>16</sup> Not only had the bomber become paramount, a misplaced emphasis on the capabilities of strategic bombing generated over-confidence in its prowess

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<sup>12</sup> S. Robertson, *The Development of RAF Strategic Bombing Doctrine, 1919-1939* (Westport: Praeger, 1995), p.137.

<sup>13</sup> N. Parton, 'The Evolution and Impact of Royal Air Force Doctrine: 1919-1939' (PhD Thesis, University of Cambridge, 2009), p.5.

<sup>14</sup> W. Murray & A.R. Millett, *Military Effectiveness Volume III - The Second World War* (Boston: Allen & Unwin, 1988), p.125.

<sup>15</sup> T. Harrison Place, *Military Training in the British Army 1940-1944 – From Dunkirk to D-Day* (London: Routledge, 2000), p.168.

<sup>16</sup> Prime Minister Stanley Baldwin's speech to Parliament on 10 November 1932. [http://www.emersonkent.com/speeches/the\\_bomber\\_will\\_always\\_get\\_through.htm](http://www.emersonkent.com/speeches/the_bomber_will_always_get_through.htm). Accessed, 12 May 2021.

beyond its practical effect. In the words of Squadron Leader Andrews, writing in 1931: 'The bomb is a weapon of precision, and has a moral and disorganizing effect totally out of proportion to the material effect.'<sup>17</sup> Such views fuelled an unwavering belief in what proved to be a fallible doctrine without addressing the training issues, such as navigation, gunnery and bombing accuracy, that were needed to make the doctrine successful.

Even after its formation in 1936, Bomber Command's standard of navigation in the period leading to war and perhaps extending until late 1942 was arguably the 'weakest' aspect of bomber operations.<sup>18</sup> Although the aircraft types were changing, radio navigation aids had not been widely adopted and this led to a significant number of forced landings and crashes because the pilot – still then responsible for navigation - had become lost. Between 1937 and 1939, 478 aircraft made forced landings.<sup>19</sup> Between September 1937 and February 1938, 90 pilots and observers were killed in flying accidents, many of them due to navigational errors, and these events magnified the poor standard of training being delivered by the RAF at the time.<sup>20</sup> On 12 December 1936, one incident highlighted the parlous state of navigational training and the absence of navigation aids when seven Handley Page Heyford aircraft took off from RAF Aldergrove in Northern Ireland bound for RAF Finningley in Yorkshire. Entering low-cloud and experiencing icing conditions, six aircraft crashed with the single survivor landing at Finningley.<sup>21</sup> Although, as

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<sup>17</sup> J.O. Andrews, 'The Strategic Role of Air Forces', *JRUSI*, 1 February 1931, pp.740-743.

<sup>18</sup> AHB, Ludlow-Hewitt Papers, Box 2, Staff Officer Notes for visit to Abingdon, 22 November 1940.

<sup>19</sup> R. Wakelam, *The Science of Bombing – Operational Research in RAF Bomber Command* (Toronto: University of Toronto Press, 2009), p.15.

<sup>20</sup> Hansard, 22 February 1938, [https://hansard.parliament.uk/Commons/1938-02-22/debates/e35c0a01-a8e4-4d02-9249-4333272324e1/RoyalAirForce\(FatalAccidents\)](https://hansard.parliament.uk/Commons/1938-02-22/debates/e35c0a01-a8e4-4d02-9249-4333272324e1/RoyalAirForce(FatalAccidents)). Accessed 16 October 2020.

<sup>21</sup> *Hansard*, House of Commons Debate, Sir Philip Sassoon, 25 March 1937, Vol. 321, cc. 3095-8W.

Robertson has stated, strategic bombing had become central to the RAF's doctrine, no thought had been given to 'translating this idea into reality,' least of all through robust operational training.<sup>22</sup> This point has been echoed by Black, who wrote that 'the hope of air power in the 1930s was not matched by the level of technology necessary to deliver it,' and this was particularly true of navigation, and more specifically, the ability to find the target.<sup>23</sup> Biddle added that 'navigation training was left to languish during the interwar years' with Celestial navigation 'largely ignored', a situation compounded by a lack of investment in radio frequency (RF) navigation aids.<sup>24</sup> From a training perspective, this inability to translate 'rhetoric into reality', to borrow a phrase from Biddle, meant that there was friction between Bomber Command and the Air Ministry about balancing the resources allocated to operations and training. This was particularly apparent starting with the RAF's expansion from 1934.

### **Aircraft Technology Context**

The aircraft that the bomber force were equipped with prior to the outbreak of war were far less complex compared with those at the end of the war. In 1937, for example, Bomber Command operated outdated aircraft such as the Hawker Hind, Hawker Audax and Fairey Gordon as light bombers and the Boulton Paul Overstrand and Handley Page Heyford as medium bombers.<sup>25</sup> All five types had fixed undercarriage, were wooden biplanes, had fixed pitch propellers, lacked flaps and only the Overstrand had a turreted machine gun in an unpowered turret; the

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<sup>22</sup> S. Robertson, *The Development of RAF Strategic Bombing Doctrine, 1919-1939*, p.xxvii.

<sup>23</sup> J. Black, *Air Power – A Global History* (London: Rowman & Littlefield, 2016), p.89.

<sup>24</sup> T. Biddle, *Rhetoric and Reality in Air Warfare* (Princeton: Princeton University Press, 2004), p.89.

<sup>25</sup> TNA AIR 41/39, AHB Narrative, *The RAF in the Bomber Offensive Against Germany, Vol. 1 – Pre-War Evolution of Bomber Command 1917-1939*.

remainder featured pintle-mounted machine guns in open turrets.<sup>26</sup> These aircraft had changed little since the First World War.<sup>27</sup> The new generation of aircraft entering service from the late 1930s, such as the Hampden, Wellington and Whitley, highlighted a major technological leap that had significant implications for training. In a lecture given at RUSI in March 1936 by Air Marshal Sir Cyril Newall, then the Air Member for Supply and Organisation (AMSO), the speaker noted changes to aircraft design with specific reference to: retractable undercarriage; flaps; variable pitch airscrews; and the move from biplane to cantilever monoplane designs.<sup>28</sup> Another factor was the increase in Maximum Take Off Weight (MTOW) and its effect on handling as well as the gradual addition of new communications, navigation systems and armament, along with the concomitant increase in specialist aircrew members to operate such systems, although these specialists came from ground crew trades. This technological gap became particularly pronounced with the arrival of the four-engine heavy bombers into operational service, the Stirling and Halifax in 1941 and the Lancaster in 1942, and this expansion called for additional training at the Operational Training Unit (OTU) and latterly, the Heavy Conversion Unit (HCU) phases of training.<sup>29</sup> These improvements in aircraft design also had implications for the training pipeline and how training should be designed and delivered. This 'training gap' is exemplified when considering the differences between the Second World War Spitfire and the Lancaster and the First World War SE5 and DH9. The latter fighter

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<sup>26</sup> O. Thetford, *Aircraft of the Royal Air Force Since 1918* (London: Putnam, 1976), see individual aircraft entries.

<sup>27</sup> C.S. Sinnott, 'RAF Operational Requirements 1923-39' (PhD Thesis, King's College, London, 1998), p.129.

<sup>28</sup> C.L.N. Newall, 'The Expansion of the Royal Air Force' (Lecture), *JRUSI*, Vol. 81, Feb/Nov 1936, pp. 347-359.

<sup>29</sup> Thetford, *Aircraft of the Royal Air Force Since 1918*, see various aircraft entries.

and bomber combination could be flown by a 'universal pilot'; while the former aircraft were technically far more complex and therefore required training specialisation.<sup>30</sup>

The 'universal pilot' mentality permeated the RAF in the 1920s and early 1930s and, given the financial constraints of that period, made economic sense but as more complex aircraft began to enter service this added to the RAF's training burden.

The financial pressures that the RAF was faced with in the interwar period were ever present and had serious consequences for the procurement of equipment and the delivery of training. This fine balance between needing to be seen as an effective fighting force and one that was cheap to run was highlighted in a lecture to Staff College students in March 1939 by Wing Commander J.W. Baker, who would become Director of Bomber Operations in February 1941. He said that, 'The aim of all training is to fit the R.A.F. for war. All aspects of our air training policy must be tested with reference to this aim.' Barker then added a dose of realism and went on to define these aspects, 'including always the overriding one of finance.'<sup>31</sup> [emphasis in original].

In terms of the increasing operational capabilities of the bomber force between 1922 and 1945, it is worth considering the technological improvements in aircraft performance further and the impact that this had on training. As ranges increased and Bomber Command moved to a strategy of night bombing following its failed self-defending bomber formation daylight attacks against Germany, new navigational and communication systems added another layer of complexity to the new generation of

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<sup>30</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-44*.

<sup>31</sup> RAFM AIR 69/216, RAF Training Lecture – Part I, delivered to the 17<sup>th</sup> Staff College Course, 1 May 1939.

bombers. Again driving the need for more specialised crew training.<sup>32</sup> This new technology and the arrival of larger and more complex aircraft also meant that flying them became more expensive and this led the RAF to look at the adoption of synthetic training equipment with which to carry out training on the ground instead of the air.<sup>33</sup>

As we have seen above, the RAF's bomber force transitioned to more complex aircraft in what can be seen as three phases. The first saw them operating single- and twin-engine wooden biplanes before employing all metal aircraft in the mid-1930s. From 1941, this fleet transitioned yet again to four-engine heavy bombers such as the Stirling, Halifax and Lancaster. As already discussed, these aircraft were a central part of the RAF's bombing doctrine but little attention was initially paid to how they would undertake this task. The result was that little investment was made in long-range navigation, night flying or how these bombers would defend themselves in countering enemy fighters. There was also the issue of failing to realise that increasingly complex aircraft required specialist crew members to undertake tasks such as navigation, gunnery, radio telephony and acting as a flight engineer. There were clear training shortfalls that took Bomber Command until 1942 to address and these will be examined later.

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<sup>32</sup> T. Withington, 'Bomber Command's Electronic Warfare Policy and Suppression of Enemy Air Defence Posture During the Second World War' (PhD Thesis, University of Birmingham, 2017).

<sup>33</sup> TNA AIR 16/337, Air Ministry Correspondence concerning the Simulation of Air Training on the Ground from its first meeting on 11 March 1940.

## Literature Review – Official Sources

Bomber Command has generated a rich vein of topics that historians have mined over the past 70 years. Much of this academic work has been based on official histories and publications that, in the case of Bomber Command, are primarily reflected in the three-volume *Royal Air Force 1939-1945* by Denis Richards and Hilary St G. Saunders published between 1953 and 1954 and the four-volume *Strategic Air Offensive Against Germany 1939-1945* by Noble Frankland and Sir Charles Webster that was published in 1961.<sup>34</sup> These official histories are underpinned by the Air Historical Branch (AHB) Narratives that looked at the majority of activities of the RAF during the war. As far as Bomber Command was concerned, these AHB Narratives have the overarching title of *The RAF in the Bomber Offensive Against Germany* and appear in seven volumes that chronologically address the evolution of Bomber Command during the Second World War.

Although useful for context, operational training has been largely ignored in the Bomber Command Narratives and the official histories. Despite Richards referring to training having a, ‘vital, complex relationship to first-line strength and efficiency,’ in his account, it has no chapters dedicated to it nor serious consideration afforded it in *The Royal Air Force 1939-1945*.<sup>35</sup> This work primarily focuses on providing ‘a history of operations and the policy that governed them’ with an admission that the authors had ‘done much less than justice’ to areas such as training.<sup>36</sup> Frankland and Webster

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<sup>34</sup> D. Richards, *Royal Air Force 1939-1945 Vol. 1* (London: HMSO, 1953). D. Richards & H. Saunders, *Royal Air Force 1939-1945 Vol. 2* (London: HMSO, 1953). H. Saunders, *Royal Air Force 1939-1945 Vol. 3* (London: HMSO, 1954) and C. Webster and N. Frankland, *The Strategic Air Offensive Against Germany 1939 – 1945*, Vols. I-4 (London: HMSO, 1961). The AHB Narratives can be downloaded from the AHB website.

<sup>35</sup> Richards, *Royal Air Force 1939-1945 Vol. I*, p.72.

<sup>36</sup> *Ibid.*

provide a more rounded view of training in their *Strategic Air Offensive Against Germany 1939-1945* with a chapter on training and tactics in volume one and a chapter on operational training in volume four, but in total, that only amounts to 28 out of over 1,700 pages. This shortcoming was highlighted by the authors in their preface to *Volume 1*. After stating that although the work was 'longer than originally designed' they conceded that some aspects 'have not been able to [be treated] as fully, perhaps, as their importance merits, such as training...'<sup>37</sup> Perhaps an understatement given the resources allocated to training by Bomber Command. By the end of the war, with a fleet of 2,856 operational bombers in March 1945, an additional 1,164 aircraft were used for training.<sup>38</sup> The size of the training effort could also be seen in the hours flown. In June 1944 for example, Bomber Command flew 44.2% of its total hours on operations, 38.5% were generated by OTUs and 17.3% by HCUs, giving a combined total training time of 55.8%.<sup>39</sup> The benefit of the *Strategic Air Offensive Against Germany* volumes is their ability to place Bomber Command's training in a wider operational context by providing both 'description and analysis' of the whole bomber force. As far as the AHB's *Strategic Air Offensive Against Germany* was concerned, its authors admitted that, 'Further investigation is needed of many of Bomber Command's supporting services such as aircraft design and production, technical and aircrew training and the organisation of the force.'<sup>40</sup>

The other AHB Narrative with particular relevance for this thesis is *Aircrew Training 1934-42* and although covering the complete RAF it helps to provide an

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<sup>37</sup> Webster and Frankland, *The Strategic Air Offensive Against Germany 1939-1945*, Vol. I, pp.v-vi.

<sup>38</sup> Webster and Frankland, *The Strategic Air Offensive Against Germany 1939-1945*, Vol. IV, Annexes & Appendices, Appendix 38.

<sup>39</sup> TNA AIR 20/1347, Notes on the History of RAF Training 1939-1944, p.19.

<sup>40</sup> TNA AIR 41/41, AHB Narrative, *The RAF in the Bombing Offensive Against Germany, Vol III: Area Bombing and the Makeshift Force*, p.285.



overview of all *ab initio* and operational training for the Service and how resources were increasingly absorbed by Bomber Command as it expanded.<sup>41</sup> Its clear limitation is that it only covers the period up until 1942 and lacks meaningful analysis. Other official studies have included *Flying Training, Volume 1 – Policy and Planning* and *Volume II - Organisation*.<sup>42</sup> Another very important official document is *Notes on the History of RAF Training 1939-44* that was published by the Air Member for Training in January 1945.<sup>43</sup> This document highlighted a number of areas that affected the training pipeline and provided an overview of how training evolved during the Second World War. This chronological development of Bomber Command is also reflected in Air Chief Marshal Sir Arthur Harris's *Despatch on War Operations* that he submitted to the Air Ministry on 18 December 1945.<sup>44</sup> Of particular interest is Appendix G, *A Review of Training*, where Harris highlighted that, 'in war-time [*sic*], trained aircrew personnel are, in the long run, the limiting factor of both expansion and operational activity, and the greatest care should be taken to ensure that they are always used to the fullest advantage.'<sup>45</sup> This provides a clear example of the weight Harris placed on the importance of operational training despite frequently being frustrated by the time it took to get aircrew to operational squadrons. Harris also used his *Despatch* to highlight his particular *bête noir* when it came to destabilising the training pipeline output; having to send aircrew to the MAAF, Coastal Command and special duties squadrons.

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<sup>41</sup> TNA AIR 41/4, AHB Narrative, *Aircrew Training 1934-42*.

<sup>42</sup> TNA AIR 10/5551, *Flying Training Volume 1 – Policy and Planning*, AP 3233 issued by the Air Ministry, 1952.

<sup>43</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-44*.

<sup>44</sup> ACM Sir A. Harris, *Despatch on War Operations 23<sup>rd</sup> February 1942 to 8<sup>th</sup> May 1945*, (London: Routledge, 2012).

<sup>45</sup> Harris, *Despatch on War Operations 23<sup>rd</sup> February 1942 to 8<sup>th</sup> May 1945*, p.169.

Goulter has praised some AHB Narratives for being 'outstanding' and for providing 'the foundation for many scholars' work in recent years' and her comments certainly apply to the RAF training narrative.<sup>46</sup> These Bomber Command Narratives, along with the four volume *Strategic Air Offensive Against Germany* official history, provide an excellent contextual backdrop and have been used in a number of works focusing on areas such as strategic leadership, electronic warfare, doctrine and general operations by the likes of Gray, Withington, Parton and Overy.<sup>47</sup> Another important academic work has seen Sinnott focus on the RAF's operational requirements as they impacted aircraft procurement, with three chapters dedicated to Bomber Command.<sup>48</sup> The fact remains that they do not consider operational training in any meaningful way but together all are very useful in providing a skeletal framework in which to look in depth at the topic.

In determining how official histories have been used to date, Faber has argued that modern historiography follows a four-step process from the official version that 'dominates the historical landscape' before 'revisionists question its veracity' while that original version is supported by 'iconoclasts' and after academic argument, 'a new historical synthesis' emerges.<sup>49</sup> Faber's model certainly seems to encapsulate the modern approach to addressing the history of Bomber Command as more areas

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<sup>46</sup> C. Goulter, 'British Official Histories of the Air War', in J. Grey (ed.), *The Last Word? Essays on Official History in the United States and British Commonwealth* (Westport: Praeger, 2003), p.143.

<sup>47</sup> P.W. Gray, 'The Strategic Leadership and Direction of the Royal Air Force Strategic Air Offensive Against Germany from Inception to 1945'; T.J. Withington, 'Bomber Command's Electronic Warfare Policy and Suppression of Enemy Air Defence Posture During the Second World War'; N. Parton, 'The Evolution and Impact of Royal Air Force Doctrine: 1919-1939'; R. Overy, *The Bombing War, Europe 1939-1945* (London: Allen Lane, 2013).

<sup>48</sup> C.S. Sinnott, 'RAF Operational Requirements 1923-39' (PhD Thesis, King's College London, 1998).

<sup>49</sup> P. Faber, 'The Anglo-American Bombing Campaign in Europe', in Loyd E. Lee (ed.), *World War II in Europe, Africa, and the Americas, with General Sources – A Handbook of Literature and Research* (Westport: Greenwood Press, 1997), p.218.

are examined a more rounded synthesis emerges. This has included areas such as doctrine, organisational culture, aircraft production and leadership.

Considering the two official histories cited above, the Saunders and Richards volumes tend towards a descriptive view of events while Goulter considered the *Strategic Air Offensive Against Germany* as 'a model for how it should be done.'<sup>50</sup> Cox echoed this when he emphasised the 'depth and quality of the research and analysis' of the history.<sup>51</sup> There is some criticism of the work, most notably from Jones who stated that although Webster and Frankland's work is 'authoritative', the authors relied too heavily on the First World War official history, *The War in the Air*, in writing about 'long range bombing' during that conflict.<sup>52</sup> This criticism is minor when compared to the overall quality of the work and refers solely to a very short period in the development of the RAF's bombing doctrine; but, as Cox has opined, the volumes, perhaps inadvertently, 'established a critically narrow set of parameters for much of the historical debate that followed.'<sup>53</sup> The aim of this thesis is to widen that debate into the sphere of operational training.

In addition to Cox's 'narrow set of parameters' observation, the approach to history, and particularly war studies in the 1970s, led to research being confined to Bomber Command aircraft, units and an associated focus on battles and campaigns as seen in works by the likes of Barker, Mason and Bowyer, and these are likely the

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<sup>50</sup> C. Goulter, 'British Official Histories of the Air War,' p.144.

<sup>51</sup> S. Cox, 'Setting the Historical Agenda: Webster and Frankland and the Debate over the Strategic Bombing Offensive Against Germany, 1939-1945,' in J. Grey, (ed.) *The Last Word? Essays on Official History in the United States and British Commonwealth*, p. 169.

<sup>52</sup> N. Jones, *The Beginnings of Strategic Air Power – A History of the British Bombing Force 1923-1939* (London: Cass, 2002), p.xiv.

<sup>53</sup> Cox, 'Setting the Historical Agenda: Webster and Frankland and the Debate over the Strategic Bombing Offensive Against Germany, 1939-1945,' p. 164.

themes that reflect Cox's 'narrow set of parameters' observation.<sup>54</sup> As Black has described, these topics drew attention away from many important areas such as 'logistics, communications and other aspects of war', although these areas are not going to sell in the commercial market, they remain likely topics for academic research.<sup>55</sup> It is interesting to note though that since Black's comments in 2004, both Stone and Withington have respectively addressed logistics and Electronic Warfare.<sup>56</sup>

This generalist catalogue of Bomber Command output covering topics such as aircraft, for example, is viewed by Morillo as an over-emphasis on technology. The 'gee-whiz' nature of weapon platforms has led 'military historians to overemphasize technology at the expense of other explanatory factors...' The so-called 'Technological Determinism' approach avoids the more nuanced social factors in how the human can affect the military outcome and here training can be seen as a key determinant of human performance and therefore, the delivery of operational effect.<sup>57</sup> Over more recent years, academics have moved their focus to look increasingly at social aspects; for example, Francis has considered cultural factors within the RAF, MacKenzie has looked at the role of superstitious behaviour and its effect on performance in Bomber Command while Pugh has addressed the issue of

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<sup>54</sup> For example: R. Barker, *The Thousand Plan* (London, Pan Books, 1967); F. Mason, *Major Archive – Avro Lancaster B. Mk I-III* (Thame: Container Publications, 1976); and, C. Bowyer, *Pathfinders at War* (Shepperton: Ian Allan, 1977).

<sup>55</sup> J. Black, *Rethinking Military History* (London: Routledge, 2004), p.33 and p.38.

<sup>56</sup> T. Stone, 'Royal Air Force Logistics During the Second World War: Transformation, Sustainment and Flexibility' (PhD Thesis, University of Exeter, 2016) and T.J. Withington, 'Bomber Command's Electronic Warfare Policy and Suppression of Enemy Air Defence Posture During the Second World War.'

<sup>57</sup> S. Morillo, *What Is Military History* (Cambridge: Polity, 2010), p. 47.

amphetamine use by aircrew.<sup>58</sup> As we have seen, although new areas of academic research are being examined, MacKenzie has argued that, despite this, 'non-operational topics get comparatively short shrift'.<sup>59</sup> He goes on to say that 'there is nothing on the history of RAF operational training units despite their importance in preparing crews to fly and fight in front-line aircraft.' This area of study has lacked academic research and Faber has observed that we currently have 'no scholarly study of American, British or German [air] combat training programs.'<sup>60</sup>

This topic is also important as the historically accepted input into military history has come from the impact of 'great men', the political and military leaders, while operational training offers a view 'from below' through the thousands of individuals trained by the bomber force. Those views incorporate the influence of social factors, such as education, beliefs and societal attitudes of those fighting in the conflict.<sup>61</sup> These factors are central to the way that operational training evolved in Britain's bomber force and, latterly, Bomber Command between 1922 and 1945 as the RAF changed from an air service with its senior officers steeped in Victorian and Edwardian values and technological experiences to those from an increasingly modern and liberal society. In shining a spotlight on these areas, the examination of contemporary features and lectures published by serving RAF officers in magazines

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<sup>58</sup> M. Francis, *The Flyer* (Oxford: Oxford University Press, 2013); S.P. MacKenzie, 'Beating the Odds: Superstition and Human Agency in RAF Bomber Command, 1942-1945', *War in History*, Vol.22, No.3, July 2015, pp.382-400; J.N. Pugh, 'The Royal Air Force, Bomber Command and the use of Benzedrine Sulphate: An Examination of Policy and Practice During the Second World War', *Journal of Contemporary History*, Vol.53(4), 2018, pp.740-761.

<sup>59</sup> S.P. MacKenzie, 'Per Ardua: Achievements, Issues, and Opportunities in Writing the History of the Royal Air Force', *War & Society*, 39:4, 2020, p.320.

<sup>60</sup> Faber, 'The Anglo-American Bombing Campaign in Europe,' p.218.

<sup>61</sup> See for example, S. Bhattachara, 'History From Below', *Social Scientist*, Vol.11, No.4, April 1983, pp. 3-20.

such as the *Journal of the Royal United Services Institution*, the *RAF Quarterly* and the RAF Staff College's magazine, *The Hawk*, were particularly useful.

## Secondary Sources

Training has not been totally dismissed by general historical aviation authors although there is greater emphasis placed on *ab initio* training, specifically the Empire Air Training Scheme (EATS), latterly known as the British Air Commonwealth Training Plan (BACTP), as well as the associated US-based training initiatives, the Arnold and Towers Schemes, are concerned. These schemes have spawned a number of books; however these tend to focus on the social experience of young men being sent far from home to train. Notable exceptions include Dunmore's *Wings for Victory*, Guinn's *The Arnold Scheme* and Killebrew's *The Royal Air Force in Texas* that provide more political and contextualised accounts.<sup>62</sup> Although the EATS/BCATP, Arnold and Towers schemes fall outside the scope of this thesis, they will be referenced with respect to the input standard that they provided for the operational training pipeline.

In researching Chapter Three covering the training legacy from the First World War, Morrow's *The Great War in the Air* was particularly useful in terms of the depth and breadth covered in the book to place the rapid development of modern and increasingly offensive air power in context.<sup>63</sup> Morrow highlighted the dangers of training by referencing Admiral Mark Kerr's observation that 'nearly 300 pilots were

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<sup>62</sup> S. Dunmore, *Wings for Victory* (Toronto: McClelland & Stewart, 1994); G. Guinn, *The Arnold Scheme* (Charleston: The History Press, 2007) and T. Killebrew, *The Royal Air Force in Texas* (Denton: University of North Texas Press, 2003).

<sup>63</sup> J. Morrow, *The Great War in the Air* (Washington: Smithsonian Institution Press, 1993).

killed in one quarter' in 1917.<sup>64</sup> Whereas Morrow looks at airpower from the perspective of all protagonists, Steel and Hart focus on 'the British experience of war in the air' in *Tumult in the Clouds*.<sup>65</sup> This book features a chapter on training using personal accounts of pilots to reflect on the topic. The authors conclude that the training being offered was 'riven with mistakes and misconception.'<sup>66</sup> A more academic approach to early aviation is taken by Grattan in his *Origins of Air War*.<sup>67</sup> Although not specifically addressing training, the author highlighted the challenges facing the RFC's deployment to France in terms of having no cadre of trained pilots or aircraft left in the UK to act as a source of training. Training is picked up by Barker in his *The Royal Flying Corps in World War I*, in a chapter that is titled, 'Training, And the Lack of It.'<sup>68</sup> Like *Tumult in the Clouds*, this chapter uses personal anecdotes and is so illustrative of the topic albeit providing a very subjective view. Most of the secondary sources on First World War aviation described above refer to the RFC and this is balanced by *Naval Aviation in the First World War*.<sup>69</sup> Again, while there is little coverage of training, the book highlights that the RNAS had a far greater appreciation and grasp for the application of air power than did the RFC, an example being the strategic attack on the Zeppelin works at Friedrichshafen on 21 November 1914.<sup>70</sup>

Although considered as a seminal history of the RAF, and the author John Terraine stating that, 'aircrew training [was] more important than any other single factor,' no chapters are dedicated to the topic in *The Right of the Line*. However,

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<sup>64</sup> Morrow, *The Great War in the Air*, p.318.

<sup>65</sup> N. Steel and P. Hart, *Tumult in the Clouds* (London: Hodder & Stoughton, 1997).

<sup>66</sup> *Ibid.*, p.100.

<sup>67</sup> R. Grattan, *The Origins of Air War* (London: I B Taurus, 2009).

<sup>68</sup> R. Barker, *The Royal Flying Corps in World War I* (London: Robinson, 2002), p.210.

<sup>69</sup> R. Layman, *Naval Aviation in the First World War* (London: Caxton, 2002).

<sup>70</sup> *Ibid.*, p.67.

Terraine did raise some interesting questions on the topic.<sup>71</sup> These focus on the readiness of Bomber Command for war in 1939, saying that the RAF 'made a picture' of future war that bore little resemblance to reality.<sup>72</sup> Terraine also emphasised that all other aspects of air power, such as support functions for the Army and Royal Navy, were largely ignored to the favour of strategic bombing. This approach, to mention aspects of training without analysis and context, has been the method adopted by many authors over the years. For example, Overy stated that training was 'long and thorough' in *Bomber Command 1939-45* but focused mainly on the operational aspects of the organisation in what is otherwise a sound analysis.<sup>73</sup> Overy's 'long and thorough' view of training is challenged by Orange who uses the Butt Report of 1941 to refute Bomber Command being a well-trained force.<sup>74</sup> Overy does however make a valid point when he observes that flying in the generally benign conditions of the Empire with 'clear skies and open landscapes' did not prepare aircrew well for the poor weather and blackout conditions encountered in Europe.

This lack of focus on operational training is also apparent in Hastings' *Bomber Command*, Delve's *Bomber Command 1936-1968* as well as Bishop's *Bomber Boys*, although they all touch on some training aspects within the overall text.<sup>75</sup> Hastings' book provides an overarching narrative of the development of Bomber Command and identifies the shortcomings of navigation and tactics during the interwar period. He argued that 'realistic training might have been carried out over the Atlantic or

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<sup>71</sup> J. Terraine, *The Right of the Line* (Ware: Cumberland, 1997), p. 82.

<sup>72</sup> *Ibid.*, p.58.

<sup>73</sup> R. Overy, *Bomber Command 1939-45* (London: Harper Collins, 1997), p.142.

<sup>74</sup> V. Orange, *Churchill and His Airmen* (London: Grub Street: 2013), pp.213-4.

<sup>75</sup> M. Hastings, *Bomber Command* (London: Pan Books, 1999); K. Delve, *Bomber Command 1936-1968* (Barnsley: Pen & Sword, 2005) and P. Bishop, *Bomber Boys* (London: Harper Perennial, 2007).



North Sea but the loss of aircraft and crews...was quite unacceptable in a climate of peace.<sup>76</sup> The author also opined that 'the chronic lack of clear thinking that had dogged bombing policy since the end of the First World War persisted even in the face of the most convincing evidence,' a factor that had a detrimental impact on operational training.<sup>77</sup> Hastings' opinion on potential training losses over the North Sea is in stark contrast with the requirement that training should be as realistic as possible to mirror conditions of war. This was highlighted from an Army perspective by Brigadier Archibald Wavell in 1933 who talked of the need for realism in both 'individual and collective training.'<sup>78</sup>

A detailed analysis of Bomber Command operations during the Second World War is provided by Middlebrook and Everitt, detailing every single raid undertaken by Bomber Command during the Second World War; giving targets, aircraft dispatched and those that returned.<sup>79</sup> Appendices include those for the 'operational performance' of squadrons and training units when the latter were used on operations such as the 'thousand bomber' raids. In similar vein, Chorley's *Bomber Command Losses – Heavy Conversion Units and Miscellaneous Units* and *Bomber Command Losses – Operational Training Units*, provides analysis of individual aircraft losses in the operational training environment.<sup>80</sup> These loss rates are important and provide a partial comparator to evaluate the effectiveness of training during the Second World War, although there were clearly other variable factors at play such as weather,

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<sup>76</sup> M. Hastings, *Bomber Command*, p.44.

<sup>77</sup> *Ibid.*, p.109.

<sup>78</sup> Brigadier A.P. Wavell, 'The Training of the Army for War', in *JRUSI*, 1 February 1933, p.260.

<sup>79</sup> M. Middlebrook and C. Everitt, *The Bomber Command War Diaries*.

<sup>80</sup> W.R. Chorley, *Royal Air Force Bomber Command Losses, Vol. 8 – Heavy Conversion Units and Miscellaneous Units, 1939 – 1947* (Hinckley: Midland Publishing, 2003) and *Royal Air Force Bomber Command Losses, Vol. 7 – Operational Training Units, 1940 - 1947* (Hinckley: Midland Publishing, 2002).

target location and enemy defences. In considering aircrew other than pilots, Jefford's *Observers and Navigators: And Other Non-Pilot Aircrew in the RFC/RNAS/RAF* is a useful source that provides some detail on training.<sup>81</sup> The book has good footnotes but lacks an index. It does however provide a very important narrative on the development and professionalization of rear-crew trades.

In terms of training organisations and units, *Royal Air Force Flying Training and Support Units Since 1912* considers the plethora of training organisations used by the RFC/RNAS/RAF since 1912 and although of benefit in terms of numbers of training units, does little to put them into context or address why they were being formed.<sup>82</sup> One positive development to transition the RAF's bombing force from a dogma driven organisation to a more operationally sound and effective force was the introduction of objectively guided analysis and method through Bomber Command's Operational Research Section (ORS) that formed in September 1941.<sup>83</sup> In *The Science of Bombing*, Wakelam highlighted the importance of using scientific methods to address operational failings and how some of its research helped enhance training methods.<sup>84</sup> An example of this was the introduction of 'small fighter training flights' to prepare crews in facing *Luftwaffe* night fighters as well as the establishment of 'night vision schools.'<sup>85</sup> In his review of the book on the rear cover, Cox makes the point

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<sup>81</sup> C.G. Jefford, *Observers and Navigators: And Other Non-Pilot Aircrew in the RFC/RNAS/RAF* (Shrewsbury: Airlife Publishing, 2014).

<sup>82</sup> R. Sturtivant, *RAF Flying Training and Support Units Since 1912* (Tunbridge Wells: Air Britain Historians, 1998).

<sup>83</sup> RAF Website, AHB Narrative, AP3368, *The Origins and Development of Operational Research in the Royal Air Force* (London: HMSO, 1963), chrome-extension://efaidnbnmnnibpcajpcglclefindmkaj/https://www.raf.mod.uk/our-organisation/units/air-historical-branch/second-world-war-thematic-studies/ap3368-operational-research-in-the-royal-air-force/. Accessed, 4 November 2022.

<sup>84</sup> R.T. Wakelam, *The Science of Bombing* (Toronto:University of Toronto Press, 2009).

<sup>85</sup> *Ibid.*, p.99.

that, contrary to the opinion of many, Harris 'was in fact a very innovative and flexible commander', a point that will also be reflected in this thesis when it comes to training when Harris was AOC 5 Group and AOC-in-C Bomber Command.

Although this introductory chapter has talked about training being largely a story of 'history from below' where individuals are trained and brought together in crews (collective training), there is no doubt that policy was directed by senior officers and so their knowledge, leadership, cultural experience and characters were vital in shaping the bomber force's training environment and determining how it conducted training. There are a number of secondary sources that provide insights into the likes of Harris and Portal, most notably Orange's *Churchill and His Airmen* and these characters are also well served by the likes of Biddle and Cox. A number of officers intrinsically involved with the development of operational training are yet to be served by biographies or analysis; these include Ludlow-Hewitt, Garrod and MacNeece Foster.<sup>86</sup>

Having considered the historiography of Bomber Command from the perspectives of official and secondary sources it is clear that although some material covering operational training is available from AHB narratives, this is not exhaustive. The same is true concerning secondary sources and indeed, from academic sources. The aim of this thesis is to address these shortcomings and the methodology for this will be highlighted in the next section by discussing content and structure.

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<sup>86</sup> Orange, *Churchill and His Airmen*, T.D. Biddle, 'Winston Churchill and Sir Charles Portal: Their Wartime Relationship, 1940-1945,' and S. Cox, 'Harris and the Air Ministry,' both in *Air Power Leadership Theory and Practice*, P.W. Gray and S. Cox (eds.), (London: The Stationery Office, 2002).

## Thesis Content and Structure

This thesis explores how operational training evolved to keep pace with changing doctrine, emerging technologies and tactics during the period from 1922 to 1945.

Operational training may be defined as the training that imparts, improves or maintains operational effectiveness of an individual, crew or unit.<sup>87</sup> As far as Bomber Command was concerned, such training was carried out in the first instance to train the individual and was 'designed to develop the competencies (a mix of skills, knowledge and attitudes)' to allow that individual to undertake a specific role as part of a homogenous crew.<sup>88</sup>

As this thesis will show, it took Bomber Command a long time to appreciate the benefits of a crewing system where each member of that crew had a clearly defined role and without doubt, much of this initial inertia was due to the pilot-centric nature of the Service. After late 1940, that individual training, divided into elementary (or *ab initio*), intermediate and advanced, was largely undertaken at specialist schools before training the complete crew in a Group Pool Squadron (GPS), latterly referred to as an Operational Training Unit (OTU). This combined crew training was referred to as 'collective training'.<sup>89</sup> As this thesis will show, the bombing force had a number of training shortfalls, or 'training gaps', but over time, it recognised fundamental factors that it needed to address to enable it to undertake the practical

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<sup>87</sup> Based on the definition adopted by the US Army, [https://www.militaryfactory.com/dictionary/military-terms-defined.asp?term\\_id=3891](https://www.militaryfactory.com/dictionary/military-terms-defined.asp?term_id=3891). Accessed, 29 October 2020.

<sup>88</sup> *JSP 822, Part 2 – Training & Education Glossary* (London: HMSO, 2021), p.15.

<sup>89</sup> L.L. MacLean, 'The Royal Air Force Training Year at Home', *JRUSI*, Vol. 80, 1935, pp.50-68.

aspects of strategic bombing and make the organisation 'fit for purpose' and 'suitable for the fulfilment of its aims and purposes'.<sup>90</sup>

In its structure, this thesis can be broadly described as falling into three chronological periods: the first of which focuses on the 12 years between the opening of the RAF Staff College in 1922 and Expansion Scheme A in 1934.<sup>91</sup> In retrospect, this period can be viewed as one of calm where the RAF was known by many as the 'Best Flying Club in the World' with pleasant overseas postings, many opportunities for sport and no major conflicts in which to get killed.<sup>92</sup> Secondly, the period up until February 1942 that saw the staging of the Aircrew Training Conference in January 1942 and the appointment of Air Chief Marshal Arthur Harris as AOC-in-C Bomber Command sees training being examined more closely by the Air Ministry as it tried to match training output to new equipment and tactics.<sup>93</sup> Thirdly, the period referred to by Volumes IV and V of the AHB Bomber Command Narratives, as phases of 'experimentation', and delivery of the 'full offensive' is marked by a maturation of training where, as this thesis will show, operational training had become 'fit for purpose.'

After Chapter Two has defined training and examined the training pipeline, Chapter Three will consider the training experiences and legacies created by the experiences of the First World War. Considering that the initial four RFC squadrons that flew to France in August 1914 only 11 years after the first manned flight by the

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<sup>90</sup> Gray, 'The Strategic Leadership and Direction of the Royal Air Force Strategic Air Offensive Against Germany from Inception to 1945,' p.38.

<sup>91</sup> Robertson, *The Development of RAF Strategic Bombing Doctrine, 1919-1939*, p.169, Table II, Scheme A.

<sup>92</sup> <https://aviationtrails.wordpress.com/2020/06/27/the-hand-of-fate-and-squadron-leader-anthony-bridgman-dfc-part-1/>. Accessed on 14 April 2021.

<sup>93</sup> TNA AIR 20/1344, Minutes of the first Aircrew Training Conference held on 23 January 1942.

Wright brothers, it was clear that operational and training experience was understandably lacking.<sup>94</sup> The next four years generated massive changes in aircraft performance, tactics and the adoption of new roles that demanded specific types of training; for example, in night flying to counter Zeppelin and Gotha raids against Britain and long-range navigation by VIII Brigade/Independent Force to bomb targets in Germany.<sup>95</sup> From the RFC initial deployment to France in August 1914 of four squadrons, the Armistice in November 1918 had seen the RAF's strength – following its creation by the amalgamation with the RFC and RNAS – increase to 193 squadrons and 15 independent flights.<sup>96</sup> This gradual growth generated the need for a formalised training organisation and structure.<sup>97</sup> The other requirement concerned the resources required to undertake that training. Towards the end of the First World War, the Training Expansion Committee was replaced by the Accommodation Committee. Both organisations had highlighted the shortfall in resources and logistics required to undertake training, such as a lack of gunnery schools.<sup>98</sup> As Chapter Three will show, the First World War left some very important legacies that needed to be digested by the Air Ministry and later, the RAF Staff College.

Chapter Four will examine the RAF's culture and corporate intellect as far as it was applied to training at the RAF Staff College in Andover through the eyes of the Directing Staff and students. Through examination of contemporary student essays,

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<sup>94</sup> Steele and Hart, *Tumult in the Clouds*, p.24.

<sup>95</sup> TNA AIR 1/823/204/5/42, contains a series of correspondence between the W.O. and RFC on night flying training.

<sup>96</sup> TNA AIR 41/45, AHB Narrative, *The RAF in the Maritime War, Vol. I: The Atlantic and Home Waters – The Prelude, April 1918 to September 1939*, p.49.

<sup>97</sup> R. Sturtivant, 'British Flying Training in World War I', *Cross & Cockade* Vol.23, No.1, 1994, pp.18-19.

<sup>98</sup> TNA AIR 1/28/15/1/132, Minutes from the Training Expansion Committee fourth meeting held on 12 July 1918.

Directing Staff presentations, and written articles in the Staff College magazine, *The Hawk*, this chapter will provide a more rounded view of how the RAF viewed training and other related topics such as tactics, technologies and organisation and, if appropriate, their impact on operational training. In addition, it will look at the development of doctrine insofar as it drove training. This is important because, as Vallance has argued, doctrine defines the strategy and then the force structure; Parton takes this one step further by saying that doctrine '...drives the way in which training is carried out'. Thus the intellectual environment of the RAF Staff College was vital, in theory at least, to shaping operational training policy.<sup>99</sup>

The inter-war years the retrospective view from the RAF was that there was no 'centralised direction and coordination' for operational flight training and no 'clear idea of its long term needs with regards to equipment and personnel.'<sup>100</sup> This chapter will show that with the commencement of Expansion Scheme A in 1934 and the reorganisation of Air Defence of Great Britain (ADGB) and Coastal Area into Commands in 1936, the RAF began to tackle shortcomings in its operational training. This chapter is also important insofar as it highlights the pilot-centric nature of the RAF. This of course has its roots in Trenchard's 'Permanent Organization of the Royal Air Force' paper of 1919 where he wanted all RAF officers to be pilots first before undertaking roles such as engineering or logistics.<sup>101</sup> Although this aim had its

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<sup>99</sup> A. Vallance, 'The Role and Evolution of Air Power Doctrine Within the Royal Air Force', *Cambridge Review of International Affairs*, pp.46-54, published online: 13 September 2007, p.47 and N. Parton, 'The Development of Early RAF Doctrine', *The Journal of Military History*, Vol. 72, No.4, October 2008, p.1156.

<sup>100</sup> TNA AIR 10/5551, *Flying Training Volume 1 - Policy and Planning*.

<sup>101</sup> TNA AIR 8/97, Cmd. 467, *The Permanent Organisation of the Royal Air Force*.

merits for a small air force, this thesis will show that Trenchard's policy became increasingly flawed as the RAF expanded.

The staff thread will continue into Chapter Five and will analyse how the RAF and in particular, Bomber Command, defined and organised its operational training requirements before examining the roles and responsibilities of those that had to deliver that training. The three fundamental factors underpinning the success of any group can be said to be its structure, organisation and management. Although Gray differentiates between leadership and management, both are vital in delivering training. He has argued that the former demands vision, force of character and the ability to inspire, whilst the latter concentrates on the 'allocation and control of resources (human, materiel and financial) to achieve objectives.'<sup>102</sup> Expanding upon Gray's comparison between management and leadership, and given that although Harris was the dominant leader of Bomber Command from February 1942, this chapter will also highlight Ludlow Hewitt, Garrod and MacNeece Foster as officers that had a significant bearing on the development of operational training in the Air Ministry and Bomber Command. The organisational whole became what the *Oxford English Dictionary* defines as a structure that is 'something that is built' that links 'mutually connected and dependent parts'.<sup>103</sup> In essence, this is the training pipeline where 'structure, organisation and management' are key to success. Unfortunately, the structure and organisation of the Air Ministry, ADGB and later, Bomber Command did not initially support a clear and defined training pipeline or the delivery of well-

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<sup>102</sup> This definition of management first appeared in P.W. Gray and J. Harvey, 'Strategic Leadership Education,' in Col Bernd Horn and Lt Col Allister MacIntyre (eds.) *In Pursuit of Excellence: International Perspectives of Military Leadership* (Kingston: Canadian Defence Academy Press, 2006), p. 91.

<sup>103</sup> L. Brown (ed.), *The New Shorter Oxford English Dictionary, Volume 2* (Oxford: Clarendon Press, 1993).



trained aircrew. Departments responsible for doctrinal development, personnel and materiel, the drivers of training, had to work in harmony to achieve an efficient training output and this only began to partially function with the appointment of an Air Member for Training (AMT) in June 1940. As Chapter Six highlights, this had a positive effect on operational training and this impact subsequently grew over time as Bomber Command's training structure matured.

Having provided the overall legacy to operational training, its intellectual and organisational underpinnings, the next three chapters will consider operational training from the perspective of the pilot and other aircrew members. Chapter Six will examine pilot training from 1922 until August 1941; the latter date marking the establishment of the Advanced Flying Unit (AFU) courses in the UK following the pilot's return from EATS or training in the US.<sup>104</sup> This period also saw the growing establishments of OTUs and HCF/HCU's in the UK that were being used for advanced collective training. In part, this growth of advanced training was being driven by the impending arrival of new four-engine heavy bombers and the need to train crews to operate them. Prior to expansion, this period was one initially of peacetime survival where the RAF was staving off attacks from the Treasury, the Royal Navy and Army whilst at the same time, trying to justify its creation. This was followed from 1934 with a series of expansion plans that were designed to bolster the size of the RAF to achieve parity with the threat posed by the German *Luftwaffe*.<sup>105</sup>

Chapter Seven will then continue the pilot training theme by examining the operational training conducted during the remainder of the Second World War with

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<sup>104</sup> TNA 10/5551, *Flying Training Vol.II - Organisation*, p.163.

<sup>105</sup> TNA CAB/24/279, Relative Air Strengths and Proposals for the Improvement of this Country's Position, 25 October 1938.

particular reference to the period from June 1941 to February 1942. That period being referred to by the Air Historical Branch as 'a period of transition for the bomber force and the policy it was to pursue' and it was the experiences of this transition that shifted the emphasis of operational training.<sup>106</sup> Both Chapters Six and Seven highlight the fragility of the training pipeline in terms of any changes to training outcome requirements which had implications for the length of courses and the resources required to conduct those courses as well as the output standard of the individual at the end of the course.

Chapter Eight examines the training of aircrew other than pilots. This is particularly important as dedicated, role-specific aircrew did not fully emerge until 1942 with the widespread adoption of the 'four-engine heavies'. The reasons for this late recognition of the importance of other aircrew were numerous but also cast light on the 'pilot-centric' nature of the RAF and the social attitudes to commissioned and non-commissioned officers. Prior to 1941, non-pilot individual aircrew training, such as that provided for air gunners and wireless operators, as well as collective crew training, took place in operational squadrons leading to inefficiencies through a diversion of effort. Training clearly had a 'vital, complex relation to first-line strength and efficiency' but the way it was organised, delivered and how it developed evolved considerably between 1922 and 1945.<sup>107</sup>

One of the fundamental methods of conducting operational training was the application of Synthetic Training Equipment (STE) to undertake as much training as practicable on the ground and Bomber Command championed this training method

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<sup>106</sup> TNA AIR 41/41, *The RAF in the Bomber Offensive Against Germany, Vol. III: Area Bombing and the Makeshift Force*, p.1.

<sup>107</sup> Richards, *Royal Air Force 1939-1945 – Volume I*, p.72.

throughout the war. As Chapter Nine highlights by 1945 the RAF was using around 200 different types of STE to provide training in a wide range of topics covering navigation, gunnery, flying training, mission training and communications.<sup>108</sup> STE was not all about the ubiquitous Link Trainer and this chapter focuses on the invention and development of training systems to enhance operational training at the individual and collective training levels. These technologies were adopted to improve training and assist in taking pressure off an increasingly overworked training pipeline and were, with few exceptions, broadly accepted by the Air Ministry, Bomber Command and its operational groups. The use of STE also saved resources and allowed training to take place in a safe environment, thereby better preparing aircrew for time in the air. The chapter will firstly consider the context of STE and then examine how STE policy was developed, how STE was managed and procured, and how synthetic training devices were used by Bomber Command to support operational training before concluding that simulation was a key element that drove the overall success of operational training in Bomber Command. This argument will be supported by comparing and contrasting how the *Luftwaffe*'s operational training syllabi for its bomber force viewed STE and how the US Navy's Bureau of Aviation used the RAF as a model for its adoption of STE after 1941. The RAF's application of STE during the Second World War has distinct and recognisable parallels with today. In modern terminology, military training systems fall into three categories: live, virtual and constructive, and all three were present during the Second World War.<sup>109</sup>

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<sup>108</sup> TNA AIR 20/6058, Illustrated Catalogue of Synthetic Training Devices, issued by DOT, May 1942.

<sup>109</sup> T. Nash and G. Ebbutt, *Jane's Simulation & Training Systems* (London: Jane's, 2018), p.16.

Although this thesis will not discretely address what resources were required to allow operational training to take place – primarily airfields, aircraft, and personnel, those themes are reflected in each chapter and highlights the interwoven relationship between training, logistics and operational output. As this thesis will show, RAF policy in this field was often disjointed but linkage between training and operational output was recognised at the highest levels as expansion accelerated. In comparison, the German *Luftwaffe* ‘stripped their schools of 600 [flying] instructors during the Stalingrad battle’ alone and by 1943 ‘there was a shortage of instructors as well as training and operational aircraft.’<sup>110</sup>

In Chapter Ten, the thesis will conclude by providing an overview of how operational training evolved and developed to keep pace with changing tactics and the more complex and technically capable aircraft and avionics systems that emerged during the Second World War. When considered as a whole, operational training was successful but in achieving that success the RAF had to go through many iterative processes and frequently failed to learn lessons from previous experiences.

### **Archival Sources**

In terms of the primary sources accessed for this thesis, these mainly include those files related to the Air Council – latterly Expansion Progress Committee, CAS, Bomber Command, Training Command, RAF Staff College, RAF general administration, RAF unregistered papers and RAF operational records, these being the AIR 6, AIR 8, AIR 14, AIR 32, AIR 69, AIR 6, AIR 20 and AIR 1 files respectively.

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<sup>110</sup> K.P. Werrell, ‘Flying Training: The American Advantage in the Battle for Air Supremacy Against the *Luftwaffe*,’ in *Air Power History*, Vol.61, No.1 (Spring 2014), p.44.

These files are housed at The National Archives (TNA) in Kew or in the case of AIR 69, the RAF Museum, Hendon. Copies of many of the AIR 6 files are contained at the RAF Museum and the Air Historical Branch as are Air Ministry Working Orders (AMWO). The latter are particularly useful in defining when a particular policy was enacted. The challenge with archival material is to track what may be termed 'correspondence chains' as some files are missing folios. This difficulty can be partially overcome by cross-referencing to other files. For example, a letter from CAS to HQ Bomber Command may be missing in the CAS files (AIR 8) but could be present in the Bomber Command files (AIR 14). The other frustration is when creating the AIR records, the then Public Records Office did not cross-reference original Air Ministry file references; the latter being widely used in the AHB Narratives as well as in the correspondence itself.

Where appropriate when discussing pilot and other aircrew training in Chapters Six, Seven and Eight, access to log books has been undertaken through the digitised archives of the International Bomber Command Centre in Lincoln. Other logbooks associated with the Royal Naval Air Service in the First World War were accessed at the Fleet Air Arm Museum at RNAS Yeovilton. This has been a useful exercise as it shows that, especially during the Second World War, no two courses were identical, with pupils flying different aircraft types during their training and having accumulated varying total flying hours at the end of their courses. The other factor to emerge from the study of logbooks was that, generally, pilots and other aircrew would fly more hours than specified for a particular course. This will be examined more thoroughly in Chapters Six, Seven and Eight.

For Government business, Cabinet records were obtained from the TNA as part of the CAB series. These are now digitised and may be downloaded making access much easier than hitherto. As far as *Air Force Lists* are concerned, the majority were accessed at the RAF Museum with some downloaded from the National Museum of Scotland.

In terms of private papers, those of Trenchard and Ludlow Hewitt were consulted at the RAF Museum in Hendon and the RAF Air Historical Branch at RAF Northolt respectively. The National Aerospace Library at Farnborough proved of value in accessing the J.V. Connolly Collection for Ministry of Aircraft Production (MAP) aircraft production figures and Bomber Command Operational Research Section's (ORS) reports on Halifax operations in 4 (Bomber) Group. The library also provided access to the papers of Cyril Napean-Bishop and his lecture notes covering Robert Smith-Barry.

To conclude, the role of operational training has been under-explored in academic research and this is surprising for three main reasons. The first is that such training consumed over 50% of Bomber Command's total flying time during the Second World War. Secondly, as well as flying time, operational training drew significant resources away from Bomber Command's operational effort, most notably aircraft, airfields and manpower. Finally and perhaps most importantly, the aim of operational training is to maximise operational effect and as such, is of pivotal importance to any military organisation as a 'force multiplier.' By examining this training, scholars can obtain a much wider understanding of the RAF's approach to strategic bombing and what shaped its doctrine. This thesis will argue that operational training evolved significantly between 1922 and 1945 by examining a

number of key drivers to improve that training as time progressed. The first step will be to examine the purpose of training and the operation of the training pipeline.

## CHAPTER TWO

### THE TRAINING PIPELINE

#### Scope

At the core of this thesis is the concept of the 'training pipeline,' a theoretically simple process that sees a student entering that pipeline at a desired 'input standard' at one end and then leaving at an 'output standard' at the other after receiving training.<sup>1</sup> The design and efficiency of that pipeline may be altered or disrupted by any number of influences including the experience of legacy, management intellect and cultures, organisational structure, changing training objectives, political factors, new training methods and available resources. Through examination of these influencing factors, this thesis will show that operational training developed to eventually keep pace with Bomber Command's evolution in aircraft technology, tactics and to match its growing fleet. It will also illuminate the requirement for any large organisation's training pipeline to be flexible, to be able to adapt to change, and to be continually assessed to ensure that it is 'fit for purpose,' that term being defined as being 'suitable for the fulfilment of its aims and purposes'.<sup>2</sup>

Before looking at the training pipeline, this chapter will consider the difference between training and education before addressing the role of training by asking why it is undertaken, what it is supposed to achieve and what are its desired outputs? The training pipeline will then be examined alongside two fundamental aspects of training design, the Training Needs Analysis (TNA) and the Systems Approach to Training

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<sup>1</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-1944*, AMT Pamphlet, January 1945, p.7 refers to the 'training pipeline'.

<sup>2</sup> P.W. Gray, 'The Strategic Leadership and Direction of the Royal Air Force Strategic Air Offensive Against Germany from Inception to 1945,' p.38.



(SAT) processes. Understanding why military forces train and the operation of the training pipeline are key elements in supporting this thesis.

### **The Purpose of Training**

Before directly considering training it is worth differentiating between training and education because the two words are often used incorrectly. Kline defines training as emphasising ‘the psychomotor domain of learning. It is a closed system – doing things in an approved way, getting the same results as everyone else.’<sup>3</sup> An example would be a pilot carrying out the drills to land an aircraft. Kline adds that education is an ‘open system’ where ‘right answers and ways of doing things often do not exist...only better or worse ones.’<sup>4</sup> An example here could be the discussion period after a lecture or the completion of an essay. Unlike training with its emphasis on psychomotor skills, education concentrates on the ‘cognitive domain, especially the higher cognitive levels...’<sup>5</sup> That is not to say that training and education are mutually exclusive. There may be times when events occur that have not been covered by the training syllabus and here the aircrew member will have to draw on intellectual cognitive behaviours such as perception, memory, past experiences, judgement or reasoning. ‘Cognitive and skill development are linked’ and failure to do so may lead to a ‘response knowledge gap’ when a serious incident occurs and the individual is unable to respond.<sup>6</sup>

Turning then to the main focus of this thesis, operational training. The interwar and wartime RAF considered training as a method of meeting ‘operational standards’

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<sup>3</sup> J. Kline, ‘Education and Training: Some Differences’, *Air University Review*, Jan-Feb 1985, pp.94-5.

<sup>4</sup> *Ibid.*

<sup>5</sup> *Ibid.*

<sup>6</sup> M. Wiggins, *Aviation Training: Learners, Instructors and Organization* (Aldershot: Avebury, 1997).

or increasing 'operational efficiency' and 'operational competency.'<sup>7</sup> As far as the RAF Staff College at Andover was concerned, training was vital to achieve 'war readiness' without really defining what war readiness was meant to be.<sup>8</sup> Indeed, during the early interwar years training was assessed simply on the number of hours flown and not on meeting nebulous training objectives such as 'war readiness'.<sup>9</sup> In many ways this situation and its associated lack of urgency to focus on training can be understood given the 'Ten Year Rule' and the inter-war focus on disarmament.<sup>10</sup> This situation changed as expansion gathered pace. Pattinson continued that, 'Training is now gauged by exercises done and standards reached...' Perhaps this new method of conducting training evaluation arose from the inter-war Air Exercises that marked the 'culmination of the training year' for the RAF that formed part of ADGB. The problem was that simply undertaking a given exercise without having to achieve measurable training outcomes is of little value. In the 1935 Air Exercise for example, 'the proportion of raiders that were not intercepted may seem surprising, if not alarming...'<sup>11</sup> According to the author, this was due to an inability to simulate air defences and the fact that target cities were illuminated. That outcome did nothing to assess training readiness or challenge accepted doctrine of the day. It also created what is termed 'negative training' or false lessons learned.

As discussed in Chapter One, operational training delivers the training that enables the individual, crew or unit to undertake its operational role.<sup>12</sup> In Bomber

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<sup>7</sup> AIR 41/4, p.34, p.35 and p.60.

<sup>8</sup> TNA AIR 69/216, 'RAF Training Lectures' delivered to the 17<sup>th</sup> Course, May 1939.

<sup>9</sup> AVM L. Pattinson, 'The Training of a Royal Air Force Pilot', *JRUSI*, No. 83, January 1938.

<sup>10</sup> The '10 Year Rule' was a Government policy that predicted that the Empire would not be involved in any major wars for at least 10 years. Each year the period was renewed.

<sup>11</sup> Gp. Capt. A. Claud Wright, 'Air Exercises, 1935', *JRUSI*, Vol. 80, February 1935.

<sup>12</sup> Based in the definition adopted by the US Army, [https://www.militaryfactory.com/dictionary/military-terms-defined.asp?term\\_id=3891](https://www.militaryfactory.com/dictionary/military-terms-defined.asp?term_id=3891). Accessed on 29 October 2020.

Command that training was provided to enable the individual to take his place in a homogeneous crew through the development of skills, knowledge and attitudes as part of a technical training course that was largely reliant on imparting psychomotor skills. Both the RAF's inter-war and early Second World War definitions do not fully define the role of operational training. Efficiency, effectiveness and technical training go some way but training is also designed to enhance morale and create cohesion. As Strachan has opined, 'Men, it is argued, fight for their mates rather than for their country.'<sup>13</sup> He goes on to argue that 'the value of training is therefore in large part psychological: it is an enabling process, a form of empowerment, which creates self-confidence.'<sup>14</sup> Nowhere was this more important than in the confines of a bomber over enemy territory. This point concerning small crew cohesiveness was also made by US Marine Corps General Charles Krulak in the late nineties when he referred to the 'strategic corporal' and this reflects earlier observations by Wavell when he said that, 'it is the action of the individual or small group of individuals that...decides the course of the modern battle.'<sup>15</sup>

The individual self-belief, crew cohesion and decision-making abilities of small groups discussed above are vital offshoots of a robust training syllabus. Another important factor is realism in training. Often referred to as a force multiplying factor, the recognition that well trained forces can determine the outcome of conflicts is not

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<sup>13</sup> H. Strachan, 'Training, Morale and Modern War' in *Journal of Contemporary History*, Vol 41 (2), 2006, p.211.

<sup>14</sup> H. Strachan, 'Training, Morale and Modern War,' p.216.

<sup>15</sup> Gen. C.C. Krulak, 'The Strategic Corporal: Leadership in the Three Block War,' <https://apps.dtic.mil/sti/citations/ADA399413>. Accessed 23 March 2023 and Wavell, 'The Training of the Army for War,' p.256.

new.<sup>16</sup> The Athenian historian Thucydides advised that, 'We must remember that one man is much the same as another, and that he is best who is trained in the severest school.'<sup>17</sup> As this thesis develops, it will show that Bomber Command's training methods improved over time as they became more realistic in reflecting the knowledge gleaned from operations.

## **The Training Pipeline Examined**

Any training process relies on the student moving through a training pipeline and the operating concept of that training pipeline is central to this thesis.<sup>18</sup> At the left hand side of this pipeline, the new student enters and is required to have a certain 'input standard,' normally a minimum educational qualification and a recommendation from an interview panel. At the end of the pipeline, the student emerged at an 'output standard' having theoretically met the training objectives derived from the TNA and able to fulfil the operational requirements of his squadron or the input standard required for his next phase of training. Formalised training course design was in its infancy during the inter-war years and therefore this thesis will use modern terminology to describe how it was applied to operational training.<sup>19</sup> The RAF however had a complete awareness of how to design courses and the cost-benefits of considering quality of output over quantity of output, despite there being no formal method, such as a SAT, or modern educationalist nomenclature for expressing the

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<sup>16</sup> J. Kratsas, 'International Military Education and Training: A Force Multiplier with Relevance for the 21st Century', Defense Technical Information Center Report, March 1997, <https://apps.dtic.mil/sti/citations/ADA326908>. Accessed on 14 February 2023.

<sup>17</sup> T. Hobbes and D. Grene (eds.), Thucydides, *History of the Peloponnesian War*, (Cambridge: Harvard University Press, 1919).

<sup>18</sup> See Table 1, The Training Pipeline Model, p.302.

<sup>19</sup> JSP 822, Defence Direction and Guidance for Training and Education, Part 1: Directive, (November 2021) and Part 2: Guidance, (November 2021).

stages or phases of that design process. This was evidenced during the conference at HQ Bomber Command to discuss the establishment of Group Training Squadrons in 1939 that was attended by a number of training specialists and operational staff.<sup>20</sup> The conference report emphasised areas such as the ownership and management of the Group Training Squadrons, the resources required for them to function correctly, their role and the syllabus required to affect the desired output.

Course design begins with a TNA to define what students need to know, how lessons should be structured and what resources are required for them to be delivered. A key part of this process is recognising ‘training gaps’ or shortfalls, such as a lack of instrument flying.<sup>21</sup> Pike and Huddleston have defined the TNA as ‘the systematic process of analysing training tasks and identifying suitable training option(s)’.<sup>22</sup> The lesson structure is then defined using Training Objectives and, once trained, the student can display knowledge, skills and attitudes (KSA) through meeting Training Outcomes that may be assessed by written or oral examination, or by undertaking practical tests. Together, these processes come under the umbrella of a SAT, comprising analysis, course design, course delivery, and course evaluation.<sup>23</sup> The quality and quantity of the output depended on a number of variables including the number of operational aircraft required to be manned; the crewing policy of those aircraft; the operational aircraft and aircrew reserves required; crew wastage in terms of training accidents, operational losses and failure within the training pipeline – so-called ‘wash-out,’ changes to unit establishments and overall

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<sup>20</sup> TNA AIR 2/4168, Record of a Conference Held at Headquarters Bomber Command on 5 September 1939, to Discuss the Provision of Group Training Squadrons for Bomber Command.

<sup>21</sup> AHB, Ludlow-Hewitt Papers, Box 2, Letter to CAS from RAF Inspector General, 3 December 1939.

<sup>22</sup> J. Huddleston and J. Pike, *Team and Collective Training Needs Analysis – Defining Requirements and Specifying Training Systems* (London: CRC Press, 2016), p.26.

<sup>23</sup> See Table 2, Systems Approach to Training, p. 303.

Air Ministry policy concerning staff and instructional tour postings. To ensure that this complex training pipeline worked as efficiently as possible required a coherent policy, organisation and structure that was well managed and provided sufficient training aircraft; instructors; airfields; funding; and well-designed curricula. Any operational training pipeline has to evolve to match output to the manning requirements of the operational aircraft fleet with the latter typified by factors such as increased aircraft holdings and detracting factors such as aircraft production efficiency; time pressures; changing technologies; a shortage of training resources; and politics; all impacting how the training pipeline operates. The ideal training pipeline needs to be flexible enough to allow it to adapt to change and it needs to be subject to continual analysis to ensure that it remains fit for purpose. The difficulties in managing Bomber Command's various training pipelines were compounded by the different aircrew roles but as this thesis will show, these challenges were eventually mastered.

Once Bomber Command's crewing policy had been finalised by mid-1942, six heavy bomber crew specialisations had been identified: pilot, navigator, flight engineer, air bomber (later referred to as bomb aimer), wireless operator/air gunner (WOp/AG) and straight air gunner. Each aircrew specialisation had its own dedicated training pipeline, the outputs of which had to be coordinated to provide inputs into the Operational Training Unit (OTU) stage of training and for the flight engineer and one dorsal air gunner to join the crew at the Heavy Conversion Flight (HCF) or, by late 1941, the Heavy Conversion Unit (HCU) phase. Although this thesis will concentrate on the evolution of operational training to meet the challenges of new technologies and tactics, it will also consider, where appropriate, developments in basic, or *ab initio*, training, that fundamentally altered the input standard to the operational

training pipeline. Training was increasingly recognised as a key contributor to improving Bomber Command's operational capabilities and effectiveness as the war progressed. It was a critical foundation on which 'air power was built'. Balfour's comment was mirrored at the crew level by a Lancaster navigator who recognising the value of training and said in 1943 that 'ops were beginning to appear less a game of chance than a game of skill...' with that skill being provided by better and improved training processes.<sup>24</sup> In short, by late 1942 Bomber Command's training pipeline was maturing and this resulted in a more efficient training system that was evolving as the war progressed.

Table One clearly identifies some of the factors that can disrupt the smooth running of the training pipeline but it is worth reiterating the impact of changing policies or the addition of new phases of training. For example, Chapter Six will show that in the mid-1930s the RAF pilot training pipeline lasted 12 months. The addition of extra training modules and travel to and from overseas training locations caused this to double by 1943. As this thesis will show, with such a long and complex training pipeline any changes made to the syllabi did not deliver instant results and at worst, could cause bottlenecks and disruption.

The next chapter will consider the First World War and examine the training legacy that this provided for the RAF. Much of this legacy was reflected in issues faced by the RAF in the Second World War as it sought to first establish and then refine its complex training pipelines.

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<sup>24</sup> D. Charlewood, *No Moon Tonight* (London: Goodhall Publications, 1984), p.134.

## CHAPTER THREE

### WHAT LEGACY WAS LEFT FROM THE FIRST WORLD WAR AND DID IT SHAPE INTERWAR AND SECOND WORLD WAR RAF TRAINING?

#### Introduction

This chapter explores if the experiences of the RFC, RNAS and RAF during the First World War and asks whether they created a training legacy that could be exploited during the inter-war and Second World War periods by the bomber force. As Chapter One has shown in examining secondary sources, a number of authors, notably Morrow, Barker, Steele, Biddle and Hart have briefly addressed training. This chapter will develop this extant historiography by looking in more depth at operational training and consider how it shaped future staff and organisational processes as well as assisting the definition of operational training methodologies. The chapter will conclude that there were numerous lessons that could have been learnt to assist in fulfilling training requirements from 1922 to 1945. Unfortunately many of these lessons were not assimilated but perhaps unsurprisingly, the First World War heralded many of the training challenges that would become apparent from the mid-1930s onwards.

The chapter will address four key areas. The first will focus on the tactical applications and technologies that provided the context for the operational training that was conducted during the First World War. This section will pay particular attention to the establishment of 41<sup>st</sup> Wing/VIII Brigade and the Independent Force (IF) and what Field Marshal Haig referred to as 'long-distance' bombing operations.<sup>1</sup>

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<sup>1</sup> H.A. Jones, *The War in the Air*, Vol.6 (Oxford: Clarendon Press, 1937), p.122.



Secondly, training organisation and policy issues will be analysed before looking at the training methods that were used during the First World War. Finally, this chapter will consider the logistics of training, including training aircraft, the availability of airfields and specialist schools to conduct operational training as well as the use of overseas training locations.

When the RFC deployed to the Continent in August 1914, following Britain's declaration of war against Germany, aviation was in its infancy; the first heavier than air flight having only taken place just over 10 years earlier and the first crossing of the Channel just five years after that.<sup>2</sup> Although basic theoretical aeronautical science had advanced rapidly throughout the late-nineteenth and early-twentieth centuries, the reliability and capability of technology to deliver robust aircraft and aero-engines to study these theories in greater depth was a major retardant to aeronautical development.<sup>3</sup> Like the Wright Flyer of 1903, both Germany's Etrich Taube and Britain's Sopwith Tabloid aircraft that were deployed to France in 1914 used wing-warping compared to the use of ailerons that were becoming available and increasingly being adopted as a more efficient form of lateral control.<sup>4</sup> By the end of the war however, the performance of aircraft such as the SE5A, Bristol F2B and Albatross D.VII was unrecognisable compared to those deployed in 1914 and this technological transformation called for improved training to match this increased performance.<sup>5</sup>

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<sup>2</sup> C. Gibbs-Smith, *Aviation – An Historical Survey From its Origins to the end of World War II* (London: HMSO, 1970), pp.100-101.

<sup>3</sup> S. House, 'Three-Dimensional Warfare – The Invention of Aerial Combat', *British Journal for Military History*, Vol. 5, Issue 2, October 2019, p.49.

<sup>4</sup> C.H. Gibbs-Smith, *Aviation – An Historical Survey From its Origins to the end of World War II*, p.153 for the Taube's wing-warping technology and p.167 for the Sopwith Tabloid.

<sup>5</sup> R. Grattan, Table 3.1 'Improvements in Aircraft Performance - 1914-18,' p.65.

## Air Power Applications and Technologies

The technical improvement to aircraft and their tactical employment during the First World War had a significant impact on training. Firstly, technical improvements led to increased performance and payload and, in particular, speed; the maximum ceiling of the aircraft; and the ability to carry increased types and weights of weapons. In turn, technical enhancements provided opportunities for aircraft to adopt new roles; a legacy mirrored in the different type of aircraft missions flown during the Second World War.<sup>6</sup> As Jordan has stated, 'most of the key air power roles and missions were established in some form or other by the end of the conflict.'<sup>7</sup> These new roles demanded specific types of training; for example, in night flying to counter Zeppelin and Gotha raids against Britain.<sup>8</sup> Initially, the role of the aircraft was limited to reconnaissance although the military was well aware of what could theoretically be undertaken once aircraft performance had improved.<sup>9</sup> This was apparent in the *RFC Training Manual* that was published in June 1914. This stated that although an aircraft's 'chief use is reconnaissance...other duties of aircraft in war' included fighting against other aircraft, transport of people and messages, ground attack and miscellaneous duties including cooperation with artillery.<sup>10</sup> Even before the release of this manual, the then Major Fredrick Sykes, commander of the RFC's Military Wing,

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<sup>6</sup> See for example, Terraine, *The Right of the Line*, for a description of the different roles undertaken by RAF aircraft during 1939-1945.

<sup>7</sup> D. Jordan, 'The Royal Air Force and Air/Land Integration in the 100 Days, August-November 1918', *Air Power Review*, Vol. 11, No.2, 2008, p.13.

<sup>8</sup> TNA AIR 1/823/204/5/42, contains a series of correspondence between the W.O. and RFC on night flying training.

<sup>9</sup> D. Edgerton, *England and the Aeroplane* (London: Penguin, 2013), p.16.

<sup>10</sup> Fleet Air Arm Museum (FAAM), Royal Flying Corps Training Manual, Part II (Military Wing) 1914. W.O.1893.

said that aeroplanes would be employed 'in fighting off the opposing aeroplanes...'<sup>11</sup>

The problem that was faced by the RFC and RNAS was a lack of any real knowledge as to how to employ and operate aircraft due to performance limitations. This conundrum was summarised in the *Naval Air Service Manual 1915*, written in November 1914, that declared:

It must be borne in mind that the whole subject [military aviation] is at present in a very experimental stage and that it is impossible in many cases to lay down hard and fast rules of procedure. Every effort must be made by all concerned to improve existing methods until some measure of finality may be reached...Chapters on wireless, night flying, and workshops will be added as further experience is gained.<sup>12</sup>

In many ways this extract encapsulated the early problems of training in the First World War in that the RNAS and RFC did not know what they had to train for. As the First World War progressed, technological innovation and specialised designs such as the scout and the bomber, ensured that the aircraft had become 'an integral part of the way wars were fought'.<sup>13</sup> Although the RFC was initially tasked with carrying out reconnaissance, by 1915 improvements to aeronautical technology began to shape tactics. Despite Trenchard's infamous memorandum of 1916 which called for 'incessant offensive' action to control the air, it had been recognised for a number of years that conducting aerial reconnaissance was predicated on achieving 'command of the air'.<sup>14</sup> The RFC's reconnaissance activities in the first six months of the war had always been conducted with an eye to destroying enemy aircraft that tried to

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<sup>11</sup> F.H. Sykes, 'Military Aviation,' in *The Aeronautical Journal*, July 1913, p.130. Interestingly, Sykes spoke about the importance of gaining 'command of the air' and that; 'The side which losses the command of the air will labour under the disadvantages of defensive action.'

<sup>12</sup> FAAM, *Naval Air Service Training Manual 1915* (London: HMSO, November 1914).

<sup>13</sup> P. Hart & N. Steel, *Tumult in the Clouds*, p.xi.

<sup>14</sup> TNA AIR 1/725/114/2, Colonel J.D. Fullerton spoke of the need to 'obtain command of the air' and the requirement for 'high-speed flying machines armed with light guns' as early as November 1906. RUSI lecture, 'Recent Progress in Aerial Navigation' delivered on 15 November 1906 and TNA AIR 1/718/29/1, Trenchard, 'Future Policy in the Air,' 22 September 1916.

interfere with the mission and as such, assorted weapons including revolvers, hand grenades, flechettes and rifles had been used to try and destroy enemy aircraft when the two sides met although, as Morrow has stated, such encounters were usually 'indecisive'.<sup>15</sup> This situation changed in the summer of 1915 when the Germans deployed the Fokker E-1 Eindecker with its synchronised Parabellum machine gun that fired through the propeller disc.<sup>16</sup> The great benefit of this design was that if the pilot fired when directly laterally in-line with his target, they therefore did not have to worry about calculating deflection. As Biddle so accurately observed, the 'air war demanded specialization' and '[a]irplanes created a need for other airplanes...'.<sup>17</sup> This observation is also supported by Grattan who said that 'technology was the principal driver of the development of tactics and strategy in the air war' and to this may be added developments in training, the symbiotic sibling of tactics and technology, that was needed to prepare aircrew for conducting new roles in higher performance aircraft.<sup>18</sup> As the Germans took a technological advantage with the Fokker Eindecker, the British had to respond with a more capable counter platform or new tactics; a trend that was to continue throughout the war with the technological and tactical advantage tipping between the combatants during the course of the conflict.<sup>19</sup> As Pugh has pointed out, if an air force aspires to control the air, that air force needs the resources with which to achieve that aim and here, aircraft output

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<sup>15</sup> J. Morrow, *The Great War in the Air*, p.116.

<sup>16</sup> *Ibid.*, p.116.

<sup>17</sup> T. Davis Biddle, 'Learning in Real Time: The Development and Implementation of Air Power in the First World War' in S. Cox & P. Gray (eds.) *Air Power History: Turning Points from Kitty Hawk to Kosovo* (London: Frank Cass, 2002), p.14.

<sup>18</sup> R. Grattan, *The Origins of Air War*, p.85.

<sup>19</sup> P. Hart & N. Steel, *Tumult in the Clouds*, p.108 discusses the arrival of the DH2 in early 1916 to challenge the Fokker Eindecker for 'supremacy'.

and aircrew training became vital; a process that created a significant model for the RAF during the Second World War.<sup>20</sup>

The focus on increased and improved training was initially sharpened in May 1915 when the number of pilots per squadron was increased from 12 to 15. The major catalyst was the growing emphasis on what Brooke-Popham referred to in his February 1915 report as 'Fighting Hostile Aeroplanes in the Air.'<sup>21</sup> The impetus for this change of tactical emphasis was not, as many authors have written, the Fokker Eindecker, as this aircraft only began to appear from August 1915.<sup>22</sup> The major driver behind Brooke-Popham's report was the growing incidence of aircraft attacking each other over the front. Brooke-Popham's report was supplemented by a re-issued RFC Training Manual that featured a section on aerial combat.<sup>23</sup> These events must also be put into the context of the BEF's spring offensive, notably the battles of Neuve Chapelle and Ypres in March and April respectively and later, the Battle of Loos in September.<sup>24</sup> These offensives called for a more aggressive and proactive approach from the RFC.<sup>25</sup> The new tactics, combined with a greater emphasis on offensive operations, highlighted some serious flaws in training, such as a lack of specialisation and experience; the latter caused by pilots arriving at the front with minimal flying

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<sup>20</sup> J. Pugh, 'The Conceptual Origins of the Control of the Air: British Military and Naval Aviation, 1911-1918,' p.61.

<sup>21</sup> TNA PRO AIR 1/746/204/3/22, Brooke-Popham's report on aerial combat *Fighting Hostile Aeroplanes in the Air*, 1 February 1915. Brooke-Popham wrote this report when he was CO of 4 Squadron.

<sup>22</sup> See D. Jordan, 'Learning to Fly: The Royal Flying Corps and the Development of Air Power', *British Journal for Military History*, Vol.4, No.2, 2018, p.25 on the 'Fokker scourge,' and J. Pugh, 'The Conceptual Origins of the Control of the Air: British Military and Naval Aviation, 1911-1918,' p.339.

<sup>23</sup> TNA AIR 10/180, RFC Training Manual Part II, A.P.144.

<sup>24</sup> M. Howard, *The First World War* (Oxford: Oxford University Press, 2002), provides a comprehensive overview of the battles and events of the First World War.

<sup>25</sup> Barker, *The Royal Flying Corps in World War I*, p.73 and p.78.

hours.<sup>26</sup> As Morrow saw it, 1915 was a watershed in aerial warfare with air arms becoming 'more sophisticated' and performing separate and distinct roles.<sup>27</sup> As a result, a number of major initiatives were established to prepare better pilots and observers for operational service and a range of emerging novel tactics. For example, the way that tactics and technology were altering training can be seen in May 1915 when pilots and observers underwent systematic machine gun training using the Lewis Gun for the first time. The Machine Gun School RFC was established at Dover in May before moving to Hythe in November.<sup>28</sup> The importance of training pilots and observers in the use of the machine gun was forgotten in the interwar years as the role of air gunner and observer were considered part-time roles to be filled by ground crew despite the importance attached to this type of training during the First World War.<sup>29</sup>

There was also an increased emphasis on formation flying which was a result of Trenchard's memorandum of 14 January 1916 which stated that all reconnaissance aircraft must be escorted by at least three scouts.<sup>30</sup> This skill was not an insignificant one to master and added another facet and layer of complexity to the training syllabus. The pressure to produce more pilots and observers crystallised in 1916 due to two significant factors, one strategic and one tactical.<sup>31</sup> The first was the Somme offensive and the second was the appearance of the first German *Jasta* in

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<sup>26</sup> H.A. Jones, *War in the Air Vol. II* (Oxford: Clarendon Press, 1922), pp.293-294, refers to pilot training measures in 1915 as 'inadequate' although acknowledging that by the autumn, 'specialization in training [had] began'.

<sup>27</sup> J. Morrow, *The Great War in the Air*, p.129. The author also states that 'technological and industrial mobilization...became crucial' to enable increased aircraft performance.

<sup>28</sup> H.A. Jones, *War in the Air Vol. II*, p.293-294.

<sup>29</sup> TNA AIR 41/4, *AHB Narrative, Aircrew Training 1934-1942*, pp.37-38.

<sup>30</sup> TNA AIR 1/2161/209/4/26, Memorandum Commander 2 Wing to Squadrons, 18 January 1916.

<sup>31</sup> In modern terminology, strategic in this sense would be referred to as theatre level operations.

August 1916.<sup>32</sup> Unlike the RFC's policy of trying to maintain air supremacy over the complete front and fight the air battle beyond the German lines, the German approach saw them avoid contact unless they had the tactical advantage. *Jastas* were used to gain localised air supremacy for a given tactical objective whilst the RFC's approach, epitomised in Trenchard's *Future Policy in the Air* memorandum of September 1916, was of 'incessant offensive'.<sup>33</sup> This was hardly surprising given the British Army's Field Service Regulations (FSR), the British Army's authority on combat operations with its emphasis on an 'aggressive doctrine'.<sup>34</sup> The continuance of this legacy was mirrored in the Second World War when Fighter Command flew *Rhubarb* and *Circus* missions over France resulting in significant losses to aircraft and crews.<sup>35</sup>

The results of this offensive air policy, and a key indicator of how tactics influenced training output, was an increase in the attrition of pilots and aircraft. Between July and December 1916, the RFC had lost 499 pilots and observers killed or missing, 250 wounded and 250 removed from service due to 'unsuitability, physical or nervous debility'.<sup>36</sup> This position, Pugh has argued, saw the RFC's capability 'eroded in 1916' and that it continued to 'flag' into 1917.<sup>37</sup> Pugh has stated that this was due to the RFC's inferior aircraft and the increased effectiveness of German tactics and air power although poor training was also a key factor. In many

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<sup>32</sup> Morrow, *The Great War in the Air*, p.152. *Jasta* is an abbreviation of *Jagdstaffeln* or hunter fighter squadrons.

<sup>33</sup> TNA AIR 1/718/29/1, Trenchard's *Future Policy in the Air* memorandum, 22 September 1916.

<sup>34</sup> Pugh, *The Conceptual Origins of the Control of the Air: British Military and Naval Aviation, 1911 – 1918*, p.180.

<sup>35</sup> S. Douglas, *Years of Command* (London: Collins, 1966), pp.113-116. According to Douglas, Portal came to see him to suggest 'leaning towards France' after being visited by Trenchard.

<sup>36</sup> Barker, *The Royal Flying Corps in World War I*, p.223.

<sup>37</sup> Pugh, 'The Conceptual Origins of the Control of the Air: British Military and Naval Aviation, 1911-1918,' p.264.

ways, this mirrored Bomber Command's experience during 1940-1941 when outdated bombers such as the Hampden, Blenheim and Whitley, combined with inadequately trained crews, failed to make any real impact in their strategic bombing role.<sup>38</sup> Casualties were so high during the period from the opening battles of the Somme offensive in July 1916 until the Battle of Arras in April and May 1917 through until the German attacks beginning in March 1918 that the length of flying training courses was cut and output standards reduced just to meet the wastage rate of service squadrons.<sup>39</sup> Even in November 1916, scout pilots were 'sufficiently trained only to take off and land without damaging their machines.'<sup>40</sup>

Not all legacies are positive and the period from July 1916 to the end of the conflict marked a phase of the war where Trenchard's policy of 'incessant offensive' led to poor decision-making by a number of senior RFC/RAF officers as the training pipeline could not meet either qualitative or quantitative demands. Barker has argued that failing to train aircrew sufficiently 'amounted to culpable if not criminal negligence.'<sup>41</sup> Although strong words, Barker's assertion does stand up to examination by considering wastage rates alone. In essence, the aircrew that were trained throughout the First World War were posted directly to their operational squadrons. As will be discussed later, aircrew training from the middle of the Second World War was not as frenetic and allowed aircrew to be held in pools and this meant that there was no time pressure to cut corners within the training pipeline. This benefit was certainly not present in 1940 or 1941 when the RAF was again suffering

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<sup>38</sup> AHB, Ludlow-Hewitt Papers, Box 2, Staff Officer Notes for Visit to Abingdon, 22 November 1940.

<sup>39</sup> TNA AIR 1/39/15/7, RFC/RAF Casualty Figures 1914 – 1918. During this three-year period, RFC/RNAS/RAF casualties killed, wounded and missing were: 1916 – 985, 1917 – 3,633 and 1918 – 4,580.

<sup>40</sup> TNA AIR 1/997/204/5/1241, series of letters between RFC Wings and HQ RFC.

<sup>41</sup> Barker, *The Royal Flying Corps in World War I*, p.220.



from a shortage of sufficiently trained aircrew and this led to a period of 'conservation' as bombing operations were significantly curtailed. As discussed in Chapter One, all training is a balance between quality and quantity of output and this balance had clearly become mismatched from July 1916 onwards.<sup>42</sup> The result was that the training system was graduating aircrew which in some cases had their training records falsified. Both Second Lieutenants G.W.T. Garwood and L.H. Mackay were certified as having flown the BE2c but, on arrival in France, told their respective Commanding Officers that they had never flown the aircraft.<sup>43</sup> Second Lieutenant C.F.A. Portal's report card showed that he had fired both the Lewis and Vickers machine guns during his training as an observer but he had only in fact fired a .303 Lee Enfield rifle.<sup>44</sup> Although the training organisation in Britain was under pressure to train aircrew as quickly as possible, this approach was clearly reprehensible and led to increased and unnecessary wastage.

These training shortfalls were being addressed on a daily basis by Squadron Commanders in France as new pilots were posted in. There are numerous examples of Squadron Commanders writing to Wing and Brigade Commanders about the poor state of training. In March 1917, for example, 3 Brigade wrote to HQ RFC in the Field about the lack of training of observers.<sup>45</sup> Another notable observation was made by Major Learmount, Officer Commanding 22 Squadron, to Headquarters 9 Wing.<sup>46</sup> Learmount complained that of five pilots posted to 22 Squadron, none had any practical gunnery training, two had crashed during their first week with the squadron

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<sup>42</sup> A. English, *The Cream of the Crop* (Montreal: McGill-Queen's University Press, 1996), p.41.

<sup>43</sup> TNA AIR 1/15/40/218 contains correspondence and affidavits from both pilots and from their commanding officers to HQ RFC.

<sup>44</sup> TNA AIR 1/2306/228/11/1, 'War Experiences of Second Lieutenant C.F.A. Portal, September 1922.'

<sup>45</sup> TNA AIR 1/1135/204/5/2224, Letter, 3 Bde. to HQ RFC in the Field, 15 March 1917.

<sup>46</sup> TNA AIR 1/1135/204/5/2224, Letter OC 22 Sqn. to HQ 9 Wg., 14 September 1917.

and all had little experience on the Bristol F2B's Rolls-Royce Falcon aero-engine. The OC noted that 'casualties are directly the result of inexperience and it stands to reason that pilots with no experience cannot put up a decent fight against the pick of the German Flying Corps.' From the perspective of operational squadrons, there was a 'training gap' that they felt should be addressed within the 'training pipeline' at home and not by operational squadrons in the field. Learmount's complaint was picked up by Trenchard who told him that it 'was not possible to do the amount of training at home that would be desirable if time permitted...' and, as the squadron commander, it was up to him 'to overcome these difficulties.' Rather icily, Trenchard told Learmount and Commander 9 Wing that they were to report to him at HQ RFC on 'the first day' that weather permitted flying. It would appear that constructive feedback was not valued from operational squadrons, the ideal source in fact to provide validation for the training process. Instead, as Trenchard highlighted, operational squadrons were blamed for training failures, a point raised again in March 1918, when 12 and 13 Wings were told 'Flight Commanders are not paying sufficient attention to the instruction of young pilots, fresh from home.'<sup>47</sup> This desire to conduct operational training within service squadrons was a mainstay of inter-war training policy within the RAF. This legacy only began to change in 1940 although, as this thesis will show, it was never completely eradicated.

### **The Early Experience of Bombing Operations**

Turning specifically to bombing operations during the First World War, these began in earnest as a response to the German Zeppelin, Gotha and Staaken air attacks on

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<sup>47</sup> TNA AIR 1/1135/204/5/2224, Letter 3 Bde. to 12 and 13 Wings, 18 March 1918.

Britain that started in 1915 and that 'caused public outcry and government embarrassment.'<sup>48</sup> As these raids increased in severity, especially following Gotha and Staaken attacks in 1917, the Government decided to form its own 'long-distance' bombing force. As Layman opines, this narrative often 'ignores' the contribution of the RNAS that had already been mounting operations from Belfort since 1914, most notably against the Zeppelin works on Lake Constance, as well as with No.3 Naval Wing at Luxeuil that occurred in summer 1916.<sup>49</sup> During a meeting of the War Cabinet on 2 October 1917 it was decided to deploy eight RNAS Handley Page HP O/100 and 20 De Havilland DH4 bombers to Ochey, near Nancy with the aim of 'attacking suitable objectives, such as the Lorraine iron-works, and, when conditions were favourable, Mannheim and Stuttgart.'<sup>50</sup> Formed as the 41<sup>st</sup> Wing and commanded by Lieutenant Colonel Cyril Newall, in October 1917 it was superseded by VIII Brigade before becoming the Independent Force in June 1918.<sup>51</sup> The 3<sup>rd</sup> Naval Wing was eventually disbanded as its aircraft were required to support the British Army for the Somme offensive.<sup>52</sup> The paradox here, and one that falls outside the scope of this thesis as it has already been examined in depth by the likes of Gray, Parton and Jones, is that Trenchard was originally against any air action that was not intrinsically focused on direct support to the British Army's operations on the ground.<sup>53</sup> 'A more gigantic waste of effort and personnel there has never been in any

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<sup>48</sup> IWM Website, <https://www.iwm.org.uk/history/the-air-raids-that-shook-britain-in-the-first-world-war>. Accessed, 22 November 2022.

<sup>49</sup> R.D. Layman, *Naval Aviation in the First World War* (London: Caxton, 1998), p.67. See also, H.A. Jones, *War in the Air*, Vol.VI (Oxford: Clarendon Press, 1937), p.118.

<sup>50</sup> TNA CAB/23/4/18, War Cabinet Minutes, 2 October 1917. These minutes refer to Ochey as Ouchy

<sup>51</sup> Jones, *The War in the Air*, Vol VI, p.123.

<sup>52</sup> Layman, *Naval Aviation in the First World War*, pp.74-5.

<sup>53</sup> Gray, 'The Strategic Leadership and Direction of the Royal Air Force Strategic Air Offensive Against Germany from Inception to 1945'; N. Parton, 'The Evolution and Impact of Royal Air Force Doctrine: 1919-1939' and N. Jones, *The Beginnings of Strategic Air Power – A History of the British Bombing Force 1923-1939*.

war,' said Trenchard as IF commander when the war ended.<sup>54</sup> Morrow refers to the 3 Naval Wing's operations as 'a paltry strategic effort' and those of VIII Brigade as being 'hampered by bad weather and inexperience' but to that list can be added poor aircraft serviceability and a lack of training.<sup>55</sup> Biddle concurs with these shortcomings and said that Allied strategic bombing efforts during the First World War were 'constrained by a shortage of suitable aircraft, inadequately trained crews, lack of navigational instruments, and poor weather.'<sup>56</sup>

The arguments of Morrow and Biddle have been challenged by Jones who has said that although the VIII Brigade/IF bomber force 'was in every respect a makeshift one...it achieved a remarkable degree of success.'<sup>57</sup> He highlighted, in particular, the amount of German aircraft, air defence weapons, balloons, searchlights and associated manpower tied up in the defence of western Germany as well as attacks creating a 'serious effect on the morale of the civilian population'.<sup>58</sup> The real irony of Trenchard's disparaging comments about the early efforts of Britain's strategic bombing force was that the shortfalls of the First World War in terms of training, navigation and poor aircraft performance were carried forward to the Second World War without being addressed, particularly that of a robust training system that was attuned to the desired operational outcome. A typical example of such shortfalls can be evidenced following a daylight raid on Mainz by 12 D.H.9s of 99 Squadron on 31 July 1918. Three pilots turned back because of engine problems; the remaining aircraft could not find the target and decided to attack the secondary

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<sup>54</sup> RAFM, Trenchard Papers, MFC 76/1/32, 11 November 1918.

<sup>55</sup> Morrow, *The Great War in the Air*, p.243 and p.246.

<sup>56</sup> Davis Biddle, *Rhetoric and Reality in Air Warfare*, p.35.

<sup>57</sup> Jones, *The Beginning of Strategic Air Power – A History of the British Bombing Force 1923-1939*, p.20.

<sup>58</sup> *Ibid.*, pp.20-21.

target at Saarbrücken. Four were shot down before reaching the target, five aircraft bombed the target, and three were shot down on the way home.<sup>59</sup> Of the nine aircraft that flew across the border, seven were shot down, giving a 77.8% loss rate. Jones added that: 'The squadron records show that most of the pilots who had newly joined the squadron from England had arrived with little experience of flying in formation, and the success of day raiding depended on the efficacy with which formation could be kept.'<sup>60</sup> The parallels with the RAF's failed attacks on German warships in the Shillig Roads and north of Wilhelmshaven from 3 September to 18 December 1918 are clear.<sup>61</sup>

According to Kingston-McCloughry, the performance of VIII Brigade/IF operations can be summarised in the following figures: of the day bomber missions, 18% of aircraft failed to reach their targets; 60% of aircraft were lost each month; and 48% of aircrew became casualties each month. For night bombing, the figures were 36%; 46% and 23% respectively.<sup>62</sup> The clear lesson here was that fewer crews and aircraft were lost during bombing missions conducted at night than during the day but the efficacy of that bombing was less as fewer bombers found their targets. Although the destructive efforts of the VIII Brigade/IF bombing force have been dismissed by many, the lessons learned during its operations were quickly forgotten but equally applicable in the Second World War especially concerning areas such as long range navigation, night flying and the self-protection afforded by bomber aircraft.

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<sup>59</sup> Jones, *War in the Air*, Vol.VI, p.141.

<sup>60</sup> N. Jones, *The Beginning of Strategic Air Power – A History of the British Bombing Force 1923-1939*, p.21.

<sup>61</sup> See Chapter Six.

<sup>62</sup> E.J. Kingston-McCloughry, *Winged Warfare* (London: Jonathan Cape, 1937), p.44.

## Training Organisation and Policy

When the RFC was formed in 1912, the Military and Naval Wings received their pilots from the Central Flying School (CFS).<sup>63</sup> With deployment to the continent in August 1914, CFS was closed and many civilian flying instructors joined the RFC or RNAS and thereby denuded the flying training system of its experienced instructors.<sup>64</sup> The instructor cohort was only re-built when some of the pilots from the initial squadrons sent to France in August returned to England for a period of rest in the winter of 1914. The belief that the 'war would be over by Christmas' created a vacuum in the pilot training organisation and policy for the first few months of the war. The contradiction is that although Jones and Barker's observations on the 'paralysis' of the RFC's training system at the beginning of the war were correct as far as CFS was concerned, these comments do not acknowledge the War Office's recognition that the RFC needed a formalised training structure.<sup>65</sup> As aircraft departed for France, the RFC formed a Reserve Aeroplane Squadron (RAS) at Farnborough with the sole aim of training pilots. Although having airfields as well as the RAS, there was still no practical training programme in place. The first major expansion took place in November 1914 when the initial RAS became No.1 RAS and No.2 RAS was formed at Brooklands. In addition to providing training, these squadrons were also tasked with creating operational squadrons, and in January 1915, No.1 RAS formed the nucleus of 10 Squadron.<sup>66</sup> By the end of 1915 there were 17 RASs but perhaps, potentially more importantly, from November 1914, the RFC had restructured into a

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<sup>63</sup> R. Morley, 'Earning Their Wings: British Pilot Training, 1912 – 1918' (MA Dissertation, University of Saskatchewan, 2006), p.23 and pp.34-5.

<sup>64</sup> Barker, *The Royal Flying Corps in World War I*, pp.210-11.

<sup>65</sup> *Ibid.*, p.146 and p.211.

<sup>66</sup> R. Sturtivant, 'British Flying Training in World War I', *Cross & Cockade*, Vol.23, No.1, 1994, pp.18-19.

number of Wings.<sup>67</sup> RASs would now come under the control of Administration Wing, commanded by Lieutenant Colonel E.B. Ashmore to provide centralised control of training. Unfortunately and despite these organisational changes, pilot training was still inadequate and haphazard even with this centralised control.<sup>68</sup> Jones stated that training was being provided by RASs, a reformed CFS and civilian flying schools but there was no central flying training syllabus or standardised instructional policy.<sup>69</sup> Due to the lack of capacity at CFS, RASs were now providing advanced as well as basic training, the so-called 'all-through' system. It is salutatory to reflect that, by the end of 1915, 17 RASs plus the CFS were supporting the RFC's 12 squadrons in the France; a clear indication of the scale of the training resources required to maintain operational squadrons in the field.<sup>70</sup> This realisation that operational squadrons demanded massive investments in a training organisation was a clear legacy of the First World War although that lesson was often forgotten during the RAF's period of expansion and during the early years of the Second World War. The need for investment in training to match the required operational output will be examined further in Chapters Five, Six and Seven.

With the restructuring into Wings, Fourth Wing was created with its headquarters at Netheravon to coordinate the activities of the RAS training squadrons.<sup>71</sup> Throughout 1915, additional Wings were formed in the UK and each became responsible for initially, two RASs.<sup>72</sup> By September 1915, prior to the Battle

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<sup>67</sup> H.A.Jones, *The War in the Air Vol. III* (Oxford: Clarendon Press, 1931), p.288.

<sup>68</sup> *Ibid.*, pp.293-294.

<sup>69</sup> Hart & Steel, *Tumult in the Clouds*, p.92.

<sup>70</sup> Barker, *The Royal Flying Corps in World War I*, p.109.

<sup>71</sup> *Ibid.*, pp.67-68.

<sup>72</sup> R. Sturtivant, 'British Flying Training in World War I', *Cross and Cockade*, Vol.25, No.1, 1994, pp.18-45. The author gives details of the formation of 5, 6, 7 and 8 Wings that all formed in the UK during 1915.

of Loos, the RFC in France comprised three Wings totalling 12 squadrons of around 160 aircraft.<sup>73</sup> This structural change was reinforced with command changes during August 1915 when Henderson, the RFC GOC in France, was posted as Director Military Aeronautics to the War Office and replaced by Trenchard, the commander of the First Wing. During this same re-shuffle, Lieutenant Colonel C.J. Burke, the commander of the Second Wing, was sent to Canada to discuss pilot training in the Dominion.<sup>74</sup> This Canadian initiative will be discussed later but it is interesting to note that the War Office was sufficiently prescient in 1915 to realise that the production of sufficient pilots was a key requirement in prosecuting the war and to do this they had to make use of the Dominions.

The shortage of instructors and training aircraft was compounded by the lack of a, 'definite air service policy as to what the Army wing [RFC] has to do...' and what policy that was present, was 'haphazard'.<sup>75</sup> Lord Derby's observation neatly identified the challenge to a nation that aspired to deliver a coherent national strategy but lacked the organisational support structure with which to do so; in this case, a robust training pipeline and an industrial system that could deliver aircraft and engines of the right quality, in sufficient numbers and in a timely manner.<sup>76</sup> Pugh has stated that this lack of strategic control by the respective politico-military organisations that were active during the war, chronologically the Air Board, Joint War Air Committee and Air

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<sup>73</sup> Barker, *The Royal Flying Corps in World War I*, p.109.

<sup>74</sup> Jones, *The War in the Air*, Vol. V, p.459.

<sup>75</sup> *Hansard*, [www.hansard.millbanksystems.com/lords/1916/may/24/the-air-service](http://www.hansard.millbanksystems.com/lords/1916/may/24/the-air-service). The Earl of Derby in the Lords Debate 23 May 1916, 'The Air Service'. Accessed 11 November 2014.

<sup>76</sup> *Hansard* and the War Cabinet minutes provide a valuable insight into the problems of aircraft production throughout the war. Problems centred on aircraft design, raw materials, production resources and industrial disputes. See for example CAB/23/2/41 and CAB 24/27/23, War Cabinet Minutes from meetings on 20 April and 22 September 1917 respectively on the problems of aircraft production.



Council, was due to a lack of 'executive authority' and that the Air Council in particular, 'was superfluous'.<sup>77</sup> Although 1915 saw the RFC take a number of steps to improve the training of pilots and observers, it still lacked an effective training system and, as the tempo of expansion grew, the RFC was subjected to increased pressures to produce additional aircrew. Although not generally recognised as such, Brigadier John Salmond provided a significant force for training evolution when he instigated major changes to the RFC's training system following his appointment as commander of V (Training) Brigade in February 1916.<sup>78</sup> Indeed, the rapid rate of expansion of training can be seen in the structural changes that occurred in the first half of 1916. Salmond had only been in post for three weeks when V Brigade was subsumed into VI (Training) Brigade and, four months later, VI Brigade was re-titled the RFC Training Brigade.

The failings of the pilot training process when Salmond took over V (Training) Brigade were summed up in correspondence between the CFS Commandant, Lieutenant Colonel Burke and the Director Air Organisation, Brigadier General Brancker. Burke noted that: 'People who have been training pilots at home during the winter are somewhat chided as to the results of their efforts, and a general briskening up is to take place.' Brancker responded:

[A]lready the output is not nearly equal to the demand, and thanks to too rapid expansion during the past six months we are very nearly bankrupt at the moment. The standard has been allowed to drop too low, hence my memorandum, but the time has not come yet to raise it to a really satisfactory basis... no information has been given as to the best way of

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<sup>77</sup> Pugh, 'The Conceptual Origins of the Control of the Air: British Military and Naval Aviation, 1911-1918,' p.117-119.

<sup>78</sup> Jones, *The War in the Air*, Vol III, p.295.

training pilots, but so far I have never met two people who agreed closely on this subject.<sup>79</sup>

Salmond made an immediate impact and sped up the delivery of training aircraft to the RASs by ending the process whereby all aircraft had to undergo acceptance testing at Farnborough irrespective of where they were constructed. From April 1916, aircraft were sent directly to the RASs and Aircraft Inspectorate Department (AID) engineers undertook the acceptance tests *in situ*.<sup>80</sup> Salmond also created structural change to training with the establishment of additional Schools of Military Aeronautics and the enhancement of RASs as Elementary and Higher Training Squadrons. He also increased the minimum solo hours flown from 15 to 20; created the RFC Officer Cadet Battalion (later Officer Cadet Wing); established a School of Night Flying in Hounslow and, in April 1916, formed a School of Military Aeronautics in Egypt. The results of these structural changes were all reflected in the RAF's training policy that was employed during the Second World War. Despite Salmond's efforts, the output standard of the pilots arriving in France was being heavily criticised and this was mainly due to a need to cut corners to speed up the transition through the 'training pipeline' to replace casualty wastage.<sup>81</sup> This of course was a vicious circle as the poorly trained pilots arriving in France were more likely to be shot down or become killed or wounded in training accidents thereby requiring more pilots to be sent to the front from England who were not properly trained.

As the RFC grew, changes were made to the training organisation. On 1 January 1917, the activities of the Training Brigade were decentralised into three

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<sup>79</sup> TNA AIR 1/131/15/40/218, correspondence between CFS and DAO dated 20 and 21 March 1916.

<sup>80</sup> Morrow, *The Great War in the Air*, p.167. Morrow argued that this approach effectively doubled the number of training aircraft available to the RFC.

<sup>81</sup> Jones, *The War in the Air*, Vol. III, pp.297-298.

geographic regional Areas, and later, five numbered Areas.<sup>82</sup> The Training Brigade remained with a headquarters function and was made a Training Division in August 1917. Within these areas, the former RASs, now renamed Training Squadrons, were located at what were termed Training Depot Stations (TDS), each TDS comprising three training squadrons. Despite the re-organisation, the air service still lacked a 'definite training programme'.<sup>83</sup> From early 1918, all of the RFC/RAF training activity was coordinated by a Director of Training in the Air Ministry. These massive alterations to the training organisation are likely to have created confusion and a challenge to policy makers and policy recipients alike. Policy was transient due to a 'need for standardisation' and technological improvements to aircraft continued to shape training needs; an issue that also had to be addressed during the early years of World War Two.<sup>84</sup>

### **Training Methodologies**

Although Sturtivant has argued that, prior to the declaration of war in August 1914, 'the training and facilities and experience offered by the CFS had proved adequate', the problem of training sufficient pilots for the RFC was identified well over a year before.<sup>85</sup> This problem was then compounded by aircraft and instructors being sent to France in August 1914.<sup>86</sup> The initial process, which may be justly described as haphazard, saw potential pilots either undertake a flying course at a civilian flying school and obtain their Royal Aero Club certificate before attending a military flying training course at CFS or undertake *ab initio* training at CFS before acquiring a

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<sup>82</sup> TNA AIR 1/678/21/13/2085, Summary Notes on RFC Organisation and Training 1917.

<sup>83</sup> TNA AIR 1/28/15/1/132, Minutes of the first Training Expansion Committee, 19 June, 1918.

<sup>84</sup> TNA AIR 1/678/21/13/2085, Summary Notes on RFC Organisation and Training 1917.

<sup>85</sup> R. Sturtivant, 'British Flying Training in World War I,' *Cross & Cockade* Vol.23, No.1, 1994, p.18.

<sup>86</sup> Morley, 'Earning Their Wings: British Pilot Training 1912 – 1918,' p.48.

certificate. CFS was originally created to provide pilots for both the Naval and Military Wings of the RFC although Barker has stated that the Royal Navy established its training centre at Eastchurch 'independently and without authority' in 1912 as a 'brazen act of unilateralism.'<sup>87</sup> The growing gulf between the Military and Naval Wings did cause severe dislocation in terms of planning and equipment procurement with the split finally sealed on 1 July 1914 when the Royal Naval Air Service (RNAS) formally came into existence.<sup>88</sup>

It is important to understand that, in its early days, CFS did not have the function of the modern CFS to act as the centre of excellence for training and standards. The early CFS was solely a training provider and, as has been shown above, had great difficulty in maintaining throughput of students due to the aforementioned aircraft availability issues. For example, on 8 July 1913, CFS had 36 aircraft on charge of which only 16 were serviceable.<sup>89</sup> This whole question of aircraft serviceability and engine availability plagued the RFC throughout the war and had serious implications for the provision of training aircraft. In October 1917, for example, the Middle East Brigade had around 550 aircraft on charge of which only 218 were airworthy.<sup>90</sup>

To overcome a lack of resources at CFS in 1913, some students were being sent directly to RFC Military Wing squadrons to undertake basic training before being sent to CFS to complete their courses. In January 1913, Colonel J.E.B. Seely, the

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<sup>87</sup> Barker, *The Royal Flying Corps in World War I*, p.13.

<sup>88</sup> The Admiralty Circular letter in which the official creation of the RNAS was announced is reproduced in S.W. Roskill (ed.), *Documents Relating to the Naval Air Service, Vol .I, 1908-1918* (London: Navy Records Society, 1969), p.156.

<sup>89</sup> TNA AIR 1/686/21/13/2252, Statistical Data of the RFC and RAF, CFS 1914-1919.

<sup>90</sup> TNA AIR 1/408/15/240/2, Strength of 'Planes and Pilots, Middle-East Brigade from October 1916, Egypt.'

Secretary of State for War, said that ‘... [t]his has been done in order to obtain the number of trained officers we require as expeditiously as possible.’<sup>91</sup> The problem with this approach was that it reduced the time and resources for squadrons to undertake operational and experimental work and meant that squadrons could not concentrate on specific unit operational training. This in-squadron training was sustained throughout the interwar years and was only reduced but did not stop with the creation of Group Pool Squadrons/Operational Training Units (GPS/OTU) in 1939-40. Squadron training also included training CFS students that had only been taught ‘the elements of handling an aeroplane in the air, landings and simple cross-country flying.’<sup>92</sup> This level of poor training was partially due to the lack of a specific training aircraft with dual controls.<sup>93</sup> The training problem was also exacerbated by the variety of different aircraft types on charge at CFS; these included tractors, pushers, biplanes and monoplanes.<sup>94</sup> This meant that no two pilots had the same training experience and therefore standardisation suffered. The role of early aircraft was solely reconnaissance and therefore the pilot ostensibly only needed to take-off, fly a set course and then land; training objectives, therefore, were few and relatively simple. As aircraft performance and their tactical employment changed as the war progressed, training methods failed to accelerate to match these enhancements.

By mid-1917, the RFC’s pilot training system had evolved into a process that many air forces would recognise today. In June 1917, the RFC had a total of 5,841 pilots under training all of which were at various stages on the eight-month ‘training

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<sup>91</sup> [www.hansard.millbanksystems.com/written-answers/1913/jan/14/royal-flying-corps](http://www.hansard.millbanksystems.com/written-answers/1913/jan/14/royal-flying-corps), Accessed 26 November 2014.

<sup>92</sup> Jones, *The War in the Air, Vol.III*, p.292.

<sup>93</sup> Hart & Steel, *Tumult in the Clouds*, p.77.

<sup>94</sup> R. Sturtivant, ‘British Flying Training in World War I’, *Cross & Cockade* Vol.23, No.1, 1994, p.18.

pipeline'. The first two months were spent in a Cadet Battalion – later to become a Cadet Wing – to undertake basic military training. This was followed by an eight-week technical ground school phase at a School of Military Aeronautics. Once completed, the students would then attend a four-week elementary flying training course followed by eight weeks at a Higher Training Squadron for advanced training. The final four weeks would be spent at a gunnery school before graduating as a qualified pilot prior to being sent to France.<sup>95</sup> Of these 5,841 pilots, Jones argued that only around 4,650 would ever reach a squadron due to being killed in training, general unsuitability or illness.<sup>96</sup> By any standard, this wastage rate of around 20 per cent was a massive drain on the training system and on the nation's manpower reserves. The system and structure was certainly in place but the RFC still lacked a clear method of training that was standardised and universally used throughout the service. One of the major legacies that this left for the RAF was the need to develop an improved aircrew selection process to reduce psychological and physiological wastage.<sup>97</sup> Another major failing was found within the instructor cadre who were still generally employed on rest and taking a break from active service; they may have been experienced pilots but they were not trained instructors.

The significant change to pilot training, and one which created a lasting legacy for the RAF's later training methods, was implemented by Major Robert Smith-Barry. In his book, *Pioneer Pilot*, Tredrey paints a picture of Robert Smith Barry, a former commanding officer of 60 Squadron, as a man who single-handedly, changed the

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<sup>95</sup> H.A. Jones, *The War in the Air*, Vol. V (Oxford: Clarendon Press, 1935), p.425.

<sup>96</sup> *Ibid.*, p.426.

<sup>97</sup> English, *The Cream of the Crop*, see Chapter 2.

way that the RFC, and later the RAF, carried out flying training.<sup>98</sup> Tredrey's narrative is a compelling one that has been taken up by a number of later authors including Barker who referred to this 'daring and spectacular airman' as being 'contemptuous of the whole basic philosophy and psychology of the training organisation' and therefore developed 'revolutionary training methods'.<sup>99</sup> Steel and Hart said that Smith-Barry 'developed a completely new method of flying instruction' which 'produced a greater number of better-trained pilots who were not fatally surprised when they moved onto the next stage of their flying education in...high-performance' service aircraft.<sup>100</sup> Smith-Barry was certainly a dynamic force in focusing a new approach to training but to place all of the credit at his feet does an injustice to officers such as Salmond, Brooke-Popham and Longcroft as well as numerous squadron commanders that called for changes to the training process from 1915 onwards. Salmond commanded the RFC Training Brigade and later the Training Division and provided senior officer support for Smith-Barry. Longcroft was GOC the Training Division after Salmond. Brooke-Popham was central in defining scout tactics. The myth that surrounds Smith-Barry was probably initiated by Jones in *The War in the Air* who stated that:

Before the era of the Gosport school, the training of pilots in England fell short of the requirements of air warfare on the Western Front. In too many instances, pilots had to complete their education on active service.<sup>101</sup>

Although Jones' comment as to pilot training falling short of frontline requirements is patently true, the establishment of the Smith-Barry school at Gosport in July 1917

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<sup>98</sup> F.D. Tredrey, *Pioneer Pilot – The Great Smith Barry Who Taught The World How to Fly* (London: Peter Davies, 1976).

<sup>99</sup> Barker, *The Royal Flying Corps in World War I*, pp. 171, 189 and 301.

<sup>100</sup> Hart & Steel, *Tumult in the Clouds*, pp.89 and 92.

<sup>101</sup> Jones, *The War in the Air*, Vol.V, p.434.

(becoming the School of Special Flying in May 1918) did not immediately change pilot training overnight.<sup>102</sup> Initially, Smith-Barry came to prominence after he wrote two papers outlining his approach to flying training in November and December 1916. He took over command of 1 (Reserve) Squadron – also referred to as No.1 (Training) Squadron - at Gosport in January 1917. The first pilots graduated in July 1917. Numbers 27 and 55 Training Squadrons merged with 1 Squadron to form a Training Depot Station that latterly became the Gosport School of Special Flying that mainly concentrated on the training of flying instructors.

One method of assessing the overall effectiveness of the Smith-Barry reforms to pilot training is to consider casualty rates and accidents. As far as the former were concerned on the Western Front, the total figures for RFC/RAF officers and NCOs killed, wounded, missing and made Prisoners of War (PoW) for 1916, 1917 and 1918 were 985, 3,633 and 4,580 respectively.<sup>103</sup> Given these figures need to be considered alongside the expansion in aircraft, and therefore personnel, from 34 squadrons in October 1916, to 46 squadrons in April 1917 to around 108 by November 1918, the continued rise in casualties is still significant.<sup>104</sup> Aircraft losses at No.5 Fighting School are also worth considering and provide a case in point. The attendance at a Fighting School occurred at the end of flying training and so, in theory, pilots should be able to operate their aircraft safely and effectively. The casualty figures for 6 September – 21 November 1918 highlighted many examples of poor airmanship and skill levels that remained widespread. In all there were 29

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<sup>102</sup> Tredrey, *Pioneer Pilot – The Great Smith Barry Who Taught the World How to Fly*, p.95.

<sup>103</sup> TNA AIR 1/39/15/7, RFC/RAF Casualty Figures 1914-1918.

<sup>104</sup> TNA AIR 1/2432/306/1, 'Air Ministry Report No.9 Fortnight Ending 4 November 1918 – Summary of Work Carried Out by the Royal Air Force in Various Theatres.' This report shows the RFC's strength on the Western Front as 85 squadrons and five special duty flights. In addition, the Independent Force had nine squadrons.



accidents in that ten week period that included taxiing into parked aircraft, stalling and spinning on take-off and landing, undershooting the runway, stalling and crashing whilst turning down-wind, mid-air collisions, numerous heavy landings and landing 'outside the aerodrome and [running] into a ditch.'<sup>105</sup> Perhaps even more telling about the overall state of training and pilot competency are the accidents that occurred after the Armistice when enemy action was not a factor. The number of deaths and injuries caused by air crashes in France from 12 November 1918 to 5 April 1919 were considerable. In the last 19 days of November alone, 30 pilots and observers were killed or injured in 23 crashes.<sup>106</sup> In December there were 27 accidents killing or wounding 32 aircrew; January 1919 saw 16 accidents, killing or wounding 18; and from 1 February until 5 April 1919 when the records cease, there were 33 accidents that killed or wounded 34.

It took time for the initial batch of instructors to be trained and for their knowledge to percolate to pupils in the rapidly expanding RFC/RAF. Where Smith-Barry's changes really impacted the training legacy left for the later RAF was in his use of a single training aircraft equipped with dual controls, the Avro 504.<sup>107</sup> Thetford opined that the Avro 504 'laid the foundations of systematic flying instruction...evolving methods which became the basis of the R.A.F.'s Flying Training School syllabus for many years afterwards.' Previously, pilots had trained on a number of different aircraft types during their basic training before moving on to a 'service type'. In further moves to alter the training status quo, Smith-Barry also

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<sup>105</sup> TNA AIR 1/2045/204/374/9, No.5 Fighting School, 38 Training Wing Royal Air Force, Casualty Reports 6 September – 21 November 1918.

<sup>106</sup> TNA AIR 1/969/204/5/1102, Summary of Accidents, Royal Air Force, 5 April 1919.

<sup>107</sup> Thetford, *Aircraft of the Royal Air Force since 1918*, pp. 44-47.

introduced the 'Gosport Tube' to allow instructors to communicate with pupils, a formal set of instructional procedures and terminologies, the so-called 'Gosport Patter', as well as the creation of a 'wing examining officer' to check and maintain flying instructor standards.<sup>108</sup> Napean Bishop has stated that one of the other major innovations that was instigated by Smith-Barry was an increase in aerobatic flying, 'particularly as regards spinning, a thing which up until then had been regarded as a "killer".'<sup>109</sup>

In terms of the pilots' training experience pre-Gosport, the example of one pilot is reflective of many. Lieutenant J.J. Breen applied to transfer to the RFC from the Royal Irish Regiment in October 1915.<sup>110</sup> After a successful interview at the Air Board, Breen was accepted and sent to 3 RAS at Shoreham where he flew solo after 45 minutes. At the end of November he was sent to Netheravon to complete his training on four aircraft types before being posted to France 'at the beginning of 1916.' Breen was clearly not impressed with the training that he had received.

The whole training [*sic*] was of the most haphazard variety. There was of course no method of verbal communication between instructor and pupil in the air and I do not even remember that any adequate lectures on the theory of flight, were ever given. One picked up what one could by observation and asking questions...If subsequent experience has impressed one thing more than another upon my mind, it is the absolute necessity for careful, systematic and individual instruction for pupils in the initial stages of their flying career.<sup>111</sup>

Breen's 45 minutes before going solo was around the norm for military pilot training in 1914-15. Flight Sub Lieutenant T.V. Lister RNAS commenced his flying training at

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<sup>108</sup> NAL, C. Napean Bishop, *Smith-Barry and the Gosport School of Special Flying, 1917/1918*. This was a lecture presented to the Royal Aeronautical Society on 26 November 1962.

<sup>109</sup> *Ibid.*

<sup>110</sup> NAL, AP1308, Sqn. Ldr. J.J. Breen, 'War Experiences' in A Selection of Lectures and Essays from the Work of Officers Attending the Fifth Course at the Royal Air Force Staff College 1926-27, April 1928.

<sup>111</sup> NAL, AP1308, Sqn. Ldr. J.J. Breen, 'War Experiences'.

Hendon and took his first flight on 24 November 1914. After four flights of 15, 10, 10 and 20 minutes he was sent solo.<sup>112</sup> After three hours and 30 minutes at Hendon flying the Bristol Boxkite, Lister was sent to the CFS where he completed a further 19 hours and 38 minutes on two further aircraft types before being posted to Calshot to undergo seaplane training in March 1915. He arrived in his first squadron in Dover with over 34 hours in his log book. Considering that Kennett has argued that RFC pilots were sent to the front with 'as little as 4-5 hours' flight time it is worth considering whether the RNAS had adopted a different training system and if so, why?<sup>113</sup> It is highly likely that the main reasons were the much smaller structure of the RNAS, the generally much lower pilot wastage rates when compared to the RFC and the need to train pilots for specialist tasks such as flying seaplanes which demanded increased flying experience and therefore, more flying hours. A question also arises concerning the more technical nature and outlook of the Royal Navy compared to the Army.

It was not until August 1915 that observer training was improved significantly with the introduction of formalised qualification tests that included gunnery, artillery observation, photography and Wireless Telegraphy.<sup>114</sup> Prior to this, observers were volunteers and were given on the job training within operational squadrons. The realisation of the importance of the observer's role was further recognised with the establishment of the Wireless School at Brooklands and by the creation of the School of Military Aeronautics at Reading in December 1915.<sup>115</sup> This school was primarily

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<sup>112</sup> FAAM, Flying Log Book of Flt. Sub-Lt. T.V. Lister.

<sup>113</sup> L. Kennett, *The First War in the Air, 1914-1918* (New York: The Free Press, 1991), p.122.

<sup>114</sup> AHB, *The Royal Air Force in the Great War* (London: IWM, 1996), p.74. This book is a reprint of the original AHB AP125, *A Short History of the Royal Air Force in the Great War* that was published in 1936.

<sup>115</sup> Jones, *War in the Air, Vol.II*, p.293-294. Jones refers to Reading as the School of Instruction.

aimed at pilots and designed to provide technical ground instruction prior to flying training. However, if space permitted, observers were allotted a place. Although clear steps had been taken to improve the professional training of the observer in 1915, a contemporary account does offer criticism of the training. Lieutenant P.S. Jackson-Taylor applied to join the RFC in September 1914 and was eventually accepted for observer training in November 1915.<sup>116</sup> After attending the School of Aeronautics in Reading he was sent to the School of Aerial Gunnery at Hythe where he was trained in the use of the Lewis and Vickers machine guns. Jackson-Taylor complained of pupils only firing 100 rounds and the difficulty of flying due to unserviceable aircraft as well as the training being too theoretical and technical 'rather than the practical aspects' needed at the front. This rather piecemeal approach to observer training was reflected by Jones in *The War in the Air* when he said that 'there was no systematic training of observers until the spring of 1918' and prior to that, observer training 'was occasional and desultory.'<sup>117</sup>

The problem of transmitting a new training methodology however, was aggravated by the changing structure of the RFC and the lack of direct control by the Training Division and later, its abolition in May 1918.<sup>118</sup> In April 1918, the UK was divided into five administrative Areas that were again sub-divided into groups that also included training units. Following the disbandment of the Training Division, training was coordinated from the Air Ministry's Directorate of Training with some responsibilities devolved to Areas, now no longer numbered but known by

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<sup>116</sup> NAL, AP1308, *A Selection of Lectures and Essays from the Work of Officers Attending the Fifth Course at the Royal Air Force Staff College 1926-27*, issued April 1928. Flight Lieutenant P.S. Jackson-Taylor, 'War Experiences 1914-18,' pp.37-42.

<sup>117</sup> Jones, *War in the Air*, Vol. I, p.459.

<sup>118</sup> TNA AIR 1/678/21/13/2085, Summary Notes on Training – RFC and RAF, various dates.

geographic locations. These were: South East, South West, Midland, North East and North West. Because of this split responsibility, there was a 'need for standardisation' in training which was still lacking.<sup>119</sup> The size of the training coordination challenges presented to the RFC/RAF during this period from late 1917 to the end of the war in November 1918 was reflected in the massive training estate; 383 airfields and numerous depots and schools were operated by the RAF at the end of June 1918.<sup>120</sup>

One type of novel training to grow during the First World War was the use of STE. For pilot training the Sanders Teacher and Eardley Billings training devices of 1910 were 'aircraft attached to the ground' and mounted on a 'universal joint' to enable pilots to experience the effects of elevator, rudder and aileron or wing warping control.<sup>121</sup> These early simulators required a strong wind to operate. This limitation was overcome by the French Antoinette trainer that featured the pilot sitting in a cockpit that had been fashioned from a half wine barrel fitted to a swivel mechanism.<sup>122</sup> A horizontal bar was located on the front of the cockpit and, through the use of his controls, the pilot had to keep the bar level with the horizon as instructors on the yaw, roll and pitch axes moved the cockpit by means of poles to alter the status quo. In addition to these pilot training devices, STE developed for observers included photographic gunnery trainers, camera obscura systems to train in bomb dropping and so-called 'puff ranges' that featured model landscapes to practise the observation of artillery fire.

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<sup>119</sup> TNA AIR 1/678/21/13/2085, Summary Notes on Training – RFC and RAF, various dates.

<sup>120</sup> TNA AIR 1/2432/306/1, these airfields covered a combined land area of 55,821,830 acres.

<sup>121</sup> M. Baarspul, 'A Review of Flight Simulation Techniques', *Progress in Aerospace Sciences*, Vol.27, No. 1, 1990, pp.1-120, p.7.

<sup>122</sup> R.L. Page, *Brief History of Flight Simulation*, paper delivered at SimTect Conference, February 2000.

## Logistics – A Means to Train

In August 1914, the combined strength of the RFC and RNAS was 2,073 officers and men; by November 1918, this figure had grown to 291,175.<sup>123</sup> In terms of RFC squadrons, the four that were sent to France in August 1918 had grown to 108 by the end of the war.<sup>124</sup> If home defence, training and overseas squadrons are taken into account, this figure rises to approximately 390.<sup>125</sup> This massive growth in manpower and squadrons during the First World War, and the concomitant need to match training and resources to achieve aircrew output, would cause the same challenges to the RAF during interwar expansion and the early years of the Second World War. The logistics of providing resources such as training aircraft, accommodation and airfields became critical from the Battle of the Somme onwards. In addition to the growth of airfields in Britain, the RNAS opened a training centre at Vendome in France in November 1916. This new training centre was first mooted in March 1916 when Captain Vaughan-Lee, RNAS Director of Air Services, said that poor weather in Britain was ‘...causing a very serious interference with the training of pilots...’<sup>126</sup> Vendome graduated an average of 15 pilots per month and these included students from the RNAS, RFC, US Army and French Navy.

As the pressure on the RFC’s training resources in Britain increased throughout 1916, a number of overseas training venues started to produce pilots and

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<sup>123</sup> H.A. Jones, *The War in the Air, Appendices* (Oxford: Clarendon Press, 1937) Appendix XXXV, Strength of British Air Personnel August 1914 and November 1918.

<sup>124</sup> TNA AIR 1/2432/306/1, Summary of Work Carried out by Royal Air Force in Various Theatres of War – A.M. Report Fortnight Ending 4<sup>th</sup> November 1918. There is much confusion about the total number of RAF squadrons available at the end of the war. The figure of 108 comes from 85 former RFC squadrons and five independent flights, three former RNAS squadrons in the Dunkirk Wing plus nine squadrons from the Independent Force at Ochey.

<sup>125</sup> [www.airwar1.org](http://www.airwar1.org). Accessed 20 February 2015.

<sup>126</sup> TNA AIR 1/678/21/13/2085, AHB - Summary Notes on Training of R.N.A.S. Personnel 1914-1918.

observers. In April 1916 the WO decided to open a flying training school in Egypt. Three UK-based training squadrons each provided a flight to act as a nucleus for squadrons in Egypt and all were in country by August 1916.<sup>127</sup> The establishment of a technical school at Heliopolis followed that was eventually to become No.3 School of Military Aeronautics whilst in December, another flying training school was opened at Ismailia and a further school established at Suez in January 1917. From January 1917, Jones stated that 60 pupils per month were being sent to Egypt and after 15 hours solo they were returned to the UK for final training.<sup>128</sup> Pupil numbers increased yet again with the opening of No.3 Cadet Wing in October 1917 so that in 1918, the flying training system in Egypt graduated a total of 2,164 pilots.<sup>129</sup>

Britain's other major overseas training facility was located in Canada and pilot training commenced there in January 1917.<sup>130</sup> Like Egypt, Canada eventually had its own School of Military Aeronautics and Cadet Wing to provide basic military training and ground school instruction prior to the commencement of flying training.<sup>131</sup> This training was conducted from eight airfields but it was found that in the winter of 1917-1918, flying had to be curtailed due to poor weather which resulted in training being moved to three airfields in Texas. By the end of the war, Canada had graduated over 2,500 pilots; and according to Jones in 1918, 200 pilots per month were being sent to Britain from Canada.<sup>132</sup> Although this number pales when compared to the 131,500 aircrew trained in Canada during the Second World War as part of the British

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<sup>127</sup> R. Sturtivant, 'British Flying Training in World War I', *Cross and Cockade*, Vol.25, No.1, 1994, pp.20-21. Aboukir is often referred to as Abu Kir.

<sup>128</sup> Jones, *The War in the Air*, Vol. III, p.450.

<sup>129</sup> Jones, *The War in the Air*, Vol. V, Appendix X 'Statistics for the Training Brigade in Egypt, 1918'.

<sup>130</sup> R. Morley, *Earning Their Wings: British Pilot Training, 1912-1918*, p.89.

<sup>131</sup> AHB, *The Royal Air Force in the Great War*.

<sup>132</sup> Morley, *Earning Their Wings: British Pilot Training, 1912-1918*, p.89. See also Jones, *The War in the Air*, Vol. V, pp.466-7.

Commonwealth Air Training Plan (BCATP), this early experience clearly provided a legacy that was revisited and exploited just over 20 years later.<sup>133</sup> Canada highlighted a major issue with Britain's 'haphazard' policy towards its air services. Unlike the RFC, the RNAS commissioned its pupils and so Canadians opted for the RNAS due to increased pay and status, instead of the much needier RFC. This, according to Jones, resulted in a glut of pilots in the RNAS and a shortage in the RFC.<sup>134</sup>

In a move to address directly the issue of the logistics needed to support the 'training pipeline', a Training Expansion Committee was established and this organisation held its first meeting on 19 June 1918.<sup>135</sup> The main task of the Training Expansion Committee was to find resources to increase flying training output to meet a need for 341 operational squadrons that were demanded by 30 September 1919.<sup>136</sup> At the inaugural meeting, Brigadier T. Hearson highlighted the need to match each operational squadron 'one for one' with a training squadron. As discussed above, by the end of the war, the RAF's training squadrons had parity in this 'one for one' goal but the lesson writ large was that training needed massive resources and logistical support to enable it to maintain operationally effective service squadrons. Perhaps the parlous nature of generating such numbers of aircrew is highlighted in the minutes of the third meeting of the Training Expansion

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<sup>133</sup> [www.rafmuseum.org.uk/research/online-exhibitions/taking-flight/historical-periods/first-world-war-flying-training.aspx](http://www.rafmuseum.org.uk/research/online-exhibitions/taking-flight/historical-periods/first-world-war-flying-training.aspx). Accessed, 18 March 2015.

<sup>134</sup> Jones, *The War in the Air*, Vol. V, pp.458-9.

<sup>135</sup> TNA AIR 1/28/15/1/132, The Committee held its ninth and final meeting on 30 September 1918.

<sup>136</sup> TNA AIR 1/28/15/1/132, Minutes from the Training Expansion Committee fourth meeting held on 12 July 1918.



Committee, held on 4 July 1918, which stated ‘that a separate mortuary building be provided at all Aerodromes, the building to be as inconspicuous as possible.’<sup>137</sup>

Although the Training Expansion Committee was replaced by the Accommodation Committee in October 1918, the organisation had completed very valuable work in highlighting the shortfall in resources and logistics required to undertake training. In July 1918, for example, the committee reported a shortage of Schools of Aerial Gunnery and Fighting stating that ‘four more are required’; that six day bombing and one night bombing school needed to be established; and that two additional ‘Schools for Instructors’ were required. The committee also required the building of new accommodation at Hythe, New Romney, Eastchurch and Manston to increase the throughput of observers.<sup>138</sup> This observer training requirement called for 400 to be trained at Hythe each month, 600 at Eastchurch and 500 at Manston as part of the plan to expand the RAF to 341 squadrons by 30 September 1919.<sup>139</sup> This logistic experience provided a legacy that again reinforced the knowledge gleaned throughout the First World War that effective operational training demanded a massive investment in training.

## **Conclusion**

In considering the operational training legacy left to the RAF by its experiences of the First World War, there is little doubt that the Service should have made better use of the knowledge that it gleaned during the period from the formation of the RFC in

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<sup>137</sup> TNA AIR 1/28/15/1/132, Minutes from the Training Expansion Committee third meeting held on 4 July 1918.

<sup>138</sup> TNA AIR 1/28/15/1/132, Minutes from the Training Expansion Committee fourth meeting held on 12 July 1918.

<sup>139</sup> *Ibid.*

1912 to the end of the war in 1918. However, as discussed in Chapter One, the RAF was under severe political and financial pressure as it first contracted, then entered a period of survival, expanded and finally, mobilised for the Second World War. The fact remains though that many of the lessons and experiences accrued during the First World War were forgotten, lost or ignored as the bomber force expanded from 1934 onwards. Although it can be argued that these lessons took a lower priority compared to the fundamental survival of the RAF, the formation of the RAF Staff College at Andover in 1922 did provide an opportunity for discussing operational training and framing training doctrine and this, as Chapter Four will show, the RAF failed to do.

Perhaps the major legacy from the First World War was a recognition that to train sufficient aircrew to sustain a nation engaged in industrialised warfare demanded a fully functioning, well-resourced and robust training organisation that had clear and identifiable training pipelines. That training organisation should employ a systematic approach to training and here, albeit not initially as far reaching as many claim, Smith-Barry's School of Special Flying provided the genesis for change. The other training shortfall that was not fully understood during the inter-war years but that was recognised during the Second World War was that the 'training pipeline' is a dynamic process and is clearly affected by changing tactics, technologies and casualties – both to personnel and aircraft. The scale of the resources to operate that pipeline shocked many senior officers during the Second World War but, as the First World War revealed, the nation's operational air fleet was matched nearly one-to-one by training aircraft. The size of this training fleet combined with the types of training needing to be delivered meant that the paucity of airfields and airspace in Britain led

to some training being conducted overseas, a process repeated in the Second World War. Another factor to emerge during the First World War was the use and benefits of STE, particularly the camera gun and camera obscura.

Unlike the Second World War, where training pressure eased following D-Day, the First World War training pipeline was always under pressure to meet quantitative output to replace aircrew wastage rates and, as a result, qualitative standards regularly suffered. Unfortunately, in a race to maximise output, personal records were falsified and operational squadrons were forced to make up the shortfall in standards by attempting to close the training-gap on active service. Despite the problems associated with aircrew training during the First World War, the RNAS/RFC/RAF had provided a large training legacy from its experiences that to a greater or lesser extent generated a basis for future training. Unfortunately few lessons were actively assimilated and therefore had to be relearnt during the RAF's period of expansion (1934-39) and during the Second World War. Despite these shortfalls, it must be recognised that Britain's development of air power during the First World War was a major achievement considering the nascent state of military aviation in 1914. Chapter Four will now consider how this legacy was considered, analysed and debated, and if operational training policy was developed further prior to the Second World War at the RAF Staff College.

## CHAPTER FOUR

### THE INTELLECTUAL UNDERPINNINGS OF RAF TRAINING – CULTURAL FACTORS AND WHAT WAS BEING TAUGHT AND THOUGHT AT THE RAF STAFF COLLEGE

#### Introduction

There has been a great deal written about inter-war RAF doctrine over recent years although none of this work concentrates on the relationship between doctrine and training.<sup>1</sup> This is perhaps surprising since Air Marshal Sir Hugh Trenchard emphasised training continuously during the formative years of the Service both in his memorandum of November 1919 that set out the structure of the RAF and in subsequent lectures.<sup>2</sup> Although Vallance argued that doctrine defines the strategy and then the force structure, Parton takes this one step further by saying that doctrine ‘...drives the way in which training is carried out.’<sup>3</sup> Doctrine is therefore vital as is the establishment of a service culture which, in the case of the RAF, had been referred to as an ‘Air Force spirit’ or a common ‘school of thought’.<sup>4</sup> Conversely, misplaced doctrine can adversely impact the design of the training pipeline and cloud the definition of desired training outcomes. Together with his senior officers, Trenchard focused on creating a sense of cohesion within the nascent RAF and the nexus for this was the RAF Staff

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<sup>1</sup> See for example: N. Parton, ‘The Development of Early RAF Doctrine’, *The Journal of Military History*, Vol. 72, No.4, October 2008, pp.1155-1178; A. English, ‘The RAF Staff College and the Evolution of British Strategic Bombing Policy, 1922-1929’, *Journal of Strategic Studies*, Vol. 16, No.3, September 1993, pp.408 – 431; P. Meilinger, ‘Trenchard and “Morale Bombing”’: The Evolution of Royal Air Force Doctrine Before World War II’, *The Journal of Military History*, Vol.60, No.2, April 1996, pp.243-270 and A. Vallance, ‘The Role and Evolution of Air Power Doctrine Within the Royal Air Force’, *Cambridge Review of International Affairs*, pp.46-54, published online: 13 September 2007.

<sup>2</sup> TNA AIR 8/97, Cmd. 467, *Permanent Organization of the Royal Air Force*, 25 November 1919.

<sup>3</sup> Vallance, ‘The Role and Evolution of Air Power Doctrine Within the Royal Air Force,’ p.47 and Parton, ‘The Development of Early RAF Doctrine’, p.1156.

<sup>4</sup> H. Trenchard, ‘Aspects of Service Aviation’, *The Army Quarterly*, Vol.2 No.1 (1921), p.280.

Trenchard used the phrase ‘an Air Force spirit’ in his Memorandum on An Outline of the Scheme for the Permanent Organization of the Royal Air Force, 25 November 1919.

College at Andover that opened in 1922. Although his robust, single-minded and uncompromising efforts in ensuring the survival of the RAF proved ultimately successful, his dogmatic adherence to a doctrine of strategic bombing that was supported by successive Staff College Commandants and the hand-picked Directing Staff (DS) that taught there, had the effect of reducing the opportunity for students to discuss doctrine or indeed, to validate and verify its effectiveness. This conservative approach also negated the ability of the DS and students to discuss how operational training could be delivered to meet the needs of this doctrine and thereby, improve operational efficiency and effectiveness.

This chapter will consider the RAF's inter-war doctrine and culture that was overseen at Andover by analysing the challenges facing the new Service; assessing the scope and marking criteria for RAF Staff College entrance examinations; assessing how and what students were taught at Andover by looking at course syllabi and lecture notes; examining how those syllabi addressed training and finally, by examining what the students thought of air power doctrine. The latter will be addressed by focusing on Air Publications (AP) covering Student Work from 1923-1927, the Staff College's in-house journal, *The Hawk* from 1928-1939 and papers that were published in the *Journal of the Royal United Services Institution*. This chapter will argue that the RAF Staff College was successful in creating an 'Air Force spirit' of sorts and some capable staff officers, but was less successful in creating an open forum in which doctrine, and its resultant operational training, could be discussed to the betterment and greater efficiency of the wider Service. This was largely due to an insistence on looking 'backwards' to the experience of the First World War although as the expansion

of the RAF gathered pace from 1934, a new and pragmatic approach to linking doctrine to operational training began to emerge albeit tentatively.

### **Challenges Facing the New Service**

The RAF was created on 1 April 1918 in what Parton described as a ‘forced marriage’ between the RFC and the RNAS.<sup>5</sup> As well as different service cultures, the RFC and RNAS held different views on how air power should be used; the former focusing on Army co-operation and home defence whilst the latter had specialised in strategic bombing, fleet support that included reconnaissance and anti-submarine warfare, and home air defence. Despite these disparities, the newly created RAF had to absorb both cultures and create a new service with its own identity. The foundation of this new Service culture was espoused in the Chief of Air Staff (CAS) Air Marshal Sir Hugh Trenchard’s Memorandum of 25 November 1919 in which he highlighted plans for the future structure of the RAF including the Cadet College [from 1926, the RAF Cadet College<sup>6</sup>], the RAF Apprentice Schools and the RAF Staff College.<sup>7</sup> The latter was clearly vital in helping the RAF define its own culture and develop doctrine. In terms of its culture, the Staff College at RAF Andover had two clear roles. The first was to ‘train officers in Staff Duties’ and the second, to ‘offer a general education which will serve as a sound foundation for the building up of a school of thought in the Royal Air Force.’<sup>8</sup> This term, ‘school of thought’, also used by Trenchard in an essay in 1921, has variously been referred to by historians as a doctrine,

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<sup>5</sup> Parton, ‘The Development of Early RAF Doctrine,’ p.1158.

<sup>6</sup> ‘Air Notes’, *JRUSI*, Volume 72, December 1926, pp.454-464.

<sup>7</sup> R. Mason, *The Royal Air Force Staff College, 1922-72*, unpublished manuscript, JSCSC Library, (358.44 (41) MAS) p.2. Mason is referring to Command Paper 467, An Outline Scheme for the Permanent organization of the Royal Air Force. Often referred to as the ‘Trenchard Memorandum’.

<sup>8</sup> English, ‘The RAF Staff College and the Evolution of British Strategic Bombing Policy,’ pp.408 – 431.

strategy, policy or principle of air warfare but this interchangeable terminology can lead to confusion.<sup>9</sup> The US Rand Corporation refers to doctrine as the ‘fundamental set of principles that guides military forces as they pursue national security objectives.’<sup>10</sup> Although modern, this definition provides an accurate reflection of what the syllabus of the RAF Staff College during the inter-war years was trying to promote.<sup>11</sup> The term fails however to determine how doctrine was created; in other words, what was to be taught or indeed, how it should be applied? Meilinger added that doctrine is based on ‘theory and practice’; however in 1919, the newly formed RAF was lacking in both to any real depth.<sup>12</sup>

If we accept that doctrine must be underpinned by theoretical knowledge as well as practical experience, we can see that these inputs would have been derived from RFC/RAF and RNAS experiences during the First World War as well as the experience of RAF air control operations and together, they formed a key component of the first RAF Staff College course which ran from 4 April 1922 to 30 March 1923.<sup>13</sup> The course, delivered over three terms and with the syllabus designed by the Staff College Commandant, Air Commodore Brooke-Popham, a 43 year-old former infantry soldier, saw the first hand-picked students giving lectures on their experiences of the First World War.<sup>14</sup> Lecture topics included ‘Experiences of Bombing with the Independent Force in 1918,’ ‘Air Fighting,’ ‘Night Flying, Home Defence,’ ‘Air Work on the Sinai-Palestine Front’ and three

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<sup>9</sup> H. Trenchard, ‘Aspects of Service Aviation’, *The Army Quarterly*, Vol.2, No.1 (1921) pp.10-21.

<sup>10</sup> RAND Corporation, <https://www.rand.org/topics/military-doctrine.html>. Accessed 22 January 2023.

<sup>11</sup> Parton, ‘The Development of Early RAF Doctrine,’ p.1156. See also the *Concise Oxford Dictionary*, (Oxford: OUP, 1977) p.304

<sup>12</sup> Meilinger, ‘Trenchard and ‘Morale Bombing’: The Evolution of Royal Air Force Doctrine Before World War II,’ p.246.

<sup>13</sup> RAFM, AIR 69/19, Programme of Work – 1<sup>st</sup> Course.

<sup>14</sup> C. Hobson, ‘Flashback – Visions of Royal Air Force History – No.1’, *Air Clues*, October 1994, pp.400-402.

lectures on 'Morale.'<sup>15</sup> Brooke-Popham highlighted three key roles for the RAF Staff College:

- a. 'To train officers for work on the staff not only in war but in peace'.
- b. 'To give future commanders some instructions in the broader aspects of war whether on sea, on land or in the air'.
- c. 'To found a school of thought and to assist in solving problems in regarding the organisation, training or employment of the Air Force [emphasis added]'.<sup>16</sup>

Superficially at least, these aims are not unusual and could be applied to any modern staff course. What is significant is the emphasis on training and the task of assisting 'in solving problems regarding the...employment of the Air Force'. It appeared then, that the Staff College was also to serve as a doctrinal development cell. How successful the organisation was in developing doctrine or 'solving problems' associated with training will be examined later.

The other role of the staff college, although less easily defined, was to provide a sense of cultural identity for the new Service. In his final address to the first course in March 1923, Brooke-Popham said that Andover would become, 'a temple for the traditions of our Service.'<sup>17</sup> The development of a cultural identity for the RAF was a key factor in ensuring the survival of the nascent Service and the ability of Andover to try and create Service 'cohesion' was very important.<sup>18</sup>

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<sup>15</sup> RAFM, Air Publication (AP) 956, *A Selection of Lectures and Essays from the Work of Officers Attending the First Course at the Royal Air Force Staff College, 1922-23*, published December 1923.

<sup>16</sup> R.A. Mason, *The Royal Air Force Staff College, 1922-72* (Unpublished manuscript, JSCSC Shrivenham) p.6.

<sup>17</sup> RAFM, MFC 76/1/140. Trenchard Correspondence with Brooke-Popham, various dates.

<sup>18</sup> Parton, 'The Development of Early RAF Doctrine,' p.1161.



If doctrine is a relatively simple concept to define, the same cannot be said of culture because of its application to a number of different areas spanning such topics as art, behaviour and organisations. In its broadest sense, culture may be described as:

...[consisting] of patterns, explicit and implicit, of and for behaviour acquired and transmitted by symbols, constituting the distinctive achievements of human groups, including their embodiments in artefacts; the essential core of culture consists of traditional (i.e. historically derived and selected) ideas and especially their attached values; culture systems may, on the one hand, be considered as products of action, on the other as conditioning elements of further action.<sup>19</sup>

The key aspect of this definition is that culture is learned as a 'class of responses' from fellow human beings and that it is articulated through a common set of 'meanings, values, morals, ways of thinking, patterns of behaviour and speech, and ways of life that a group of people share'.<sup>20</sup> In the case of the RAF, the Service had to first bring together two distinct cultures from the Royal Navy and the British Army – with the latter containing numerous sub-cultures - that were themselves modified by a common 'pattern of behaviour'; that of flying. This task has often been taken for granted or not sufficiently examined but Trenchard was convinced that the culture of the nascent Royal Air Force had to be first crafted and then nurtured. After dismissing the suggestion that the 'army and navy' should 'train my people', he said:

After a little cogitation I came to the conclusion that if I formed squadrons, and built my own bases, schools and technical institutions as well, there would be a howl for more economies. Equally I knew that if I decided to

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<sup>19</sup> J. Baldwin, S. Faulkner, M. Hecht & S. Lindsley, *Redefining Culture – Perspectives Across Disciplines* (Mahwah, N.J.: Lawrence Erlbaum Associates, 2006), pp. XV-XVI.

<sup>20</sup> M. Brown, 'On a Definition of Culture', *Psychological Review* Vol.60 No. 3, 1953, p.215. The common values definition is taken from, E. Chambers & A. Northedge, *The Arts Good Study Guide* (Milton Keynes: OU Press, 1997), p.11.

have a few fighting squadrons and to use all the maintenance and other branches of the older services, I should be guilty of misusing a force that would grow more and more necessary for national defence on its own account. I therefore decided – and gradually convinced my Secretary of State that we ought to defy the other services and risk unpopularity by building foundations with nothing much else to show – but foundations that it would be hard to destroy.<sup>21</sup>

As with any large military organisation, sub-cultures are prone to develop within the overall culture of the main organisation and this was highlighted by the formation of the Commands in 1936. Bennett, for example, talks of the rivalry between Bomber and Coastal Commands whilst Francis quoted Gibson in *Enemy Coast Ahead* who described the ‘rivalry and resentment’ between Fighter and Bomber Commands.<sup>22</sup> Jones expanded upon this and said that Fighter Command was ‘keen to try new ideas’ while Bomber Command was ‘complacent’ believing that it could find and hit targets without ‘scientific aids’.<sup>23</sup> Francis refers to these rifts as ‘institutional demarcation’.<sup>24</sup> These rifts are not uncommon; they could have been seen in the Royal Navy between submariners, destroyer crews and shore-based officers and in the British Army between certain regiments and corps or between household and line infantry regiments.<sup>25</sup> Perhaps the largest cultural mismatch within the RAF was between air and ground crew and later, between regular, Auxiliary Air Force (AAF) and Volunteer Reserve personnel.<sup>26</sup>

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<sup>21</sup> A. Boyle, *Trenchard – Man of Vision* (London: Collins, 1962), p.341.

<sup>22</sup> R. Bennett, *Behind The Battle – Intelligence in the War with Germany, 1939-1945*, (London: Pimlico, 1999), p.172 and M. Francis *The Flyer – British Culture and the Royal Air Force 1939-1945*, p.45.

<sup>23</sup> R.V. Jones, *Most Secret War* (London: Coronet, 1978), p.275. See p.67 for the reference to scientific aids.

<sup>24</sup> M. Francis *The Flyer – British Culture and the Royal Air Force 1939-1945*, p.44.

<sup>25</sup> D. French, *Military Identities: The Regimental System, the British Army, and the British People c. 1870-2000* (Oxford: OUP, 2005).

<sup>26</sup> Although Trenchard talked about the creation of an Auxiliary Air Force in his Command Paper 467, ‘An Outline Scheme for the Permanent Organisation of the Royal Air Force’, that was written in November 1919, funding was not provided until the Air Estimates of 1925-26 with the first four squadrons formed in late 1925. See Montgomery Hyde, *British Air Policy Between the Wars*, p.175.

When considering the relationship between RAF aircrew and ground crew, a number of factors became apparent. The fundamental issue is that unlike the Royal Navy or Army, RAF officers did not fight together with their men and, in addition, officer aircrew did not command the ground crew. This, argued Terraine, led to a lack of respect shown to aircrew.<sup>27</sup> This situation was exacerbated from 1940 when the RAF changed to a central station servicing system for its aircraft and fitters were no longer allocated to a particular aircraft and pilot. Jones argued that this system 'achieved flying hours at the expense of the *esprit de corps* that formerly existed between air crew and ground crew.'<sup>28</sup> Contemporaneous accounts also highlight this problem. Writing in *The Hawk* in 1929, an anonymous author stated that in the RAF there was a tendency, 'to draw a strict line between flying and non-flying personnel...thinking...of the latter as having, a very minor part in the operation of the unit.'<sup>29</sup> With all officers being part of the General Duties Branch, there was an automatic assumption to hold the worth of the pilot greater than that of other members of the RAF. This created a pilot-centric culture that would later have a detrimental effect on training.

Another cultural factor that made the RAF unique was the way that senior officers fought the battle. In both the Royal Navy and Army, senior officers and their staffs were present in the theatre of operations and could direct the battle. To an extent, this was true with respect to the Battle of Britain where AOC

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Entry into the RAF Volunteer Reserve began in April 1937 following its creation in July 1936. See Terraine, *The Right of the Line*, p.115.

<sup>27</sup> Terraine, *The Right of the Line*, pp.4-5.

<sup>28</sup> Jones, *Most Secret War*, pp.530-1. See also James, *The Paladins*, p.187.

<sup>29</sup> JSCSC, anon. 'Leadership and Morale', *The Hawk*, Vol. 1, No. 2, December 1929, pp.165-170. *The Hawk* was the journal of the RAF Staff College and published annually in December. It was first published in 1928.

Fighter Groups directed fighter controllers, who in turn, directed squadrons but not so with Bomber or Coastal Commands. Here, senior officers and their staffs directed plans but when aircraft were dispatched, control passed to the aircraft commander. The key question here is how did the RAF develop its doctrine and how was it promulgated to allow these missions to be accomplished?

The rather simplistic answer to this question centres on Trenchard's fervent belief in the independent nature of the Air Service and the ability of the bomber to deliver a destructive impact on the enemy's industrial 'sources of supply' as well as a debilitating erosion of morale within the general population.<sup>30</sup> This belief in the bomber was combined with Trenchard's earlier emphasis on the offensive nature of airpower and an aversion to defensive tactics that was encapsulated in the phrase, 'the aeroplane is not a defence against the aeroplane...[but]...a weapon of attack'.<sup>31</sup> This offensive tenet of Trenchard's doctrinal beliefs was hardly original as he 'belonged to the nineteenth century British Army' and was therefore familiar with the contents of the British Army's Field Service Regulations (FSR) with their eight principles of war, the second being the principle of offensive action'.<sup>32</sup> By 1912, the British Army's Staff College, 'the central school of military education for the Empire,' had developed its own doctrinal principles that were encapsulated in the Staff Manual; again, it is likely that Trenchard had been exposed to this document.<sup>33</sup>

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<sup>30</sup> Trenchard, 'Aspects of Service Aviation,' pp.10-21.

<sup>31</sup> RAFM, Trenchard Papers, MFC 76/1/4, Trenchard's Order, 22.9.16.

<sup>32</sup> Higham, *The Military Intellectuals in Britain*, p.234 refers to Trenchard as a 19<sup>th</sup> century soldier. The Principles of War can be found as an Appendix to, A. Searle, 'Inter-service Debate and the Origins of Strategic Culture: The Principles of War in the British Armed Forces, 1919-1939,' in *War in History*, Vol. 21, No. 4, 2014, pp.4-32.

<sup>33</sup> J. Hittle, *The Military Staff its History and Development* (Harrisburg: Military Service Publishing, 1944), p.135.

A more intimate knowledge of the Army's Field Service Manual can be attributed to Brooke-Popham as he attended Camberley and became the first Commandant of the RAF Staff College.<sup>34</sup> As a former infantry soldier and a graduate of Sandhurst, Brooke-Popham would certainly have been imbued with the 'offensive spirit'. The same can be said of Ludlow-Hewitt, Joubert de la Ferté, Freeman and Barratt the second, third, fourth and fifth commandants respectively prior to the outbreak of the Second World War. All four were former soldiers and Camberley graduates apart from Freeman who attended Greenwich. All had attended the Royal Military College at Sandhurst apart from Ludlow-Hewitt who attended the Royal Military Academy Woolwich.<sup>35</sup> Of the five pre-war Commandants, three were infantry officers and two from the Royal Field Artillery (RFA). It is clear that the 'spirit of the offensive' was a fundamental factor that ran through the RAF's ethos.<sup>36</sup>

### **Gaining Entry to Staff College**

English has argued that Trenchard was the principal architect of inter-war air policy and that Staff College students 'were the recipients rather than the originators of views on strategy.'<sup>37</sup> This view is common amongst a number of historians with Meilinger arguing that 'Trenchard's instinctive beliefs on this subject found form in the official doctrine manuals of the RAF' and that Trenchard's ideas were institutionalised at the RAF Staff College'.<sup>38</sup> This

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<sup>34</sup> See the *Oxford Dictionary of National Biography*.

<sup>35</sup> See *Oxford Dictionary of National Biography* for the details of senior RAF officers.

<sup>36</sup> J. Pugh, *The Royal Flying Corps, the Western Front and the Control of the Air, 1914-1918* (Abingdon: Routledge, 2017), p.42.

<sup>37</sup> English, 'The RAF Staff College and the Evolution of British Strategic Bombing Policy, 1922-1929,' pp.425-6.

<sup>38</sup> Meilinger, 'Trenchard and Morale Bombing: The Evolution of Royal Air Force Doctrine Before World War II,' p.244.

institutionalisation argument certainly has credibility as Brooke-Popham and Ludlow-Hewitt both subscribed to Trenchard's views on the supremacy of the bomber and it is significant that Brooke-Popham wrote the syllabus for the first Staff College course which some, such as English, argued helped to promulgate doctrinal emphasis on the bomber.<sup>39</sup>

The counter-view to this is provided by Mahoney who has argued that, 'while Andover has been seen as a dogmatic institution that transferred accepted doctrine into students, this view is not sustainable when one examines the Staff College's curriculum.'<sup>40</sup> Although part of a wider curriculum, this dogmatic approach to teaching strategic bombing at Andover was clearly present. In a 1923 lecture by Wing Commander Edmonds, as a member of the Andover DS, he stated that, 'in the case of the big war our object is to destroy the enemy's national morale.'<sup>41</sup> Edmonds goes on to talk about bombing the enemy's vital strategic targets such as factories, arsenals and rail centres and this he argued, would also have 'a very great moral (sic) effect amongst the civil population.'<sup>42</sup> Although the doctrine was clear, the training required to achieve that doctrine was rarely discussed.

Certainly, in terms of the selection process to attend Andover from the second course onwards, the Qualifying Examination questions do emphasise a dogmatic approach to bombing doctrine that potential candidates were expected to adhere to. Although questions were by no means uniquely centred

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<sup>39</sup> English, 'The RAF Staff College and the Evolution of British Strategic Bombing Policy, 1922-1929.'

<sup>40</sup> R. Mahony, 'Trenchard's Doctrine: Organisational Culture, the Air Force Spirit and the Foundation of the Royal Air Force in the Interwar Years'; *British Journal for Military History*, Vol.4, Iss.2, February 2018, p.160.

<sup>41</sup> C. Edmonds, 'Air Strategy', *JRUSI*, Vol.LXIX, No.474, p.195.

<sup>42</sup> *Ibid.*, p.198.

on bombing, this doctrine was both explicit and implicit in DS opinions and the Staff College syllabus. These questions and marking schema were published with the aim of being used as a revision tool for future candidates and so their distribution and possible impact was felt across the RAF.<sup>43</sup> Potential students were expected to answer 18 essay questions from a total of 57 that were divided into six subject areas. Of these 57 questions, only six were specifically associated with bombing which appeared in Subject IB 'Principles of Strategy and Their Applications – Land and Air' and Subject IIB 'War Origin and Tactics – Land and Air'. After an introduction by Air Vice-Marshal J.L.B. Vesey, the Director of Organisation and Staff Duties in the Air Ministry, which berated candidates for their poor 'standard of work', the fact that they had not studied for the examination 'intelligently' and had displayed, 'bad spelling...bad writing, and...bad phraseology', the examiners then provided an insight into the RAF's doctrine as far as bombing was concerned.<sup>44</sup>

Examiner comments on answers to Question 1 from Subject IB, 'Strategical text books always emphasize the merits of the Offensive over the Defensive. Does it apply to air and how do you justify the allotment of Offensive and Defensive Aircraft to ADGB?' highlighted pure doctrinal dogma. Comments such as '...the air supplied for the first time the chance of striking a very severe blow on the nerve centre of the enemy at the very outset of operations' clearly echo Trenchardian doctrine and writings. The examiner's comments then emphasised that many students failed to recognise 'the extreme difficulty of ensuring that defending aircraft will actually be able to

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<sup>43</sup> RAFM, AP1352,' Report on the Qualifying Examination for The R.A.F. Staff College held on 27<sup>th</sup>, 28<sup>th</sup> and 29<sup>th</sup> March 1928 with Copies of Examination Papers and Remarks Thereon.'

<sup>44</sup> *Ibid.*

obtain contact with the bombing aircraft.’ Further comments from examiners highlighted that a ‘well-drilled’ bomber formation provided a ‘formidable concentration of fire.’ This enabled it to ‘resist successfully’ attack by ‘single-seat fighters’.<sup>45</sup> Single-seat fighters also found difficulty in attacking bombers, it was stated, ‘except from behind’ and ‘only provide an inferior kind of [fire power] concentration’.

The difficulty here is understanding where the RAF drew the lessons to allow it to state these opinions as fact. As Chapter Three has shown, VIII Brigade/Independent Force operations were losing 60% of their aircraft each month during daylight operations and 46% on night sorties.<sup>46</sup> English is highly likely to be correct when he said that ‘to do well on the qualifying examination, it was safest to adopt the prevailing Air Force view in matters of doctrine.’<sup>47</sup> This point is echoed by Stubbs who opined that candidates ‘tailored their answers to elicit the highest marks possible.’<sup>48</sup> This doctrinal thinking prevailed until initial operations over targets such as Heligoland and Wilhelmshaven in September 1939. These operations resulted in heavy losses, were marked by poor navigation and proved that the self-defending bomber formations employed on daylight attacks were unsustainable.<sup>49</sup>

But six out of 57 entrance examination questions specifically associated with bombing does not, in itself, create a *prime facia* case to support the

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<sup>45</sup> RAFM, AP1352, ‘Report on the Qualifying Examination for The R.A.F. Staff College held on 27<sup>th</sup>, 28<sup>th</sup> and 29<sup>th</sup> March 1928 with Copies of Examination Papers and Remarks Thereon.’ Examiner comments on Question 1, Subject IB and Question 1, Subject IIB.

<sup>46</sup> Kingston-McCloughry, *Winged Warfare*, p.44.

<sup>47</sup> English, ‘The RAF Staff College and the Evolution of British Strategic Bombing Policy, 1922-1929,’ p.423.

<sup>48</sup> D. Stubbs, ‘The Culture of the Royal Air Force, 1918-1945,’ in P. Mansoor & W. Murray (eds.), *The Culture of Military Organizations* (Cambridge: Cambridge University Press, 2019), p.410.

<sup>49</sup> TNA, AIR10/5551, p.19.



argument that the RAF's doctrine was purely based on strategic bombing nor, as we shall see, did the eclectic Staff College syllabus. Parton argued that there was not a 'monolithic, Trenchardian' doctrine focused on independent strategic air power in the early inter-war years but a concentration on air control as this doctrine was of 'greater importance to the service during the critical first five years of its life'.<sup>50</sup> This is perhaps a logical argument but air control is not significantly different to strategic bombing in terms of the physical and 'morale' effects that senior officers felt could be inflicted on the enemy. For example, in a lecture given by Flight Lieutenant A.D. Davies to fellow Staff College students in April 1935 on Air Control operations in Aden, he said that after a caravan was held up,

Ath Thaaner (*sic*) was therefore bombed on 25<sup>th</sup> April [1932] by three aircraft, which caused considerable material damage and produced a great moral (*sic*) effect on the tribesman.<sup>51</sup>

The question that this account raises is how did Davies know that there was considerable damage and great effect on the often intangible, morale? Given the trenchant views of senior and influential officers such as Trenchard, Salmond, Brooke-Popham, Ludlow-Hewitt and Joubert de la Ferte on the 'physical and morale' effects of strategic bombing, it is difficult to argue that the RAF's core doctrine did not revolve around strategic bombing despite the coverage of other topics in the syllabus. Although there were few direct questions on strategic bombing in the entrance examination, the dogma present in comments to answers related to the use of the bomber clearly showed that the bomber was at the vanguard of RAF doctrine; a doctrine that

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<sup>50</sup> Parton, 'The Development of Early RAF Doctrine,' p.1177.

<sup>51</sup> RAFM, AIR 69/111, 'Air Operations in Aden', Flt. Lt. A.D. Davies, 13<sup>th</sup> Course, 10 June 1935.

was endemic and pervasive. It was simply not possible for junior officers taking the entrance examinations to adopt views counter to those prevailing with the cadre of senior officers who had largely trained as Army officers and who now held high office in the Air Ministry or DS at the Staff College.<sup>52</sup>

In the case of the latter category, Wing Commander C.H.K. Edmonds was a member of the Andover DS. In a lecture given to the Royal United Service Institution on 12 December 1923, Edmonds said that, 'in the case of the big war our object is to destroy the enemy's national *morale*'.<sup>53</sup> The fixation on destroying the enemy's morale had more to do with the writing of authors such as Wells, Griffiths and Fawcett than scientific study of previous experience.<sup>54</sup> As Michael Paris has implied, RAF doctrine was based more on 'fanciful novelists' rather than any scientifically derived knowledge.<sup>55</sup> Paris goes on to say that 'It was, after all, easy enough between the wars to follow with blind faith the claims of the airmen, for the advocates of air power had not been given the time to prove their extravagant claims.'<sup>56</sup>

Although the knowledge needed to attempt the entrance exam was derived from a number of sources, but one 'major source document', according to Parton was the 'hugely influential' CD 22. *Operations Manual, Royal Air Force*.<sup>57</sup> The first

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<sup>52</sup> A look at the *Oxford Dictionary of National Biography* clearly shows that the 'offensive spirit' imbued during British Army training was accreted by a number of senior RAF officers involved in direction of, or teaching at, the RAF Staff College. Examples include Trenchard, Freeman, Ludlow-Hewitt, Newall, John Salmond, Brooke-Popham and Ellington to name but a handful.

<sup>53</sup> Edmonds, 'Air Strategy,' pp. 191-210. Edmonds emphasises morale.

<sup>54</sup> H.G. Wells, *The War of the Worlds* (London: Heinemann, 1898). G. Griffith, *The Angel of Revolution: A Tale of Coming Terror* (London: Tower Publishing, 1893).

<sup>55</sup> M. Paris, 'The Rise of the Airmen: The Origins of Air Force Elitism,' c.1890-1918', *Journal of Contemporary History*, Vol.28 (1993), pp.131-132.

<sup>56</sup> Paris, 'The Rise of the Airman: The Origins of Air Force Elitism', p.139.

<sup>57</sup> In his PhD Thesis, *The Evolution and Impact of Royal Air Force Doctrine: 1919-1939*, Parton says that CD 22 was used to prepare for entrance exams and was issued to every student from No. 2 Course onwards.

six chapters of CD 22 were taken from the British Army's Field Service Regulations Volume II and reflected the general offensive nature of British Army doctrine that the RAF's strategic bombing doctrine mirrored.<sup>58</sup> Interestingly, senior RAF officers, such as Brooke-Popham and Trenchard, who both favoured strategic bombing to attack the 'morale' of the enemy, were at odds with CD 22 as it concentrated on:

The destruction of his air forces at their bases on the ground is the most effective method of attaining the main object, to it must be subjected all other independent uses for aircraft until this destruction has been at least, partially accomplished.<sup>59</sup>

It is clear that the RAF saw the bomber as a doctrinal panacea. They were taking the long view where conviction of doctrinal success clouded the reality of how that success was to be achieved, namely through effective training. This chapter will now turn to discuss what was being taught at Andover, with an emphasis on the RAF's approach to training.

### **The Staff College Syllabus**

Turning to the RAF Staff College syllabus, or in the terminology used at the time, the 'Programmes of Work.' Like the entrance examination, there was little overt emphasis on bombing operations. The 'Programmes of Work' for the 9<sup>th</sup> Course which began in January 1931, for example, shows an eclectic mix of topics that would not be out of place on a modern staff course.<sup>60</sup> The three term course, each with its own 'Programme of Work', comprised a mixture of operational lectures; visits to industry; visits to military establishments, such as the chemical school at

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<sup>58</sup> RAFM, CD 22, Operations Manual, Royal Air Force July 1922.

<sup>59</sup> RAFM, CD 22 Operations Manual Royal Air Force, July 1922. Chapter VII, Air Operations and Aerial Fighting.

<sup>60</sup> RAFM AIR 69/74, Programmes of Work – Ninth Course, 19 January – 17 December 1931.

Porton, the Army Staff College in Camberley, the Royal Navy Staff College, Greenwich and Royal Aircraft Establishment in Farnborough; staff duties writing; geo-political studies and exercises with the Royal Navy and Army. The Programmes of Work for the 13<sup>th</sup> Staff Course held in 1935, for example, saw only two periods delivered over sessions in Term One, week 11 and Term 3, week one that were given over to 'Bombing' and 'Air Warfare – Bomber Tactics'.<sup>61</sup> So, although there was no great emphasis on the practical teaching of bomber operations, there appeared to be a core doctrinal belief within the DS at the Staff College which would have pervaded all teaching. This is unsurprising considering that all instructors were personally selected by Trenchard for the first course, as indeed, were the students. This 'bomber centric' doctrine has already been identified as far as AP 1352 is concerned but an analysis of lecture notes by the DS at Andover during the inter-war years clearly showed a 'bomber bias'. In a lecture entitled 'Air Policy and Strategy' that was delivered in March 1939, the Commandant, Air Vice-Marshal Sir Arthur Barratt said that:

Since the defence of this country, or of any threatened part of the Empire against air attack, can only be made fully effective by carrying out a resolute and sustained counter air offensive, it is essential that we should be able to produce an offensive air effort comparable with that of any potential enemy.<sup>62</sup>

The DS position, and one shared by many of those Staff College graduates from the early courses, reflected what English described as an 'unshakeable belief in strategic [bombing] doctrine'.<sup>63</sup>

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<sup>61</sup> RAFM AIR 69/109, 13<sup>th</sup> Staff Course Programmes of Work, 1935.

<sup>62</sup> RAFM AIR 69/213, Air Policy and Strategy, Lecture by AVM Sir A. Barratt first delivered on 16 March 1939. Underlined text is Barratt's emphasis.

<sup>63</sup> English, 'The RAF Staff College and the Evolution of British Strategic Bombing Policy, 1922-1929,' p.408. Research undertaken by English shows that the A.P.s covering the 'Work of Officers' at Andover published between 1923 and 1927, featured 32 articles, 22 of which discussed 'some aspect of bombing.'

Eleven years earlier, another RAF Staff College Commandant was espousing the power of strategic bombing. Air Commodore Ludlow-Hewitt was Commandant from 1926-1930 and in his lecture to the sixth course in 1927, as part of his Air Warfare Lecture, said that, 'air bombardment is the principal means of bringing the enemy to battle in the air' and that the 'bomb is the principal weapon of all Air Power.'<sup>64</sup> Such unequivocal statements from the Commandant would have left students in no doubt about the core beliefs surrounding RAF doctrine, and the course to adopt to achieve the coveted p.s.a. (passed Staff College Andover) on graduation. Perhaps the most surprising element of the teaching at Andover during the inter-war years was that there was no attempt to validate or verify the core doctrine of strategic bombing. The author has seen no evidence of any analysis which considers the fundamental question: if strategic bombing is the doctrine, how is it to be achieved? Implications of implementing the doctrine on areas such as the required skills and standards of navigation, gunnery, bomb aiming, tactics and any form of threat analysis were missing from the syllabus.<sup>65</sup> It appeared as if students were being spoon-fed the doctrinal medicine and swallowing it without question or complaint. Another noticeable absent topic concerned global aeronautical developments, specifically the development of new aircraft, navigational aids and tactics. The shortfall in the syllabus did not fully reflect an environment that was supposed to be 'the cradle of...[the RAF's]...brain.'<sup>66</sup>

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<sup>64</sup> AHB, Ludlow-Hewitt Papers, Staff College Lecture notes, Box 3.

<sup>65</sup> S. Robertson, *The Development of RAF Strategic Bombing Doctrine*, covers a number of technical areas but does not concentrate on operational training.

<sup>66</sup> Trenchard's Address (actually delivered by AVM Sir John Salmond) to the first course at the RAF Staff College on 4 April 1922 in 'The Royal Air Force Staff College', *Flight*, April 13 1922, p.217.

Although 'strategic doctrine' formed the central tenet of offensive doctrinal teaching, not all students eschewed the 'defensive'. In an essay entitled *Fighter Squadrons in Air Defence*, Flight Lieutenant G.E. Gibbs, wrote in 1927 that, the topic of air defence had 'been well ventilated' on the fifth course. 'I do not think I need go further into the political aspect of Air Defence than to say that the BRITISH ISLES [sic] are very vulnerable to air attack and therefore we must anticipate public insistence on local measures of Air Defence in addition to our bombing offensive.'<sup>67</sup> Even this acknowledgement of defensive tactics by the author is clearly viewed as secondary to 'our bombing offensive'. At least Gibbs acknowledges that defence and offence are not mutually exclusive. It is interesting to note that Gibbs' views did not retard his career as he was posted from Andover to become Trenchard's PA and eventually retired as an Air Marshal.<sup>68</sup> Given that strategic bombing doctrine teaching was not particularly overt at Andover, it was clearly expected that students should hold the sentiment of 'strategic doctrine' close. This message was reinforced at every available opportunity and we can assume that 'doctrinal orthodoxy' was expected and delivered by the vast majority of students.<sup>69</sup>

It is clear that the early years of the Staff College mirrored a period when the RAF was coming to terms with its status and it is likely that the strategic offensive doctrine provided a secure anchorage from which to explore the future applications of air power that ran counter to Trenchardian teaching. Over time, some former students felt the confidence to challenge the doctrinal *status*

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<sup>67</sup> RAFM, AP1308, A Selection of Lectures and Essays from the Work of Officers Attending the Fifth Course at the Royal Air Force Staff College, 1926-27, published April 1928.

<sup>68</sup> RAF Web. rafweb.org/Biographies\_GE.html. Accessed, 3 May 2023.

<sup>69</sup> English, 'The RAF Staff College and the Evolution of British Strategic Bombing Policy, 1922-1929,' p.427.

quo as exemplified by Squadron Leader J.O. Andrews DSO, MC, p.s.a. whose paper, entitled 'The Strategic Role of Air Forces', was published in the *Journal of the Royal United Services Institution* in 1931.<sup>70</sup> In his prophetic introduction, Andrews neatly summarised the problems faced by the newly formed RAF.

Unhappy in one respect is the Service that has no history. Its doctrine must perforce largely be based on theory and on such knowledge as can be gleaned from peace exercises, in which it is notoriously difficult to simulate reality. The ugly facts of war have killed many a beautiful theory, and we must therefore bear in mind that the doctrines of the use of air power are at present, and until proved by war, speculative.<sup>71</sup>

Andrews argued cogently, largely in response to a previous essay by the pro-bombing theorist, Squadron Leader John Slessor, that the approach to defensive doctrine was dictated by experiences of 1914-1918 and did not take into account the performance of more modern aircraft.<sup>72</sup> Slessor made the case for offensive action, 'by which physical, moral [*sic*] and economic is brought to bear upon the enemy' and highlighted that, in 1918, the RAF deployed 400 aircraft and 350 pilots against a 'German bombing force, the total strength of which was only about 40 aircraft'. This, he argued, provided 'an example of a successful diversion' of resources. In countering Slessor's argument, Andrews stated that by 1931 a number of factors had changed since 1918: many aircraft were now fitted with R/T to provide command and control; the Observer Corps was better equipped; and that aircraft performance provided fighters with a 40% better rate of climb to 15,000 feet. In summary,

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<sup>70</sup> J.O. Andrews, 'The Strategic Role of Air Forces', *JRUSI*, Vol. 76, February 1931, pp. 740-743.

<sup>71</sup> *Ibid.*, p.740.

<sup>72</sup> J.C. Slessor, 'The Development of the Royal Air Force', *JRUSI*, Vol. 76, February 1931, pp.324-334. Slessor became a Bomber Group AOC, AOC-in-C Coastal Command and a post-war CAS.

Andrews stated that, 'Technical progress has rendered our limited war interception largely valueless.'<sup>73</sup>

To deliver effective long-range bombing demanded a force that was trained to counter increasingly effective fighters and to navigate to and find the target. In addition, pilots needed to be trained to fly at night but, as Chapter Six will show, only minimal hours were dedicated to this skill. These training requirements certainly did not form part of the teaching at Andover nor consideration for the markers of the Entrance Examination. How this strategic doctrine was reflected during the Staff College's formal lectures on training will now be discussed.

### **The Staff College Approach to Training**

In many ways, training was one of the cornerstones of the development of the RAF. In November 1919, Trenchard wrote under a paragraph heading of the 'Extreme Importance of Training', that 'the whole future of the Royal Air Force depends...[on]...the training of its officers and men.'<sup>74</sup> Central to Trenchard's idea in the creation of the RAF was to concentrate efforts and marshal 'resources on perfecting the training of officers and men' at the expense of frontline squadrons. This was a wise move as Trenchard understood that a well-trained cadre could be used to expand the service when required.

Trenchard's deftness of action showed an ability to compromise and the ability

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<sup>73</sup> Andrews, 'The Strategic Role of Air Forces', *JRUSI*, Vol. 76, February 1931, pp. 740-743.

<sup>74</sup> RAFM, Trenchard Papers, Cmd. 467, 'An Outline Scheme for the Permanent Organization of the Royal Air Force,' CAS Memo to Secretary of State for Air, 25 November 1919.



to take the long view as far as the evolution of the Service was concerned; characteristics not often attributed to the 'father of the RAF'.<sup>75</sup>

In discussing the RAF Staff College, the emphasis has been on an establishment that provides education. There is a distinct difference between 'education' and 'training'.

Training is preparing people, individually or collectively, for given tasks in given circumstances; education is developing their mental powers and understanding.<sup>76</sup>

In attempting to educate Staff College students about training, and thereby enhance their understanding, the course devoted three periods to the topic, which were referred to as Training I, Training II and Training III, which covered Policy, Individual Training and Operational Training respectively. In the Training I – Policy presentation given by Wing Commander J.W. Baker (who became Director of Bomber Operations in February 1941) to the 17<sup>th</sup> Course in May 1939, he stated that 'The aim of our peace-time training policy is to fit the Royal Air Force for war.' He added that, 'All aspects of our training policy must be tested with reference to this aim.' As he continued, many factors influence what training can be provided 'including always the overriding one of finance...'<sup>77</sup> After differentiating between aircrew, the 'fighting element' which he said accounted for 'only about 15%' of the RAF, and the supporting

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<sup>75</sup> Higham referred to Trenchard as being 'doggedly committed to his own prejudices' and as 'taciturn, inarticulate infantryman.' See *The Military Intellectuals in Britain, 1919-1939* (Westport: Greenwood Press, 1966), p.7 and p.157. Ferris, quoted in P.W. Gray, 'The Strategic Leadership and Direction of the Royal Air Force Strategic Air Operations Against Germany from Inception to 1945,' p.115 described Trenchard as 'a ruthless, cunning bureaucratic infighter.'

<sup>76</sup> J. Kiszely, 'Modern Challenges for Post-Modern Warriors', *The Shrivenham Papers No 5*, December 2007, p.14 quoted in, A. Byford and I. Shields in 'Viewpoint – W(h)ither Air Power Education?', *Air Power Review*, Vol.13, No.2, Summer 2010, pp.95-100.

<sup>77</sup> RAFM, AIR 69/216, 'RAF Training Lectures,' by Wg. Comd. JW Baker MC DFC, delivered to 17<sup>th</sup> Course, RAF Staff College, May 1939.

'maintenance element', Baker went on to say that four main factors affect training policy:

- a. Responsibilities in Imperial Defence.
- b. Functions of the RAF in war.
- c. Finance.
- d. Time.

Although Baker does not mention doctrine, one can assume that 'Functions of the RAF in War' equate to doctrine. Baker goes on to define these functions as:

- a. Striking by independent air action.
- b. Direct co-operation [Navy and Army].
- c. Fighting – which is either a security measure or a natural consequence of [a. or b. above].

The dilemma that was faced by the RAF, at least according to Baker, was whether to offer specialised training for specific air power roles or to use aircraft, and personnel, in a number of different roles to achieve 'flexibility and adaptability'. Baker argued that specialisation has 'one advantage only', that of 'maximum peacetime efficiency'. The flexible approach, he argued, was difficult to implement due to the number of different courses that aircrew would be required to undertake to maintain currency in a swathe of different roles. This would also result in 'a lack of unit efficiency due to constant changes in employment.'<sup>78</sup> Considering that Baker gave this lecture in 1939, it contains a number of contradictions not least of which was a fundamental failure to grasp

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<sup>78</sup> *Ibid.*

the need to train individuals to undertake thoroughly key functions such as navigation, role specific tactics or gunnery, all areas of which showed deficiencies during the early years of the Second World War. Baker explained that; 'The solution has been a compromise but based on the fundamental principle that the bomb is the chief weapon of the Air Force.' This rather strange statement, concluding with an emphasis on offensive bombing action, was followed with the comment that training thus far had been, 'a peace-time expedient to fit peace-time limitations.'<sup>79</sup>

As already stated, Baker's comments appeared to emphasise a major disjoint in matching training to the RAF's expected wartime role. A key element of pilot training in this inter-war period was whether pilots should be trained to undertake specific roles or have a 'universal' role. This dilemma will be examined in further detail below.

The 'specialisation v. flexibility' argument presented to the officers attending the 17<sup>th</sup> Course was not new to the RAF. In a paper written in 1921, Trenchard had said that 'it is essentially wasteful to divide the Air Force up into separate bodies for each duty.'<sup>80</sup> One of the major problems faced by the RAF in the inter-war period was the sheer number of aircraft types in service and the corresponding varied training needed to prepare crews to operate them. This point was not lost on an anonymous student on the 10<sup>th</sup> Course who addressed this problem in a feature entitled 'The Case for Standardisation of Service Aircraft.'<sup>81</sup> Written in 1932, the student contended that the RAF was

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<sup>79</sup> *Ibid.*

<sup>80</sup> Trenchard, 'Aspects of Service Aviation', *The Army Quarterly*. The core of this paper was taken from Trenchard's address to the Air Conference on 14 October 1920.

<sup>81</sup> JSCSC, *The Hawk*, Vol.5, No.5, December 1932, p.11.

operating 14 different types of front line aircraft and that these should and could, be reduced to three: a single-seat fighter; a General Purpose (GP) / Army Co-Operation aircraft and finally, a day/night bomber; the student clearly forgot the maritime requirement. Trenchard cited examples of long-range bombers being used for reconnaissance, close air support or 'artillery work'.<sup>82</sup> In terms of the aircraft of 1920 he perhaps had a point, although he did not consider the extra training crews for such multi-role aircraft would have to undertake. It was also a valid argument in terms of presenting the RAF as a flexible force that could 'substitute' for military and naval forces, therefore emphasising the cost-effective nature of the new Service, but for this argument to still be aired in 1939 by Baker clearly did not acknowledge the change in aircraft performance and complexity nor indeed, the requirement for thoroughly trained aircrew.<sup>83</sup>

The counter view is that the RAF did not know what to train for as it had both imperial and home considerations at play. This dilemma was summed up by Wing Commander L.N. Hollinghurst on 31 May 1935 when he delivered the RAF Training I – Policy lecture to the 13<sup>th</sup> Course at Andover.

For example, ten years ago we were basing our war schemes, as regards the air, largely on war with France – now they have been re-orientated, and Germany is once again the bogey...Our problem...is to be prepared for any sort of war or warlike duty in any sort of theatre...[and]...training should therefore aim at a high degree of flexibility.<sup>84</sup>

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<sup>82</sup> Trenchard, 'Aspects of Service Aviation', *The Army Quarterly*. The core of this paper was taken from Trenchard's address to the Air Conference on 14 October 1920.

<sup>83</sup> For discussion on 'substitution' see Trenchard's 'Four Essays on the Supremacy of Air Power,' G. Dyndal (ed.), *Trenchard and Slessor: On the Supremacy of Air Power over Sea Power* (Trondheim: Tapir Academic Press, 2007), pp.21-70.

<sup>84</sup> RAFM, AIR69/110, Wing Command L.N. Hollinghurst lecture 'RAF Training I – Policy' delivered to RAF Staff College 13<sup>th</sup> Course, 31 May 1935.

In a lecture to the Royal Navy Staff College entitled 'Air Power and Strategy' on 16 March 1939, the RAF Staff College Commandant, Air Marshal Arthur Barratt reinforced the argument against specialisation 'both in the technical design of aircraft and the training of their crews beyond certain limits, we automatically weaken our offensive air strength – our air power.'<sup>85</sup> Considering the different types of specialist aircraft then on the drawing boards or in prototype stage when Barratt spoke, his comments seem out of touch with reality. For instance, the four-engine Stirling and Halifax bombers were under development, the Spitfire and Hurricane were about to enter squadron service, the first Army co-operation Lysander aircraft were entering service as was the Sunderland maritime patrol aircraft.<sup>86</sup> From the beliefs of these members of the DS at Andover and the contents of the lectures it can be inferred that training was seen as something that was always financially restrained and planned to address undetermined operational needs. It is also clear that 'Trenchardian received wisdom', although relevant during the formative years of the RAF, was not being challenged by the inter-war DS at Andover and therefore free ranging debates on training were unlikely to have taken place at the RAF Staff College. The 'compromise' that was highlighted by Baker in 1939 resulted in 'common air training' that was 'supplemented by special training for specific duties where necessary'.<sup>87</sup> As far as this split between *ab initio* and role specific or operational training is concerned, little can be criticised however the real compromise occurred with individuals being 'trained in more than one

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<sup>85</sup> RAFM, AIR 69/213, AVM A.S. Barratt, lecture, 'Air Policy and Strategy' delivered to RN Staff College on 16 March 1939. This lecture was subsequently delivered to the RN War Course and the Higher Commanders' Course in March and May 1939 respectively.

<sup>86</sup> Thetford, *Aircraft of the Royal Air Force Since 1918*, various pages.

<sup>87</sup> RAFM, AIR 69/216, 'RAF Training Lectures' by Wg. Comd. J.W. Baker, delivered to 17<sup>th</sup> Course, RAF Staff College, May 1939.

function'; units being maintained on 'a functional basis [cadre]' that could be expanded when required; and the need to train units for more than one role 'outside their normal functions'. This 'jack of all trades approach' led to the comment that although training was 'successful as far as it went...it did not go far enough to fit the output for first line work, and its shortcomings in this respect increased as technical development changed the types with which squadrons were armed.'<sup>88</sup> In modern parlance, there was a 'training shortfall'.

Another problem that was faced by the inter-war RAF was that of organisation, especially as far as training was concerned. In the first of six lectures on 'The Organisation of the Royal Air Force – I' presented to the 12<sup>th</sup> Course on 23 January 1934, Group Captain A.A. Walser said on the topic of training that 'it is a dead certainty that the preoccupation of peace-time administration and the demands of economy will all the time tend to obscure these requirements, [the need for a well-trained Service] and to encourage us to accept an organisation not able to bear the test of war.'<sup>89</sup> The prophetic Walser was well versed in training, having served in the Air Ministry's Directorate of Training and Organisation (D.T.O.) in 1921 alongside the Deputy Director, Group Captain Ludlow-Hewitt.<sup>90</sup> Walser's observation of the RAF's organisation and its impact on training will be examined more fully in Chapter Five.

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<sup>88</sup> TNA AIR 41/4, 'Aircrew Training 1934-1942', p.31.

<sup>89</sup> RAFM AC96/51/26, Wg. Comd. A.A. Walser lecture, 'The Organisation of the Royal Air Force – 1,' given to the 12<sup>th</sup> Course, 23 January 1934.

<sup>90</sup> RAFM, Air Force List, Jan-Jun 1921. Air Force Lists were published in two categories, Public and Confidential. The latter contained unit locations.

## Student Views on Andover

Having considered what was being taught by the DS at Andover, this chapter will now look at what was being thought by the students. The vehicle for this analysis is *The Hawk*, the 'Annual Journal of the Royal Air Force Staff College'.<sup>91</sup> This is an important aspect in the development and thought processes of the Service because, over time, the Staff College was accepting students that were direct entry officers into the RAF and not former Royal Navy or Army officers. Essentially, the Victorian- and Edwardian-era officers were being replaced by younger and perhaps more technologically aware individuals with a greater ability to accept change. This 'new generation' were more questioning of the status quo and, as this thesis develops, will be seen to increasingly embrace new types of training.

Looking at the inter-war issues of *The Hawk* provides a small insight into the culture and doctrine of the Service but even though contributors had supposed anonymity, it would be a brave student who would really try and counter official doctrine; surprisingly there are a few individuals that did. The eleven issues that were published, before the Andover Staff College closed in 1939, contain an eclectic mix of material.<sup>92</sup> According to the editorial leader in *The Hawk* No. 2, '...the bulk of *The Hawk* is rightly devoted to articles of general interest and to the experiences of war, both personnel and

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<sup>91</sup> *The Hawk* was first published in December 1928 and covered a selection of material including essays of professional interest, reports on dinners, sporting events, satirical articles and lists of students and instructors from specific courses. Initial copies of *The Hawk* cost 2/6d and carried advertising from local companies in Andover. As its standing grew, production quality increased and advertising from London-based companies began to appear.

<sup>92</sup> R. Mason, *The Royal Air Force Staff College, 1922-72*, unpublished manuscript, JSCSC Library, p.22. Seventeen courses had been held at Andover before closure due to the outbreak of war in September 1939.

otherwise.<sup>93</sup> By December 1932, the editor stated that '[w]e believe that *The Hawk* has now found a definite place amongst serious service journals as a magazine which reflects an important section of authoritative opinion in the RAF.'<sup>94</sup> Still later, in December 1935, the editor talks of the 'increasing circulation' of the journal and its readership in the Dominion air forces.<sup>95</sup>

Although the editors talked about the professional nature of *The Hawk*, the fact is that the features and contributions were largely comedic in nature and provided 'a lasting memento of the work and play and entertainment' of that year's respective course.<sup>96</sup> With each edition being published at the end of the course, there was nothing wrong with providing course members with a memento of their time at Andover but to pretend that *The Hawk* was anything other than a 'house magazine' is, perhaps, disingenuous. Apart from the very rare article of any real foresight, most 'professional feature' submissions were backward looking and concentrated on 'service experiences' of the First World War or on air control.<sup>97</sup> Even in December 1938, *The Hawk* contained features entitled 'Operations in the Sinai' and 'From Ypres to the Sea'. Perhaps more indicative of its conservative academic nature, in the 1934 and 1935 editions, there was no mention of the Expansion Schemes during this same period nor the Italian air campaign in Abyssinia; while the Spanish Civil War was not mentioned in the issues from 1936-1939.

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<sup>93</sup> JSCSC, 'Editorial', *The Hawk*, Vol.2 No.2, December 1929, p.9.

<sup>94</sup> JSCSC, 'Editorial,' *The Hawk*, Vol.5, No.5, December 1932, p.7. The previous year's edition had undergone production improvements with semi-matte paper and a new blue cover with an embossed Staff College crest and motto (*Visu et Nisu*).

<sup>95</sup> JSCSC, *The Hawk*, Vol.8, No.8, December 1935, p.7.

<sup>96</sup> JSCSC, 'Editorial', *The Hawk*, Vol. 11, No. 11, December 1938, p.8.

<sup>97</sup> In Volume 1, Number 1, for example, of the 26 features, six were devoted to air policing and eight to experiences in the First World War.



There were exceptions to the rule; in 1928 there was a feature entitled, 'The University Air Squadrons' which talked of the link between 'science and learning' and the modern RAF.<sup>98</sup> The same issue carried features on night flying and army co-operation. In a feature on the aircraft industry in the Netherlands, the author spoke to the Fokker company about the benefits and problems of using wood or duralumin in the design and building of cantilever wings but such technical features were rare.<sup>99</sup> Training topics were seldom discussed although one contributor highlighted a visit to the Polish Air Force's flight school at Deblin in 1931 where he described the methods of instruction and training equipment as 'very high...[and] ...excellent' respectively.<sup>100</sup> Over the next six issues, notable features of interest included topics ranging from 'High Flying, a Service Problem', a discussion on the theories of Douhet, air defence and 'The Case for Standardisation of Service Aircraft'.

Some of these papers clearly espoused the view that aviation and the potential uses of air power were changing but it seemed that the DS were torn between Trenchardian received wisdom and the pace of change caused by various expansion schemes. In *The Hawk* of December 1936 the following extract from 'The Review of the Year' highlights a picture of confusion and perhaps portrays a lack of confidence in the future. Given the last sentence and the reference to tail skids, it is possible that the Review had been written by a member of the DS.

The year of 1936 has been one of expansion, of swift planning and swift execution. It has been rather bewildering, and those responsible for lectures on organisation and kindred matters have had much ado to keep

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<sup>98</sup> JSCSC, anon. 'The University Air Squadrons,' *The Hawk*, Vol.1, No.1, December 1928, pp.45-47.

<sup>99</sup> JSCSC, anon. 'Aircraft Industry in the Netherlands', *The Hawk*, Vol.2 No.2, December 1929, p.100.

<sup>100</sup> JSCSC, anon. 'A Visit to Poland', *The Hawk*, Vol.4, No. 4, December 1931, p.18.

pace with the changes. New squadrons are formed every week; new stations, by some magic, seem to spring up overnight 'suitable for use by aircraft fitted with tail wheels only'. Alas, the possession of a tail skid nowadays is a sad mark of inferiority and our poor Moths and Harts are not allowed to visit the newest stations...In a short time our service will have grown to such proportions that those of us, who laboured through the lean years, will feel themselves lost in it.<sup>101</sup>

Was this really the passing of the old guard? As the writer of 'The Review of the Year', without any sense of irony, talked of the massive changes underway, his contribution is followed by features entitled 'Iraq in 1920' and 'Twenty Years Ago – the memories of a DH2 Scout pilot in France'. In a very enlightening feature that appeared in the December 1935 issue, one contributor seemed to identify and elucidate the problems that were being faced by the RAF in its attempt to transition itself to a new era. In a feature entitled '*Macte Nova Virtute Puer*', a phrase that can be translated as 'look to your new found courage boy' or 'go forth with new value boy', the author made some brave assertions about the leadership and direction of the RAF.<sup>102</sup>

The author recognised that the RAF had no tradition but argued that this is not necessarily a bad thing as 'tradition, broadly speaking, resists reform'. He argued that the RAF saw itself 'as enlightened, modern, [and] go-ahead' but in fact 'the hard shell of conservatism' stifled 'the eager enthusiasm of the younger generation' and made the RAF unfit for war. Turning to the topic of the RAF's senior officers and the DS at Andover, the author stated that these groups adopted a position of masters but these distinguished men had failed 'to keep pace with the march of progress' and although they had been 'supported for a time by their great reputations, end by making themselves

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<sup>101</sup> JSCSC, anon. 'Review of the Year,' in *The Hawk*, Vol.9 No. 9, pp.10-13.

<sup>102</sup> JSCSC, anon. '*Macte Nova Virtute Puer*', *The Hawk*, Vol. 8, Issue 8, December 1935, pp.53-55. Both translations are very apposite given the courage required to submit the paper, and the way in which the RAF was changing.

ridiculous.’ The author noted that the RAF’s leadership did not maintain an ‘open mind’ and was unwilling to learn. This anonymous author highlights an important point. His frustrations seem to indicate a widening gap between the RAF’s leadership and the emerging technologies of the post-expansion period that the RAF was then being subjected to.

So it frequently happens that those who are in a position to direct and train the services in time of peace, and who would have to lead them in war, are commonly those in whom we might expect to find signs of mental inflexibility. Whether this author, a member of the 13<sup>th</sup> Staff College course, reflected common opinion is open to debate, but his views certainly chime with those of Robertson who reflected that the RAF had a ‘fundamentally anti-intellectual approach to war’, and Overy, who stated that the ‘air force culture played down the importance of technique and tactics’.<sup>103</sup> In his PhD thesis, Cording said that ‘[for] too long the direction of the war had been left in the hands of senior officers whose previous service had become irrelevant to war requirements in the 1940s.’<sup>104</sup> This crisis of confidence in the RAF’s leadership that occurred in the late 1930s is epitomised in the ‘anonymous memorandum’ entitled ‘A Weak Link in the Nation’s Defences’, now attributed to Wing Commander Kingston-McCloughry by a number of academics including Ritchie.<sup>105</sup> The memorandum stated:

Many informed officers of medium seniority are in despair at the day to day drift, the counter orders which follow orders, the muddles, the waste

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<sup>103</sup> Robertson, *The Development of RAF Strategic Bombing Doctrine 1919-1939*, p.xxvi and R. Overy, *The Bombing War*, p.50.

<sup>104</sup> R. Cording, ‘The Other Bomber Battle: An Examination of the Problems that Arose between the Air Staff and the AOC Bomber Command between 1942 and 1945 and their Effects on the Strategic Bomber Offensive (PhD Thesis: University of Canterbury, NZ, 2006).

<sup>105</sup> S. Ritchie, ‘A Political Intrigue Against the Chief of the Air Staff: The Downfall of Air Chief Marshal Sir Cyril Newall’, *War and Society*, Vol.16, No.1, May 1998, pp.84-5.

of effort and the consequent unnecessary loss of life and aircraft which result from weak higher direction within the Air Ministry ... There is a most urgent need to replace Air Chief Marshal Newall as Chief of the Air Staff?

It would appear though that this leadership problem was not a problem peculiar to the RAF. In his diary entry for 31 March 1942, Lord Alanbrooke wrote that, [h]alf our Corps and Divisional Commanders are totally unfit for their appointments, and yet if I were to sack them I could find no better! They lack character, imagination, drive and power of leadership.<sup>106</sup> Alanbrooke put this situation down to the losses of the First World War reducing the pool of officers from which to select to attend Army Staff College in the inter-war years; this would have also applied to the RAF. In *The Bombing War*, Overy quoted a squadron commander in Bomber Command who said that senior officers with only First World War experience were worthless; 'the crocks...must be swept from the board.'<sup>107</sup>

## Conclusion

The establishment of the RAF Staff College was a fundamental tenet of Trenchard's reasoning, underpinning his Memorandum of 25 November 1919 that addressed the formation of the new Service. Trenchard was well aware that turning what was a 'war creation on a temporary basis' into a viable and militarily effective third force needed 'a fruitful soil from which to spring.'<sup>108</sup> Trenchard had a number of challenges to ensure the survival of the new Service and these included political and economic factors as well as countering rivalries from the Royal Navy and Army. Central to Trenchard's plan

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<sup>106</sup> Lord Alanbrooke, *War Diaries 1939-1945* (London. Phoenix, 2002), p.243.

<sup>107</sup> Overy, *The Bombing War*, p.291.

<sup>108</sup> RAFM, MFC 76, Cmd. 467, 'An Outline Scheme for the Permanent Organization of the Royal Air Force.'

to lay 'the foundations of a highly-trained and efficient force' was to perfect 'the training of officers and men' and this was to be conducted under the mantle of the RAF's own training organisations, one element of which was Andover. In addition, Trenchard wanted to 'foster the Air Force spirit' by creating a cultural identity for the new Service. The new organisation also had the opportunity to review, discuss and modify where necessary, the RAF's doctrine that was contained in CD 22. Establishing the RAF Staff College, Trenchard selected the DS and the students for the first course that started in April 1922. Given that doctrine '...drives the way in which training is carried out,' it is a little surprising that so little time at Staff College was spent addressing the challenges of *ab initio* or operational training; or validating and verifying doctrine. Doctrinal debate was undoubtedly stifled by received Trenchardian wisdom that was echoed by many acolytes and reinforced by emphasis on the 'bomb' by successive commandants, notably Brooke-Popham and Ludlow-Hewitt. The lack of course content on how training should be conducted and the development of training syllabi were mirrored in the lack of topics on the subject in *The Hawk*. Comments made by Air Marshal Sir John Slessor in 1978 perhaps mirrored some of the Staff College's shortcomings, when he reflected on his time there as a student in 1924. It was 'all so amateur in those days. I enjoyed and made a lot of friends...we knew nothing really. Our experience of the first war wasn't enough to produce any really very good policy, but it [Staff College] was useful and great fun.'<sup>109</sup>

Orange's view that [t]he RAF's Staff College 'discouraged independent thought in the 1920s and 1930s...' certainly strikes a chord and reflects the

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<sup>109</sup> IWM, Air Marshal Sir John Slessor interview, recorded March 1978, Catalogue 3176, Reel 3.

view that Andover was 'a defender of orthodoxy rather than...a stimulus for original thought'.<sup>110</sup> It also shows that, generally, officers were not being encouraged, nor were they independently searching out new technological approaches to air warfare such as aerodynamics, navigation, weapons or tactics. One can only conclude, supported by investigation of the syllabi and contemporary articles in *The Hawk*, that the RAF looked more to the past than to the future during this inter-war period. With the aeronautical advances of the mid-1930s that radically improved aircraft performance, this stance was short-sighted and potentially dangerous and seriously short-changed the Royal Navy and Army when it came to providing support to those two services.

The RAF Staff College also threw a spotlight onto another area that would cause issues for training over the coming years. Although Andover was supposed to help create 'an Air Force spirit' it was clear that, instead of unification of culture, Andover helped to create a number of multi-cultures within the RAF. First was the 'pilot-centric' culture that emphasised the pre-eminence of the pilot and secondly, the gulf between those that flew and those that 'support' that fighting element. All would have implications for the development of efficient training programmes in the future and these will be examined in subsequent chapters when discussing pilot and non-pilot aircrew training. Before addressing those issues, the next chapter will examine the organisational structure of the RAF with a particular emphasis on the bomber force's training organisation.

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<sup>110</sup> Orange, *Churchill and His Airmen*, p.87 and Parton, *The Evolution and Impact of Royal Air Force Doctrine: 1919-1939*, p.17.

## CHAPTER FIVE

### THE ROLE OF THE AIR COUNCIL, AIR MINISTRY AND BOMBER COMMAND IN DEFINING OPERATIONAL TRAINING POLICY, PLANNING AND METHODOLOGIES

#### Introduction

The three fundamental factors underpinning the success of any group can be said to be its structure, organisation and management. *The Oxford English Dictionary* defines structure as 'something that is built' that links 'mutually connected and dependent parts'.<sup>1</sup> Organisation meanwhile, is defined as undertaking 'vital functions or processes' in a coordinated manner. As far as the Air Ministry was concerned, that structure was its departments and directorates and its organisation can be said to be the staff system that was provided by RAF officers and civil service members of the Secretariat. The management element introduces the human dimension and can be said to be the determining factor in how structures and organisations work, especially when considering leadership aspects.<sup>2</sup> Gray differentiates between leadership and management. He has argued that the former demands vision, force of character and the ability to inspire, whilst the latter concentrates on the 'allocation and control of resources (human, materiel and financial) to achieve objectives.'<sup>3</sup> Both are vital elements to ensure the successful operation of a training pipeline and, as the previous chapter has shown, training was never at the forefront of the Staff College syllabi. Training was poorly understood and not matched to desired operational outputs and this resulted in a lack of emphasis and prioritisation during the inter-war

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<sup>1</sup> L. Brown (ed.), *The New Shorter Oxford English Dictionary, Volume 2* (Oxford: Clarendon Press, 1993).

<sup>2</sup> Gray, *The Strategic Leadership of the Royal Air Force Strategic Air Offensive Against Germany from Inception Until 1945*, pp. 1-2.

<sup>3</sup> Gray and Harvey, 'Strategic Leadership Education,' p. 91.

and early war years. This chapter will consider the development of the Air Council and Air Ministry by firstly taking a contextual overview of both organisations before looking at their creation and early development in detail and how they directly affected operational training.

Next, consideration will be given to the Civil Service, or Secretariat, that played a central role in assisting the RAF to function. The chapter will conclude that in the inter-war years there was no effective 'centralised direction and coordination' for operational flight training and no 'clear idea of its long term needs with regards to equipment and personnel.'<sup>4</sup> This only began to change with the acceleration of the RAF Expansion Schemes in 1935 and reorganisation of ADGB and Coastal Area into Commands in 1936. This led the RAF to assess the management of its structural organisation and to tackle shortcomings in operational training such that by late 1942 a professional and robust training system was emerging. Its further development served Bomber Command well for the remainder of the war.

### **Air Council and Ministry Formation in Context**

The Air Ministry was overseen by the Air Council which, as the former's 'supreme governing body', comprised politicians, civil servants and senior RAF officers.<sup>5</sup> The powers of the Air Council were derived from the Air Force (Constitution) Act of 1917 that also provided the legal authority to amalgamate the RFC and RNAS.<sup>6</sup> The Air Council's senior political figure was the Secretary of State for Air who, depending on perceived national threats and political considerations, might or might not be a

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<sup>4</sup> TNA AIR 10/5551, *Flying Training Policy and Planning*.

<sup>5</sup> Phillpot, *The Royal Air Force – An Encyclopaedia of the Interwar Years, Vol 1, The Trenchard Years 1918-1929*, p.388.

<sup>6</sup> TNA AIR 19/145, Paper No.1, The Organisation of the Air Ministry, 8 January 1940.



member of the Cabinet.<sup>7</sup> The Air Council replaced the Air Board, the latter described by Pugh as 'largely ineffective,' and officially came into effect on 3 January 1918. It met 'as required' and delegated the day-to-day running of the RAF to the CAS, the CAS's departmental heads and the Air Ministry's Secretariat; this secretariat being the Civil Service.<sup>8</sup> The Air Council's main role was to 'provide direction and policy in matters of personnel, aircraft construction, supply and organization.'<sup>9</sup> With the majority of the Air Council being formed of senior RAF officers, the gradient between it and the Air Ministry was not as large as it appeared in theory although, with the presence of politicians, the most senior of which was the Secretary of State for Air and the Secretariat, the CAS could not simply use the Air Council to rubber-stamp RAF policy. Although its composition altered throughout the inter-war and war years, the main attendees were the Secretary of State for Air, who chaired the meetings; the Parliamentary Under Secretary for Air, a civil servant whose main responsibility was for the Secretariat; the CAS; two to four Air Members, who were senior officers with a responsibility for a particular portfolio; and a Secretary who was a senior civil servant.<sup>10</sup> The original Members of the Air Council were: the Master-General of Personnel, the Controller General of Equipment, the Inspector General of the Royal Air Force, the Director-General of Aircraft Production, and the Administrator of Works and Buildings.<sup>11</sup> It is worth noting that the early functions of the Air Council, those

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<sup>7</sup> Montgomery-Hyde, *British Air Policy Between the Wars, 1918-1939*, Appendix 1 highlights the chronological list of Secretaries of State and those that sat in the Cabinet.

<sup>8</sup> AHB, Air Council Minutes 1918-1935. The Air Council first met on 3 January 1918 and met a total of 69 times throughout 1918, 23 in 1919, nine in 1920, nine in 1921, five in 1922 and three in 1923. These minutes are also available in the TNA AIR 6 files.

<sup>9</sup> Phillpot, *The Royal Air Force - An Encyclopaedia of the Interwar Years: Volume 1, The Trenchard Years 1918 to 1929*, p.426.

<sup>10</sup> Montgomery-Hyde, *British Air Policy*, Appendix III provides a list of Members of the Air Council from January 1918 to March 1939.

<sup>11</sup> FFG, 'The Royal Air Force – Administration, Organization and Direction', *JRUSI*, 1 February 1937, p.89.

being personnel, general equipment, aircraft production, infrastructure and the overarching quality assurance provided by the Inspector General, remained in place, albeit with titular changes in some cases, until the end of the Second World War.

In addition, the Air Council could call subject matter experts to attend for particular agenda items as required. The Air Council could also call officers that had met with their displeasure. An example of the latter was the case with AOC-in-C Bomber Command, Air Chief Marshal Sir Edgar Ludlow-Hewitt, following his letter of 25 May 1939, when he complained of shortcomings of Bomber Command due to the RAF's rapid expansion.<sup>12</sup> Ludlow-Hewitt appeared before the Air Council on 4 August 1939 and it is interesting to note that most of his concerns centred on training deficiencies.<sup>13</sup>

From 25 June 1935, Air Council meetings were replaced by RAF Expansion Measures Secretary of State's Progress Meetings (EPM).<sup>14</sup> Critically, although the name changed, the EPM undertook the same roles as the Air Council and contained the same heads of department personnel. The strong relationship between the Air Council and Air Ministry was due to the RAF senior officers that sat on the Air Council heading departments within the Air Ministry. An example of such a department and one that had a major responsibility for training, was that of the Air Member for Personnel (AMP), a new title for what started as the Master-General of Personnel and became the Director of Personnel. The AMP oversaw the Director of Training as well as the Directors of Personnel Services, Postings, Medical Services, Education

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<sup>12</sup> AHB, 176<sup>th</sup> Expansion Progress Meeting Minutes dated 18 July 1939.

<sup>13</sup> AHB, 179<sup>th</sup> Expansion Progress Meeting Minutes dated 4 August 1939.

<sup>14</sup> TNA AIR 6/23. This file contains the minutes for the first 20 EPMs from 25 June – 17 December 1935.

and Chaplaincy. Direction from the Air Ministry was issued through Air Ministry Weekly Orders (AMWO) that 'promulgated for information and guidance and necessary action' directives down to Areas, Commands, Groups, Stations and Squadrons.<sup>15</sup> Although perhaps the AMP's wide portfolio of responsibilities was acceptable in the nascent years of the RAF, when relatively few aircrew were being trained, pressure certainly increased from 1934 with the inception of the first expansion scheme. The other issue was the turnover of AMPs and their variable time in office. Between February 1922 and the end of 1942 the Air Council was served by 10 AMPs.<sup>16</sup> Seven incumbents held the post for less than 18 months, with Gossage, John Salmond and Portal in post for eight, 12 and 14 months respectively. This lack of a specific training authority at Air Ministry level and the turnover in personnel meant that the challenges of defining training policy were magnified. These difficulties will be examined in more detail below.

### **Foundations and Failings**

In many ways, this inter-war period shaped the way that future approaches to staff work and training were addressed although the apparatus with which to achieve these goals was often painfully slow to evolve. For example, the RAF Staff College at Andover was not established until 1922 and the output of RAF staff officers never really matched the requirements of inter-war expansion schemes or the early years of the war.<sup>17</sup> As late as 1938, for example, Bomber Command HQ had 37 staff officers of which only four (11%) were graduates of Andover.<sup>18</sup> The number of Andover

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<sup>15</sup> RAFM, Air Ministry Weekly Orders. The first AMWO was published on 20 March 1918.

<sup>16</sup> RAFM, *Air Force Lists* 1922 – 1942.

<sup>17</sup> RAFM AIR 69/19, Programme of Work for the First Course.

<sup>18</sup> RAFM, *Air Force List* January 1938.

graduates on the staff at Fighter, Coastal and Training Commands was equally small, being 9%, 8% and 10% respectively.<sup>19</sup>

The organisation and structure of the Air Ministry evolved such that the management of the flying training organisation and the means to generate flying training policy was well established by 1942 but the process did face certain challenges in arriving at that point, many associated with human factors. These ‘tensions in relationships’ generally encompassed personalities and organisations, ‘where different parts, or divisions, may have competing priorities.’<sup>20</sup> Friction not only occurred between Service departments but also between operational commands and departments within the Air Ministry as well as between Service staff and politicians or civil servants.<sup>21</sup> As Gray highlighted, frictions and tension were magnified by many who maintained a ‘silo mentality’ by being incapable or unwilling of seeing and understanding issues affecting other departments.<sup>22</sup> An example of such friction has been highlighted by Sir Maurice Dean, a senior Air Ministry civil servant, who has said that the CAS (Ellington) and his staff were against a rapid expansion of the RAF in 1934 because it would ‘dilute supplies of experienced people [and] attenuate skills.’ Dean was, with hindsight, opposed to this view arguing that ‘Germany, and later the US, both did it.’<sup>23</sup> More damning perhaps was Dean’s view that Ellington ‘knew little about aviation’, having never flown in combat during the First World War

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<sup>19</sup> RAFM, *Air Force List*, January 1938.

<sup>20</sup> Gray, *The Strategic Leadership and Direction of the Royal Air Force Strategic Air Offensive Against Germany from Inception to 1945*, p.82.

<sup>21</sup> Cox, ‘Harris and the Air Ministry’, p.210.

<sup>22</sup> Gray, *The Strategic Leadership and Direction of the Royal Air Force Strategic Air Offensive Against Germany from Inception to 1945*, p.3.

<sup>23</sup> M. Dean, Recording made by the IWM in March 1978. Catalogue Number 3186, Reel 2. These recordings cover four reels and last approximately two hours. Dean is very circumspect and political in what he reveals in the recordings, especially concerning Ellington and Newall but more forthcoming in his book.

or after 1918.<sup>24</sup> Nonetheless, as far as flying training was concerned, the need to communicate across silos was of paramount importance, especially as the RAF began its expansion. This meant the AMP having to work closely with other departments, such as the Air Member for Supply and Research (AMSR), for the provision of training aircraft and spares as well as the Director of Works and Buildings for airfields and infrastructure.

When the Air Ministry came into being on 3 January 1918, under Lord Rothermere as its inaugural Secretary of State for Air, its first priority was to put in place a process to amalgamate the RFC and RNAS, reduce personnel and then sell surplus aircraft.<sup>25</sup> Like any new Department of State, the Air Ministry required staff, offices, a budget and, above all, a policy with which to dictate how the new Service would develop and thrive in the future.<sup>26</sup> On the surface at least, the greatest demand was the amalgamation itself, especially given the animosity that existed between the two Services over the procurement and use of aircraft that was present from the formation of the RFC in April 1912.<sup>27</sup> However, this challenge was outdone by other issues that created 'an atmosphere of unpleasantness' that was to overshadow the formative years of the Service.<sup>28</sup> These issues may be broadly considered under the headings of personalities, politics and structural organisation which created serious disruption to a nascent Service that ideally needed clear direction and stability in

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<sup>24</sup> Dean, *The Royal Air Force and Two World Wars*, p.88.

<sup>25</sup> *Armed Services Aviation Before 1918*, <http://discovery.national.archives.gov.uk/details/r/C8.com>. Accessed, 10 February 2015.

<sup>26</sup> Dean, *The Royal Air Force and Two World Wars*, p.26. Dean referred to these requirements as 'vital needs'. Sir Maurice Dean became the Private Secretary to the Chief of the Air Staff in 1934 and remained in the Air Ministry for the next 12 years finishing the period as the Head of the Air Staff Secretariat.

<sup>27</sup> See, for example, Edgerton, *England and the Aeroplane*, p.15. The author highlights the breakaway of the RNAS from the RFC, and its separate procurement and training policies.

<sup>28</sup> C.G. Grey, *A History of the Air Ministry* (London: Allen & Unwin, 1940), p.75.

which to establish itself and train for the future. Biddle, for example, has argued that 'internal dissension' within the Air Council and Air Ministry retarded the rapid establishment of an efficient Air Ministry.<sup>29</sup> Paradoxically, it also required these same conditions to create and execute the planned reduction in aircraft and personnel of the Service. Such a backdrop resulted in training being given a very low priority. In November 1918, the RAF had 291,170 officers and men and a total of 22,647 aircraft.<sup>30</sup> As far as the Air Ministry strength at the time of the Armistice is concerned, the figure of 4,651 included serving officers and civil servants.<sup>31</sup> The requirements for stability and direction were clearly apparent during the first meeting of the Air Council on 3 January 1918. The minutes recorded that:

General Trenchard said that he proposed to prepare a schedule shewing [sic] the delegation of duties for approval by the Air Minister. As soon as this was settled the amount of staff necessary for carrying out these duties would then require approval and the names of officers to be detailed could be approved afterwards.<sup>32</sup>

At the next meeting, the members reviewed a 'draft statement of the distribution of duties in the Air Ministry'.<sup>33</sup> Over the coming months, more details were added but, even as late as May, the Air Council minutes recorded the responsibilities of members needed a 'more precise definition'.<sup>34</sup> These delays, in part, were due to the hiatus caused by the resignations of Rothermere (Secretary of State for Air) and Trenchard (CAS), a situation that Chamier described as 'a somewhat deplorable start'.<sup>35</sup> Rothermere was replaced by Lord Weir. According to Weir's predecessor,

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<sup>29</sup> Davis Biddle, *Rhetoric and Reality in Air Warfare*, p.66.

<sup>30</sup> Jones, *The War in the Air Vol. VI Appendices*, Appendix XXXI. These figures are quoted by Montgomery Hyde in *British Air Policy Between the Wars* where he adds that the RAF comprised '188 combat squadrons.' p.49

<sup>31</sup> AHB, Air Council Minutes, 92<sup>nd</sup> Meeting, 8 December 1919.

<sup>32</sup> AHB, Air Council Minutes, 1<sup>st</sup> Meeting, 3 January 1918.

<sup>33</sup> AHB, Air Council Minutes, 2<sup>nd</sup> Meeting, 8 January 1918.

<sup>34</sup> AHB, Air Council Minutes, 28<sup>th</sup> Meeting, 23 May 1918.

<sup>35</sup> J.A. Chamier, *The Birth of the Royal Air Force* (London: Pitman, 1943), p.171.

Trenchard had a '...dull, unimaginative mind' and, from Trenchard's perspective, he disliked civilian bosses and resented Rothermere for '...asking advice on aviation from others.'<sup>36</sup> This was a clash of personalities that threatened the future of the Service from its outset. Following his resignation over the clash with Rothermere, Trenchard was replaced as CAS by Major General Sir Frederick Sykes on 15 April 1918, and, as a result of Sykes' appointment, General David Henderson also resigned from the Air Council, '...to escape from the atmosphere of falsehood and intrigue which had enveloped the Air Ministry.'<sup>37</sup> Personality issues continued to detract from what should have been the Air Council's real business, that of the amalgamation of the RFC and RNAS, the concomitant reduction in personnel and equipment, the development of a post-war doctrine and the nurturing of the RAF through defining a structure to make it flourish.<sup>38</sup>

With a new Secretary of State for Air and CAS in place, the distribution of duties between Air Members of the Council was proposed at the meeting held on 8 June 1918. It was stated that: 'The question of the responsibility of training as between the CAS and Master-General of Personnel was considered at length on a paper put forward by CAS...the balance of advantage lay in leaving the responsibility for training, up to the point when squadrons mobilise, with MGP.'<sup>39</sup> This is an important document as it provided a benchmark that formed the basis of training policy during the inter-war years although, in many ways, it generates more

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<sup>36</sup> See Orange, *Churchill and His Airmen*, p.56 and J. Morrow, *The Great War in the Air*, p.319.

<sup>37</sup> Grey, *A History of the Air Ministry*, p.81-82.

<sup>38</sup> E. Ash, *Sir Frederick Sykes and the Air Revolution 1912-1918* (Abingdon: Routledge, 1999) provides background on the relationship himself, Rothermere, Trenchard and Henderson.

<sup>39</sup> AHB, Air Council Minutes, 32<sup>nd</sup> Meeting, 8 June 1918. The title Master General of Personnel became the Director of Personnel in 1919, lost his seat on the Air Council, and became part of the CAS's department in the Air Ministry. The post of Air Member for Personnel was established in 1922 and re-joined the Air Council.

questions than it answers. Firstly, it was agreed that 'Air Members should consult as to the best means of defining and communicating to the Directorate of Training through MGP precisely what training requirements are...[that]...emphasises training between mobilisation and deployment.' The minutes also state that CAS was responsible for 'training policy' while MGP was charged with the 'training of all personnel – officers and men of the RAF, until such times as their unit mobilises...' <sup>40</sup> So far, the minutes described a somewhat dictatorial policy whereby Air Members, led by CAS, directed training policy and procedures through the MGP to the Directorate of Training, who was overseeing the squadrons that actually undertook that training.<sup>41</sup> With the MGP also responsible for manning, recruiting, records, discipline, honours and awards, ceremonial duties, medical services and chaplains, he could hardly be viewed as a training expert with a sole focus on the subject.<sup>42</sup>

The other policy that this document enshrined in inter-war RAF training culture was the idea of operational training being conducted within squadrons after 'that unit mobilises.'<sup>43</sup> The result of this policy was that squadrons became responsible for various types of technical training that detracted from their operational role or task-specific training. Having formulated the structure for future aircrew training, the Air Council minutes of 8 June 1918 argued for the appointment of the Director of Training to sit on the Air Council so as to '...speed up formulating [training] policy...' and link the lessons learned from operations to that of training policy. Paradoxically, this decision to place a Director of Training on the Board of the Air Council

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<sup>40</sup> AHB, Air Council Minutes, 32<sup>nd</sup> Meeting, 8 June 1918.

<sup>41</sup> The Director of Training reported to the MGP/AMP.

<sup>42</sup> AHB, Air Council Minutes 32<sup>nd</sup> Meeting, 8 June 1918. See MGP Appendix in minutes.

<sup>43</sup> *Ibid.*



highlighted the earlier flawed decision to divide policy decisions on training between the CAS and MGP as training demanded a far more focused staff specialist. Despite the need, the appointment of a dedicated Air Member for Training (AMT) to the Air Council had to wait until July 1940.<sup>44</sup>

In some ways, these training discussions were afforded less weight than might have been expected due to the glut of pilots available when the First World War ended and this is perhaps why training was not afforded a higher priority. Pilot training was subsequently officially stopped on 9 January 1919.<sup>45</sup> The problem with this approach is that a 'black hole' appears that is defined by a vacuum of pilots of a certain age and experience level. This 'black hole' is most noticeable in the future when officers of a certain rank are unavailable to fill mid-rank appointments. There was plainly a growing issue with training, specifically in terms of how it was organised and managed at the Air Ministry level. This point has been raised in the AHB Narrative on Flying Training when referring to the early inter-war period:

...operational units had become entangled with training. There was no centralised direction and co-ordination, no authority to represent training as a single problem and no clear idea of its long term needs with regard to equipment or personnel.<sup>46</sup>

Another factor that potentially affected training during this period was the establishment of the post of 'Inspector-General of the Royal Air Force Units,' on 12 September 1918.<sup>47</sup> The first incumbent, Major General Sir Godfrey Paine, was

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<sup>44</sup> See TNA AIR 41/4, *Aircrew Training 1934-1942*. The first incumbent was AVM (Acting Air Marshal) A.G.R. Garrod. See RAFM *Air Force List* December 1940.

<sup>45</sup> AHB, Air Council Minutes, 70<sup>th</sup> Meeting, 9 January 1919.

<sup>46</sup> TNA AIR 10/5551. This document was written in 1952 and initially released as AP 3233 Vol. 1 Policy and Planning. The quote is taken from p.11.

<sup>47</sup> RAFM, Air Ministry Weekly Orders, No. 1011 dated 12 September 1919.

tasked with reporting on 'the organisation, training and discipline' of the Service. Although this role was a valuable one in that it provided a theoretically non-partisan and pan-departmental view of training, it is unclear how the Inspector General's reports were viewed by the Air Council and Air Ministry. As far as the Air Council Meeting Minutes up until 1931 were concerned, they contained no training agenda items that were attributed to the Inspector General.<sup>48</sup> Paine had considerable experience with flying training, having been the commandant of the Naval Flying School at Eastchurch in 1911, Central Flying School at Upavon from 1912 and of the RNAS Central Depot and Training Establishment at Cranwell in 1915.<sup>49</sup> He was also responsible, in conjunction with Sykes, for drafting the first joint RFC/RNAS flying training manual in 1913 and became Fifth Sea Lord responsible for Naval Aviation in 1917, but this expertise was not used in the development of future training policy.<sup>50</sup>

Considering the massive workload of the Air Council after the First World War it is strange that the number of meetings declined year on year. In 1919 there were 23, nine in both 1920 and 1921, five in 1922 and only three in 1923.<sup>51</sup> During this period, staffing levels in the Air Ministry reduced from 4,651 in November 1918 to 2,539 in November 1919.<sup>52</sup> This figure continued to fall and by 1 April 1930, there were 1,704 staff working in the Air Ministry.<sup>53</sup> Although staffing levels were falling during this formative period, the organisation and structures to run the Service were evolving and examination of that structure in December 1919 clearly showed the

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<sup>48</sup> AHB, Air Council Minutes, 1918-1935. These Minutes can also be found at TNA PRO AIR 6.

<sup>49</sup> [www.rafweb.org/biographies/Paine.htm](http://www.rafweb.org/biographies/Paine.htm). Accessed, 7 February 2022.

<sup>50</sup> Pugh, *The Conceptual Origins of the Control of the Air: British Military and Naval Aviation, 1911 – 1918*, p.98.

<sup>51</sup> AHB, See Air Council Minutes, 1919-1923.

<sup>52</sup> AHB, Air Council Minutes, 92<sup>nd</sup> Meeting, 8 December 1919.

<sup>53</sup> <https://homepages.warwick.ac.uk/~lysic/1920s/airministry.htm>. Accessed, 6 June 2015.

embryonic skeletal form that would be recognisable in 1942.<sup>54</sup> This decline in staffing levels is not surprising given the financial austerity that the RAF had to operate within during the inter-war years, particularly the Ten Year Rule. Importantly, a sustainable organisational structure was in place that could accommodate change if required. The 1919 Air Force List shows five departments, what can be termed operational directorates, falling under the responsibility of the CAS, these being: the Directorate of Operations and Intelligence; Directorate of Training and Organisation; Directorate of Personnel; Directorate of Equipment; and Directorate of Works and Buildings. A sixth Directorate, that of Supply and Research, that was headed by Air Vice-Marshal Edward Ellington who also sat on the Air Council, was being constituted in late 1919 and not shown in detail in the 1919 Air Force List. Considering the moratorium on pilot training and the continuing reduction in aircraft and personnel, the Director of Training, Air Vice-Marshal P.W. Game, had 23 staff officers in his organisation, including Group Captain E. R. Ludlow-Hewitt as his deputy.<sup>55</sup> In the late 1930s, Ludlow-Hewitt was to play an increasingly major part in developing the RAF's flying training organisation, particularly in the formation of Group Pool Squadrons.<sup>56</sup> Game had to face certain basic issues in trying to promulgate training policy decisions as his letter of 14 April 1920 shows: '[s]ome doubt appears to exist regarding the exact meaning of the terms unit, formation, etc., as applied to the proposed organisation of the Royal Air Force...'.<sup>57</sup> This is perhaps not surprising given the restructuring of the

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<sup>54</sup> RAFM, *Air Force List*, December 1919.

<sup>55</sup> *Oxford Dictionary of National Biography* – give details of both officers training experiences.

<sup>56</sup> TNA AIR 2/4168 contains a memorandum from Ludlow-Hewitt as AOC-in-C Bomber Command to his Bomber Group AOCs dated 16 March 1939 where he refers to the 'sacrosanct' nature of Group Pool Squadrons (the forerunners of OTUs) and that aircraft and manpower were to remain in these squadrons and not to be used for 'making good deficiencies in first line squadrons.'

<sup>57</sup> TNA AIR 8/97, Letter DOT to AOC Areas and Officers Commanding Independent Commands that accompanied Notes of Peace Organisation of the RAF, 14 April 1920.

RAF into numbered areas that were then replaced by geographical areas (eg. Southern, Northern and Eastern) and then redefined geographical areas (eg. Inland, Coastal and Wessex) as well as sub-division into Groups.<sup>58</sup>

The other organisational element of the Air Council and Air Ministry in 1919 that is striking was the number of civil servants and finance staff. In the case of the Air Council this bureaucracy can be seen through composition of its members.<sup>59</sup> Headed by Winston Churchill as the Secretary of State for Air, the vacant Under Secretary of State for Air position had yet to be filled by the Marquis of Londonderry following the resignation of J.E.B. Seely in December 1919.<sup>60</sup> Prior to his appointment as Under Secretary of State for Air, Londonderry was the Air Council's Finance Member with a staff of one Assistant, one Private Secretary and 25 Principal, Assistant Principal and Higher Division Clerks. As Controller General of Civil Aviation, having been replaced by Trenchard in March 1919, Major General F.H. Sykes had 30 staff while the Secretary to the Air Council, Sir W.A. Robinson, had four Assistant Secretaries, seven Principals, seven Assistant Principals and 12 Higher Division Clerks. As C.G. Grey observed in 1940, the RAF was 'controlled by...civil servants [and they] represent the treasury [that] holds the purse strings.'<sup>61</sup> Grey's comments as to finance are important and the AHB Narrative took this observation a step further by saying that, '...the days of political neglect and financial restriction...[created an]...over-rigid mould to the staff mind...'<sup>62</sup> Dean notes and

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<sup>58</sup> Phillpot, *The Royal Air Force, Volumes 1 and 2* provides a good description of these various groups. Details are also provided for the early structure in Chapter Two.

<sup>59</sup> RAFM, *Air Force List*, December 1919.

<sup>60</sup> N.C. Fleming, *The Marquess of Londonderry* (London: Tauris, 2005), p.80. According to Fleming, Seely resigned because he felt that the position of Under Secretary was beneath him. This highlights another example of dysfunction during the formative period of the Service's life.

<sup>61</sup> Grey, *A History of the Air Ministry*, p.100.

<sup>62</sup> TNA AIR 10/5551, p.11.

counters these observations, perhaps unsurprisingly as a senior civil servant, and said that there was little friction between the RAF's senior officers and Civil Service with the relationship being 'excellent'.<sup>63</sup> This rather passive and non-confrontational view is also reflected in Dean's recorded interviews made by the IWM in 1978 where he said that 'the cross fertilisation of ideas and experiences' between the military and civil sides of the Air Ministry 'led to friendships' and were 'most harmonious'.<sup>64</sup> Despite Grey's comments that the Civil Service represented the Treasury and the AHB's view on an 'over-rigid' civil service, there are numerous examples that will be examined in subsequent chapters where the Civil Service worked closely with Bomber Command to enhance operational training.

The years between the end of the First World War and the formation of the RAF Staff College at Andover marked a vital period for the Service. Cooper has said that the RAF, in the inter-war years, 'can be illuminated through an understanding of the circumstances of its birth'.<sup>65</sup> Cooper also raised a leadership issue when he stated that the senior officers 'who were expected to lead the Royal Air Force' had been promoted in the Army or Royal Navy and 'many did not actually approve of the removal of aircraft from the control of the established services' and 'few can have escaped entirely from residual feelings of loyalty to their former masters'.<sup>66</sup> Whilst this may have been true during the chaos, contraction and confusion of the first months of the RAF's painful birth, the strength of Trenchard's leadership and the focus

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<sup>63</sup> Dean, *The Royal Air Force and Two World Wars*, p.82.

<sup>64</sup> Dean, *IWM Recordings*, Catalogue No. 3186, Reel 1. Recorded March 1978. Owen offered what may be considered a more realistic view in R. Owen, *Tedder* (London: Collins, 1952), p.91 in describing Mr Scott, the Head of the AMP's Secretariat Department, S.6, in that, 'he could veto any new proposal on the grounds of added expense [and] veto he did.'

<sup>65</sup> Cooper, 'Blueprint for Confusion: The Administrative Background to the Formation of the Royal Air Force, 1912-19', *Journal of Contemporary History*, Vol.22, No. 3, July 1987, p.438.

<sup>66</sup> *Ibid.*, 'p.440.

provided by his Memorandum of November 1919, as well as his promotion of acolytes such as Salmond, Portal and Newall, perhaps challenged and countered this threat of the development of sub-cultures. A more sceptical view might highlight the lack of former RNAS officers in senior positions on the Air Council and serving in the Air Ministry that negated the Army versus Navy sub-culture development from that particular perspective. Stubbs has argued that 'the release of Air Publication 1225,' in 1920 'marked another important chapter in the RAF's organizational thinking' to 'institutionalize' the RAF with 'codified beliefs'.<sup>67</sup> As we have seen in previous chapters, those beliefs were centred on the doctrine of strategic bombing.

Although not commonly considered by academics, the leadership and management capabilities of these senior officers must be examined in the light of establishing a new service. Even the mild mannered and politically aware Dean stated in 1978 that Ellington and Trenchard knew little about flying. With aviation in a 'state of [technological] ferment' in the 1930s and the need for massive expansion underway, it can be argued that some of the RAF's problems stemmed from its lack of informed leadership at the top of its organisation.<sup>68</sup> Trenchard, in writing to the Secretary of State for Air Sir Samuel Hoare in 1928 after nine years as CAS, was reflecting on his time in office having potentially become a 'dictatorship'.<sup>69</sup> Tellingly, Trenchard wrote that the RAF needed to bring in 'new blood from the outside at the top fairly often as I often feel myself the great handicap of losing touch with outside

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<sup>67</sup> D. Stubbs, 'The Culture of the Royal Air Force, 1918 – 1945,' in P. Mansoor & W. Murray (eds.), *The Culture of Military Organizations* (Cambridge: Cambridge University Press, 2019), p.406. AP 1225 was an analysis of the Independent Force's bombing operations against Germany in 1918.

<sup>68</sup> Dean, *IWM Recordings*, Catalogue No. 3186, Reel 2. Recorded March 1978.

<sup>69</sup> TNA AIR 8/97, Letter CAS to SoS-for-Air, 13 November 1928. This letter was in response to a letter from the SoS-for-Air asking how long future CAS' should remain in office.

realities.<sup>70</sup> His comments are totemic and reflect a generational gap in understanding technology and its application, especially in trying to define operational training requirements to meet doctrinal needs. With four CAS following Trenchard before the appointment of Charles Portal in October 1940, the question must be asked whether they were also handicapped by 'losing touch' in any way? This major admission by Trenchard did not prevent him from using his influence during the Second World War with Portal and Harris to encourage strategic bombing. Trenchard's letter to Hoare resonates strongly with the words of the unknown student at the RAF Staff College in 1935 that were quoted in the previous chapter but are worth reiterating here:

Too often we see able and distinguished men, acknowledged masters of their craft, who fail to keep pace with the march of progress, and supported for a time by their great reputations, end by making themselves ridiculous.<sup>71</sup>

It is also worth considering Higham's observation when he wrote that the RAF was facing a 'challenge of modernisation' and that its high-level political and military decision-making was being conducted by Victorians born between 1860 and 1865.<sup>72</sup> The next generation, he argued, was not present until around 1940.<sup>73</sup> It was this generation that was able to take operational training forwards to match the rapidly emerging aviation technologies now being demonstrated in higher-performance, all metal aircraft.

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<sup>70</sup> TNA AIR 8/97, Letter CAS to SoS-for-Air, 13 November 1928. Author's emphasis.

<sup>71</sup> Anon, '*Maete Nova Virtute Puer*', *The Hawk*, No.8, December 1935, 13<sup>th</sup> Course.

<sup>72</sup> Although Higham quotes 'between 1860 and 1865' the watershed could perhaps be considered as 1890 with the likes of Trenchard (1873), Ellington (1877) and Newall (1886) born before that year and Tedder (1890), Portal (1893) and Slessor (1897) born after.

<sup>73</sup> R. Higham, *Two Roads to War: The French and British Air Arms from Versailles to Dunkirk* (New York: Naval Institute Press, 2012), p. xix.

## Structure and Organisation

As discussed above, the Air Ministry had developed the nascent structure with which to organise and manage training by 1922 but that structure was still evolving. That year also saw the creation of the AMP to replace the MGP.<sup>74</sup> Its first incumbent was Air Vice-Marshal Oliver Swann, a former RNAS pilot.<sup>75</sup> Initially, this training structure could perhaps be described as dysfunctional as the CAS directed policy, MGP was responsible for training through the Director of Training up until the point that a squadron mobilised while operational training was undertaken in the squadrons. If the Director of Training was considered at the leading edge of managing training and promulgating policy, staffing levels had to be commensurate with this role. In June 1921, Game and Ludlow-Hewitt were still in post.<sup>76</sup> Below them their organisation comprised two Wing Commanders, three Squadron Leaders, eight Flight Lieutenants, seven Flying Officers, one educational advisor and one assistant educational advisor. It is likely, given Trenchard's emphasis on training in his memorandum on the permanent organisation of the RAF that he wanted to maintain control of training during the early years of the Service.<sup>77</sup> This is reflected in the 'revised organisation of the Air Ministry' that was promulgated on 1 August 1922 when the previous training responsibilities held by MGP/AMP reverted to the CAS's Department through the newly created Director of Training and Staff Duties, headed by Air Commodore T.C.R. Higgins.<sup>78</sup> Ultimate responsibility was held by the CAS's

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<sup>74</sup> C.G. Grey, *A History of the Air Ministry*, p. 125.

<sup>75</sup> Oxford Dictionary of National Biography. Accessed 7 February 2023.

<sup>76</sup> RAFM, *Air Force List*, June 1921.

<sup>77</sup> TNA AIR 8/97, Cmd. 467, *An Outline Scheme for the Permanent Organisation of the Royal Air Force*.

<sup>78</sup> RAFM, Air Ministry Weekly Orders, No.623, 10 August 1922. See also 'Royal Air Force Notes' in *JRUSI*, February 1923, Vol.68, p.175.



department until 1924 when training transferred once again to the AMP, who re-established the post of Director of Training.<sup>79</sup> The clear difference between 1921 and 1930 was the reduction in departments that the CAS had a direct responsibility, from seven to three.<sup>80</sup> This transfer of responsibility highlights a lack of importance given to training but again, given the background of disarmament and financial austerity, it is hardly surprising.

In 1926, the training waters were muddied still further with the publication of *The Organisation of the Royal Air Force, 1919 – 1926*.<sup>81</sup> The title page contained an introduction by Trenchard saying that the document was written to update his Memorandum of 1919. The 1926 document had the original Memorandum on the left hand pages and a description of how Trenchard's aims and ideas had been brought to fruition on the right. Aside from adding to the Trenchard 'father of the Royal Air Force' myth, from a training perspective, the 1926 additions refer to the creation of a home defence force-based third command, subsequently known as Air Defence of Great Britain (ADGB) that was established on 1 January 1925.<sup>82</sup> The document stated that '[t]he Air Officer Commanding-in-Chief of this force will be charged with the training of all Home Defence squadrons and will have operational control of the whole of the Forces comprising the Air Defence of Great Britain...'. In short, the responsibility for training was now divided between the CAS through his Directorate of Staff Duties, AMP through his Directorate of Training, the AOC-in-C ADGB for

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<sup>79</sup> Air Ministry, British Government Department, at <https://homepages.warwick.ac.uk/~lysic/1920s/airministry.htm>. Accessed, 16 February 2015. See also RAFM, Air Ministry Weekly Orders, No. 384, dated 5 June 1924.

<sup>80</sup> Grey, *A History of the Air Ministry*, Organization of Air Ministry 1921 and 1930 appendices.

<sup>81</sup> TNA AIR 8/97, *The Organisation of the Royal Air Force, 1919 – 1926*, March 1926.

<sup>82</sup> Philpott, *The Royal Air Force - An Encyclopaedia of the Interwar Years: Volume 1, The Trenchard Years 1918 to 1929*, p. 2554.

home defence squadrons and squadron commanders. With so many agencies involved and considering the relatively small size of the RAF, the challenge of directing robust and efficient training became increasingly complex with no real training authority to oversee the process.

By 1930, the AMP, Air Vice-Marshal Sir Tom Webb-Bowen, was responsible to the Secretary of State for Air 'for the administration of so much of the business relating to the personnel, discipline, and training of the Air Force as may be assigned to him from time to time by the Secretary of State.'<sup>83</sup> Specifically, this role entailed maintaining manning levels and '[t]raining of the R.A.F.' The AMP had a Director of Training who was responsible for 'the flying training of air force personnel both regular and reserve.'<sup>84</sup> The issue that faced the RAF was that training policy remained divided between AMP and the CAS. In his Air Ministry restructuring report that was instigated by the CAS, Air Chief Marshal Sir John Salmond, and completed in February 1933, Air Marshal Sir Robert Brooke-Popham made a number of recommendations as to how training should be organised.<sup>85</sup> The fundamental changes would move Director of Training's responsibilities for individual training to the CAS's training department with Director of Training to taking over War Training, or operational training. The report arrived on CAS's desk as he was handing over to his brother, Air Chief Marshal Sir Geoffrey Salmond, an occurrence that Walker said was 'rather awkward and ill-timed for the deliberation of such an important piece of work.'<sup>86</sup> Sir Geoffrey Salmond died on 27 April 1933 and was replaced by his brother

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<sup>83</sup> RAFM, *The Air Ministry Organization*, AP 1399, December 1930, p.9.

<sup>84</sup> *Ibid.*

<sup>85</sup> TNA AIR 2/673, War Organization of the Air Ministry, 22 February 1933.

<sup>86</sup> D. Walker, 'Supreme Air Command: The Development of Royal Air Force Command Practice in the Second World War' (PhD Thesis, University of Birmingham, 2017), p.31.

as acting CAS until 22 May 1933 when Air Chief Marshal Sir Edward Ellington took over.<sup>87</sup> Brooke-Popham identified training as a significant area for improvement, particularly in terms of war organisation and expansion measures. This idea of bringing *ab initio* and collective training together under one department as a 'continuum', as Walker described it, was a very strong argument as it linked tactics and threat analysis that were already responsibilities of the CAS department, with training. In sum, training methods and training outcomes would be determined by tactics and become the responsibility of one authority. For various reasons, including a lack of focus generated by the death of Sir Geoffrey Salmond, this did not happen, with *ab initio* training remaining with AMP under Director of Training while CAS was responsible for collective unit training under the Directorate of Staff Duties. One improvement would see the CAS's Deputy Directorate of War Operations receive an increase in personnel.<sup>88</sup>

Although Director of Training remained under AMP, the Department of the CAS's Director of Staff Duties became responsible for three key components of training.<sup>89</sup> Department TW 1 was responsible for the training of fighter and bomber units as well as the development of air tactics; TW 2 the training of crews for Royal Navy aircraft; and TW 3 for Army Cooperation squadrons. AMP's Directorate of Training was divided into six sub-departments with T 1 responsible for *ab initio* training; T 2 for armament training; T 3 for flying regulations; T 4 for seaplane, air pilotage (navigation) and parachute training; T 5 for all other training; and T N for

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<sup>87</sup> Grey, *British Air Policy Between the Wars*, pp.509-13.

<sup>88</sup> RAFM AIR 69, Organisation of the Royal Air Force, June 1934.

<sup>89</sup> RAFM, *Air Force List*, June 1934.

naval training.<sup>90</sup> This rather confusing structure seems to have naval training mirrored in the Directorate of Staff Duties and the Directorate of Training while the latter's flying regulation section would appear to have been more at home in the Directorate of Staff Duties considering one of that Directorate's sections was responsible for publications. What this reorganisation did achieve was to make AMP/Director of Training responsible for individual training and Director of Staff Duties responsible for collective training.

The other challenge faced by the RAF in 1934 according to the then Director of Training, Air Commodore A.W. Tedder, 'was a more than tenfold expansion of the Flying Training Organisation, to meet the growing expansion of the Service.'<sup>91</sup> In 1934, the personnel strength of the RAF was around 30,000 and this had grown to 174,000 by the outbreak of the Second World War in September 1939 and to 1,080,000 by the end of the war in 1945. In essence, the RAF's rather haphazard approach to training in the years up until 1934 had little impact on a peacetime air force, even taking into account the additional squadrons generated and therefore increased training required, by the Home Defence Scheme of 1923.<sup>92</sup> The approach to training, however, would come under increasing pressure from 1934 as a series of expansion plans demanded the training of a growing number of aircrew.<sup>93</sup> This will be examined in more detail in Chapter Seven.

Tedder's appointment as Director of Training marked a shift in policy although pressure from the Treasury did not allow the fulfilment of his aim of undertaking all

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<sup>90</sup> See Table 3, Organisation of the Air Ministry – 1934, p.304.

<sup>91</sup> Lord Tedder, *With Prejudice* (London: Cassell, 1966), p.5.

<sup>92</sup> TNA AIR 19/24, Home Expansion Scheme – 5<sup>th</sup> Revision, dated 1 May 1928.

<sup>93</sup> Robertson, *The Development of RAF Strategic Bombing Doctrine, 1919 – 1939*. See for example Tables II – IX for the scope of the RAF's Expansion Schemes.

operational training at Service Flying Training Schools (SFTS).<sup>94</sup> Where Tedder did succeed, however, was to conduct *ab initio* training in civilian flying schools and that allowed the SFTS to conduct more operational tasks, such as gunnery and 'air bombing' training.

The creation of ADGB reinforced the role of squadrons to undertake operational training such that prior to 1936 and the formation of the RAF's new Command structure, CAS, AMP and squadrons were responsible for conducting aircrew training. This situation changed in 1936 with the formation of Training, Bomber, Fighter and Coastal Commands.<sup>95</sup> In May 1940, Training Command was divided into Technical Training Command and Flying Training Command.<sup>96</sup> The latter held responsibility 'for all aspects of the selection and training of [individual] aircrew' and were responsible for the RAF's Elementary and Service Flying Training Schools (EFTS/SFTS) that conducted non-operational flying training.<sup>97</sup> Although responsible for EFTS and SFTS output, Flying Training Command had no strategic decision-making role to play as this still remained with AMP and under the direction of the Air Council.<sup>98</sup> In many ways this structure worked well at the strategic training level as it provided a platform to discuss training in the wider context of the provision of resources to conduct that training and the general expansion of the RAF. An example of this, which will be discussed in more detail in Chapter Six, was the provision of training aircraft, or more accurately, the shortage of training aircraft. In March 1938,

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<sup>94</sup> TNA AIR 41/4.

<sup>95</sup> RAFM, Formation of RAF Commands, <https://www.rafmuseum.org.uk/research/research-enquiries/history-of-aviation-timeline/british-military-aviation/1936-2/>. Accessed, 21 March 2023.

<sup>96</sup> RAF, [https://www.rafweb.org/Organsation/Cmd\\_H3.htm](https://www.rafweb.org/Organsation/Cmd_H3.htm). Accessed 21 March 2023.

<sup>97</sup> RAFM, <https://www.rafmuseum.org.uk/research/online-exhibitions/taking-flight/historical-periods/training-command/>. Accessed 21 March 2023.

<sup>98</sup> TNA AIR 6/33, 117<sup>th</sup> EPM Minutes, 15 March 1938.

for example, the Air Council was coming to terms with the failure of the De Havilland Don and Miles Mentor, and slow production of the Miles Magister and Airspeed Oxford. The training aircraft situation caused the Chancellor, Sir John Simon, to warn the Air Council that they 'should be exposed to the risk of severe political criticism' if training aircraft could not be provided.<sup>99</sup> As far as operational training was concerned, the creation of Bomber Command theoretically saw that organisation take over the responsibility from frontline squadrons; however although the pressure on frontline squadrons to conduct such training eased over time, it never totally disappeared.

One example of Bomber Command's new training responsibility can be seen in the formation of Group Pool Squadrons to reduce the training conducted by frontline squadrons. In addressing the Air Council in November 1938, the Air Member for Supply and Organisation (AMSO), Air Vice-Marshal W.L. Welsh, said of pilots joining their first frontline squadron after leaving SFTS:

They had neither the general flying experience nor the proficiency in handling their equipment to make them fit for general operations. As a result, their training had to be completed by squadrons and this tended to lower the morale of squadrons particularly when accidents, due to the inexperience of pilots occurred.<sup>100</sup>

These Group Pool Squadrons were the forerunners of Bomber Command's Operational Training Units and Heavy Conversion Units and marked a significant evolution in the way crews were trained. This will be examined more fully in Chapters Six, Seven and Eight.

Although the operational training responsibilities taken on by Bomber Command were welcomed from the perspective of training being able to reflect

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<sup>99</sup> TNA AIR 6/33, 117<sup>th</sup> EPM Minutes, 15 March 1938.

<sup>100</sup> AHB, 141<sup>st</sup> EPM Minutes, 1 November 1938.

operational lessons, the real benefit for training came with the appointment of an Air Member for Training (AMT). Just as the importance of operational training was being recognised, so too was the need to appoint an individual that could oversee all aspects of training at Air Council level. During an Air Ministry meeting in June 1940, the Secretary of State for Air (Sinclair) told attendees that ‘the biggest question of all which the Air Ministry were faced at the present time was the production of pilots and crews.’<sup>101</sup> Sinclair stated that ‘it was desirable to appoint an officer who would execute control of training in all its aspects’ and ‘would be a Member of the Air Council,’ with ‘direct access to the Secretary of State.’ The first three priorities for the new Air Member for Training were to firstly increase ‘immediately’ the number of OTUs; secondly, increase the output of wireless operators/air gunners; and thirdly, to reappraise the Empire Air Training Scheme. Five days after this meeting an Order in Council was promulgated to change the constitution of the Air Council to include an AMT.<sup>102</sup> The remit afforded this new member was significant and included responsibility for ‘the Royal Air Force training programme and for all questions of training policy,’ including ‘operational and school training,’ to include ‘Flying Training and Technical Training Commands.’<sup>103</sup> This remit was of strategic importance in that it placed training on a war footing and recognised that aircrew were of little importance if Technical Training Command were not generating trained technical ground crew to support their aircraft. AMT had an holistic view across the complete gamut of RAF training. AMT’s appointment also marked a major change in the way that the RAF considered operational training when it stated that the AMT was ‘to

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<sup>101</sup> TNA AIR 2/4550, Notes of a Meeting Held on the 21 June 1940, dated 24 June 1940.

<sup>102</sup> TNA AIR 2/4550, Order in Council, 26 June 1940.

<sup>103</sup> TNA AIR 2/4550, Air Ministry Draft Office Memorandum, 27 June 1940.

ensure that the training programme as a whole is adequate to meet operational requirements.’ The management of training would be discussed at regular training progress meetings chaired by the AMT. On 28 June 1940 Sinclair appointed Air Vice-Marshal A.G.R. Garrod to the post. Described as ‘an enthusiast for pressing new ideas to practical conclusions,’ Garrod remained as AMT until April 1943, when he was replaced by Air Marshal Sir Peter Drummond.<sup>104</sup>

### **The Secretariat**

In writing of Sir Maurice Hankey, the Cabinet Secretary from 1912 until 1938, Higham encapsulates the benefits of the role of the Civil Service in providing ‘an orderliness and consistency to grand strategy’.<sup>105</sup> Sir Maurice Dean, who served in the Air Ministry from 1929 and throughout the Second World War in a variety of roles, including CAS’s Private Secretary and Head of the Secretariat, referred to the Air Ministry’s adoption of the Admiralty’s ‘bedded-out secretariat’ system that saw civil servants attached to service members of the Air Council.<sup>106</sup> Dean described the relationship between the Civil Service and serving officers in the Air Ministry as ‘excellent’ although, as Grey pointed out, the RAF was ‘controlled by...Civil Servants...and Civil Servants represent the Treasury...[and] the Treasury holds the purse strings...’.<sup>107</sup> This was a point echoed by Taylor who concluded that defence

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<sup>104</sup> *Oxford Dictionary of National Biography*, entry for AVM AGR Garrod. <https://www.oxforddnb.com/view/10.1093/ref:odnb/9780198614128.001.0001/odnb-9780198614128-e-33338?rskey=ezeYXy&result=2>. Accessed, 29 October 2021.

<sup>105</sup> Higham, *Two Roads to War*, p.287. Hankey was also the Secretary of the Committee of Imperial Defence.

<sup>106</sup> Dean, *The Royal Air Force and Two World Wars*, p.282.

<sup>107</sup> Grey, *A History of the Air Ministry*, p.100.



policy was run from the Treasury.<sup>108</sup> In fact, despite extolling the ‘excellent’ working relationship between the RAF officers and Secretariat, Dean acknowledged that:

The fact is that during the Twenties and Thirties defence policy was run by the Cabinet Office and the Treasury, in effect by Hankey and Fisher. An illustration of this can be found in the fact that when re-armament began to be considered in 1933 the first Defence Requirements Committee was composed of Hankey (Chairman), Vansittart (Permanent Under-Secretary of State for the Foreign Office), Fisher for the Treasury and the three Chiefs of Staff.<sup>109</sup>

As this chapter has shown, the financial impact on the development of training within the RAF was a major retardant, a point echoed by Lord Tedder in his book, *With Prejudice*. Tedder highlighted the ‘Ten Year Rule’ as that ‘ingenious rule...which had served as a perfect alibi for inaction...’.<sup>110</sup> Tedder ameliorated this view later in the book when describing his time as Director of Training under the AMP. He said that, ‘[o]ver a period of years, the Secretariat under the Air member had acquired immense power which was exercised quite justifiably to ensure maximum economy.’<sup>111</sup> Tedder’s views written in 1966 are more representative of those of a CAS than perhaps of a frustrated Air Commodore Director of Training with significant previous tours in a Flying Training School, Air Armament School and as Deputy Director of Training in the Air Ministry.<sup>112</sup>

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<sup>108</sup> A.J.P. Taylor, *English History 1914-1945* (Oxford: Clarendon Press, 1965), p.130. Although dated, Taylor provides interesting insights to the characters of the day and their inter-relationships with others.

<sup>109</sup> Dean, *The Royal Air Force and Two World Wars*, pp.101-3. Sir Maurice Hankey was the Cabinet Secretary and Chairman of the DRC and noted for his anti-RAF views. Sir Robert Vansittart was the Head of the Foreign Office and Sir Warren Fisher, Head of the Treasury.

<sup>110</sup> Lord Tedder, *With Prejudice*, p.3.

<sup>111</sup> *Ibid.*, p.5.

<sup>112</sup> *Oxford Dictionary of National Biography*, Lord Tedder. Accessed, 24 April 2014.

The direct financial control described by Grey, Dean and Taylor, and to a lesser extent by Tedder, becomes apparent when considering the role of the Permanent Under Secretary within the Air Council. This senior civil servant was:

...responsible for financial advice and the control of all expenditure, for accounting to Parliament for the expenditure of public money and stores, and for the supervision of the contracts organisation. He is also Secretary to the Air Council and is responsible for supervising the efficient working of the Air Ministry as a Department of State, [and] for the coordination of its business...<sup>113</sup>

In addition, the Permanent Under Secretary was also responsible for accounting, contracts, recruiting and the establishment of civilian staff and press relations. When compared to the CAS, the real power at the heart of the Air Ministry was clearly in political, not military hands. This is an important factor to bear in mind when assessing the development of operational capabilities, including training, in the inter-war period and early years of the Second World War.

A review of the biographies of any senior military leader during the Second World War highlight the long hours that were being worked. The same can be said of the Civil Service within the Air Ministry and this raises the issue surrounding the efficacy of decision-making. In 1937, the Head of S1, L.G.S. Reynolds, who amongst other areas, was responsible for civil service recruitment, wrote a report in which he warned against 'fatigue of the higher staff in the departments which would require to function under the greatest pressure on the outbreak of war.'<sup>114</sup> Reynolds went on to raise the problem of recruiting enough civil servants during a period when other ministries – such as those for National Service and Supply – were being formed and

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<sup>113</sup> TNA AIR 19/145, The Organisation of the Air Ministry, 8 January 1940.

<sup>114</sup> TNA AIR 2/4233, Manning Report from L.G.S. Reynolds, S.1 to Abraham and Spaight, 14 June 1937.

needed staffing. Reynolds' concern about a shortage of staff was reiterated in a further report that was issued just over two weeks later. In it, he emphasised that senior staff were 'suffering from fatigue' and that the Committee could not 'certify that the Civil Branches of the Air Ministry are in a state of readiness for war.'<sup>115</sup> The situation was perhaps more grave than Reynolds stated. The same file shows the draft Committee Report in which the phrase, 'the inadequacy of the existing staff' was removed before publication.<sup>116</sup> This, and subsequent Air Ministry manning reports, paint a bleak picture in the run-up to war. Ironically, the report, dated 23 June 1938, contains a note that stated that the publication of the report '...has been unavoidably delayed owing to the pressure of work...'<sup>117</sup> This staffing and fatigue issue is an important one and when balanced against the lack of Andover trained officers filling staff posts highlights that the Air Ministry departments that were looking after operational training were not operating as efficiently as they might have been.

The Secretariat was certainly behind its expected war footing preparations that were scheduled to be completed in the autumn of 1936.<sup>118</sup> According to J.M. Spaight, the Air Ministry's Principal Assistant Secretary, this would require the Air Ministry civil service staff to be doubled to 4,000 by the outbreak of war.<sup>119</sup> How the date of the outbreak of war was to be determined was not specified. The uncertainty of the period is perhaps a little difficult to grasp even given the benefits of hindsight but the 1936

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<sup>115</sup> TNA AIR 2/4233, 5<sup>th</sup> Report – Committee on War Organisation of Civil Side of the Air Ministry, 29 June 1937.

<sup>116</sup> TNA AIR 2/4233, 5<sup>th</sup> Report – Committee on War Organisation of Civil Side of the Air Ministry, 29 June 1937.

<sup>117</sup> TNA AIR 2/4233, 7<sup>th</sup> Progress Report – Committee on War Organisation of Civil Side of the Air Ministry, 23 June 1938.

<sup>118</sup> TNA AIR 2/1658, Memorandum from C. LI. B. dated 13 May 1935 ordering the establishment of a committee under J.M. Spaight to oversee putting Air Ministry civil servants on a war footing by autumn 1936.

<sup>119</sup> TNA AIR 2/1658, Memorandum, J.M. Spaight to C.LI.B. 7 June 1935.

Defence White Paper certainly provided a nexus to prioritise plans. As the document was being drafted, the Cabinet Secretary (Sir Maurice Hankey) wrote a letter to the President of the Privy Council (Ramsay MacDonald) in which he referenced the complexity and costs of modern weapon systems and the need to concentrate 'on the real immediate problem – Supply and Productive Capacity [of aircraft] and the more controversial and doubtful issues would be relegated as much as possible into the background.'<sup>120</sup> It is not clear what the 'more controversial and doubtful issues' were that Hankey referred to but the general correspondence surrounding the 1936 Defence White Paper showed the power of the politicians and particularly the Secretariat in not only defining defence strategy but also equipment procurement. The inference of course is that the production of aircraft took priority and scant consideration was afforded to the training pipeline that was designed to generate crews. MacDonald stated that 'military requirements in relation to international conditions [are] changing almost from day to day.'<sup>121</sup> The President of the Privy Council went on to warn against the need for procurement and wanted spending to be under 'constant review so as to save very serious national waste, and avoid giving an impetus to a competition in arms and a consequent encouragement to war mentality.'<sup>122</sup> It is difficult to see how a robust training pipeline could be established with policy being subject to 'constant review'. But an awareness of budgets was not only the remit of the civil service, the Treasury and the politicians.

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<sup>120</sup> TNA PREM 1/192, Letter Cabinet Secretary to President of the Privy Council, 21 February 1936.

<sup>121</sup> TNA PREM 1/192, Letter from President of the Privy Council to the Cabinet Secretary, 14 February 1936.

<sup>122</sup> *Ibid.*

In April 1937, the AMP, Air Vice-Marshal Bowhill, issued a memorandum to the Air Council in which he proposed increased navigation training for pilots both at the Service Flying Training School (SFTS) and, within squadrons, 'to make them competent navigators'.<sup>123</sup> Bearing in mind the clear requirement for adequate navigation training given the orders placed for long range bombers such as the Stirling and Halifax as well as extant aircraft, and the prevalent doctrine of strategic bombing, this training was dismissed on cost grounds.<sup>124</sup> At a subsequent meeting in June, the CAS (Ellington) stated that, although supporting such training, the navigation discussions had to wait until the 'financial implications [were] studied', a clear indication that Service personnel were manifestly aware of the financial pressures that they had to work under.<sup>125</sup> Given the RAF's doctrine placing the bomber at the forefront of its strategy, it is perhaps surprising that Ellington did not push the case for increased navigation training more strongly.

## **Conclusion**

Although the structure and organisation of the Air Council and Air Ministry evolved dramatically between 1922 and 1942, they had their roots 'in the circumstances of their birth'. This, even in the most generous of terms, was haphazard and chaotic. Although historians, such as Higham and Orange, have criticised the RAF's senior officers, there is evidence to indicate that there was a lack of technical awareness and a real recognition about the type of training required as well as the methods that should be adopted to deliver it in order to make the RAF's doctrine a workable

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<sup>123</sup> TNA AIR 6/30, 82<sup>nd</sup> Air Expansion Committee Meeting, 6 April 1937.

<sup>124</sup> Thetford, *Aircraft of the Royal Air Force Since 1918* provides details of RAF aircraft that operated between 1918 and 1945.

<sup>125</sup> TNA AIR 6/30, 83<sup>rd</sup> Air Expansion Committee Meeting, 1 June 1937.

proposition. In addition, too much emphasis was being placed on conducting operational training in frontline squadrons. To an extent, these shortcomings were hidden during the lean years prior to and through the early years of expansion; but with expansion schemes accelerating, the Air Ministry had to alter its organisation to promote increased training efficiency. The first step was to differentiate between individual and collective training. The former came under the AMP's Director of Training and the latter became the responsibility of the CAS's Director of Staff Duties. As Director of Training between 1934 and 1936, Tedder must take major credit for overhauling flying training although, as ever, Treasury pressure meant not all of Tedder's plans could be brought to fruition. The importance of training was really recognised in July 1940 with the creation of the Air Member for Training to sit on the Air Council. This provided a central focal point for all training matters associated with RAF ground and aircrew and denoted a significant improvement to the way that training was organised and viewed prior to Garrod's appointment. Despite these structural and organisational improvements, some operational training was still being undertaken in service squadrons up until 1939 and, in many cases, much later.

Although criticism can be directed at the leadership and management of the inter-war Air Ministry, this Chapter has shown that the majority of the Air Ministry's staff were from the Secretariat with their responsibilities being both political and financial. As Grey has said, operational policy was directed by the Treasury. Add to this, the paucity of Andover staff college graduates working in staff positions within the Air Ministry, the over-stretched Secretariat and the residual influence of older ex-Army and Royal Navy senior officers, the so-called 'Victorian effect', and it can be seen that the challenges to efficiency were clearly great. Despite these limitations, a

new generation of senior officers, such as Tedder, who could provide vision and inspiration without the encumbrance of dogma, together with middle ranking and junior officers, many of whom had operational flying experience on modern aircraft and with a more technical view of aviation, managed to create a robust operational training system by 1942. The organisation and structure needed for the Air Ministry to give direction and provide policies for its operational training activities between 1922 and 1942 certainly evolved but this was clearly a case of evolution through necessity.

## CHAPTER SIX

### PILOT TRAINING - 1922 TO JULY 1941

#### Introduction

Formed on 1 April 1918, the RAF had no traditions of its own and was trying to master the practical aeronautical technicalities of science that was not yet two decades old.<sup>1</sup> As Chapter One has highlighted, its difficulties were compounded by 'Government indifference' to its continued existence and 'hostility' to the creation of independent source of air power from the Royal Navy and British Army.<sup>2</sup> In November 1918, the Service had 290,000 officers and men and 80 training squadrons to support nearly 200 operational squadrons.<sup>3</sup> By March 1921 this had reduced to 27,900 officers and men, and a total of 28 squadrons, six of which were at cadre strength.<sup>4</sup> The RAF was in a state of flux and this situation was, as David Jordan has said, 'set against a backdrop of financial austerity,' a situation exemplified by the '10 Year Rule'.<sup>5</sup> Adopted in 1919, the rule stated that: 'It should be assumed, for framing revised Estimates, that the British Empire will not be engaged in any great war during the next ten years, and that no Expeditionary Force is required for this purpose.'<sup>6</sup> From a training perspective, shifting establishments and priorities made defining a working pilot training pipeline almost impossible. With

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<sup>1</sup> T. Mansell, 'Flying Start: Educational and Social Factors in the Recruitment of Pilots of the Royal Air Force in the Interwar Years,' in *History of Education*, Vol.26, No.1, 1997, p.72.

<sup>2</sup> Dean, *The Royal Air Force and Two World Wars*, pp.33-34.

<sup>3</sup>*Ibid.*, p.33.

<sup>4</sup> D. Wragg, *RAF Handbook 1939-1945* (Stroud: Sutton Publishing, 2007), p.3 and Phillpot, *The Royal Air Force – An Encyclopaedia of the Interwar Years: Volume 1, The Trenchard Years 1918 to 1929*, p. 1892 and p. 1943.

<sup>5</sup> D. Jordan, 'The Air Defence of Great Britain: An Overview, 1920-1936', *Air Power Review*, Vol 21, No 1, 2018, p. 141.

<sup>6</sup> TNA CAB 23/15/616A, War Cabinet Minutes of a meeting held at 10 Downing Street on 15 August 1919.



a glut of First World War pilots and observers available, the need to generate aircrew in the short-term was not considered a priority.

By December 1922, the RAF comprised 32 squadrons, TEN in the United Kingdom and 22 overseas, which were supported by 30,000 officers and men.<sup>7</sup> In March 1934, prior to the implementation of Expansion Scheme A, this had grown to a total of 42 home-based squadrons, including 28 bomber squadrons, and by September 1939, had increased again to 39 operational bomber squadrons.<sup>8</sup> By 1 May 1945, RAF personnel had increased to 1,079,835 officers and men, of which 193,313 were aircrew [17.9%]; a massive expansion of the training burden.<sup>9</sup> It is worth reiterating that when the Second World War ended in Europe in May 1945, Bomber Command alone had 98 squadrons equipped with 2,856 aircraft.<sup>10</sup> In addition, another 1,164 aircraft were used by the Command for training and these equipped 16 Operational Training Units (OTU) and 12 Heavy Conversion Units (HCU). To this list must be added a number of aircraft operated by smaller training units, such as Bomber Defence Training (BDT) Flights and the Bomber Command Instructors' School at RAF Finningley.

The nearly 29% of Bomber Command's aircraft strength being used for operational training in 1945 provides an indication of the training resources and effort required to resource the strategic bombing force's training pipeline. The size of that training effort could also be seen in the hours flown. In June 1944, for example, Bomber Command flew 44.2% of its total hours on operations, 38.5% were

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<sup>7</sup> RAFM, Air Force List, 1922.

<sup>8</sup> Webster & Frankland, *The Strategic Air Offensive Against Germany 1939-1945*, Vol. IV, Appendix 38 and J.M. Spaight, *The Sky's The Limit* (London: Hodder & Stoughton, 1940), p.25.

<sup>9</sup> Terraine, *The Right of the Line*, p.681.

<sup>10</sup> Webster & Frankland, *The Strategic Air Offensive Against Germany 1939-1945*, Volume IV, Annexes & Appendices, Appendix 38.

generated by OTUs and 17.3% by HCUs, giving a combined total operational flying training time of 55.8%.<sup>11</sup> This training element grew in parallel with the growth of the operational main force over time and evolved in both quality and content to keep pace with new technologies and tactics as they evolved, and this will be examined in greater detail below from August 1941, in Chapter Seven. An example of this new, technology driven, training can be seen in Bomber Command's adoption of navigation and bombing aids such as H2S, Gee and Oboe as well as defensive aids, most notably Monica.<sup>12</sup>

How that expansion took place to accommodate pilot manning requirements up until the formation of the first Heavy Conversion Flights (HCF) in August 1941 will be the focus of this chapter.<sup>13</sup> It will examine how pilots were trained in the RAF between 1922 and August 1941 with specific focus on operational training in Bomber Command. As the figures above highlight, the pressures on the training pipeline increased massively following the collapse of the *Conference for the Reduction and Limitation of Armaments* (latterly referred to as the *Geneva Disarmament Conference*) that took place between 1932 and 1934 and the subsequent introduction of the Expansion Schemes.<sup>14</sup> The other key factor in expansion was the rise of the Nazi Party and the coming to power of Adolf Hitler in Germany in January 1933, along with the associated threat that this posed.<sup>15</sup> The latter was exemplified by Germany's withdrawal from the *Geneva Disarmament Conference*, and the League of Nations in October 1933.<sup>16</sup>

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<sup>11</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-1944*, AMT, January 1945.

<sup>12</sup> Withington, 'Bomber Command's Electronic Warfare Policy and Suppression of Enemy Air Defence Posture During the Second World War'.

<sup>13</sup> Sturtivant, *RAF Flying Training and Support Units Since 1912*, p.12.

<sup>14</sup> TNA CAB/23/77 Cabinet Meeting Minutes, 8 November 1933.

<sup>15</sup> J.M. Roberts, *Europe 1880-1945* (Harlow: Pearson Education, 2001), p.375.

<sup>16</sup> <https://www.politico.com/story/2013/06/this-day-in-politics-092520>. Accessed, 8 October 2020.

In addressing how these events led to the expansion of the RAF's bomber force between 1922 and August 1941 and the subsequent growth and evolution of training methods, this chapter will analyse chronologically how operational training evolved to keep pace with the increased pilot throughput required for a growing bomber fleet, an evolving strategic bombing doctrine and the adoption of new technologies, such as multi-crew, four-engine bombers. The three chronological periods selected for this chapter broadly follow those of the Air Historical Branch's *The RAF in the Bomber Offensive Against Germany* narrative but with some modification. The pre-war evolution up until September 1939 will be examined in two phases: the first will consider the post-First World War rebuilding period from 1922 until Expansion Scheme A was approved by Cabinet in July 1934.<sup>17</sup> The second will cover the expansion of the RAF, concluding with the outbreak of war in September 1939. This chapter will then turn to the operational training that took place during Bomber Command's initial restricted bombing and conservation phases and its transition to unrestricted operations. This third period also covers the expansion of the OTU training process and what can be termed the professionalisation of operational training. This was marked by the realisation by Bomber Command that additional training was required to better prepare crews for employment within four-engine heavy bomber squadrons, the establishment of Heavy Conversion Flights (HCF), later becoming Heavy Conversion Units (HCU).

As this chapter will show, the RAF's hopes for the bomber were not initially underpinned with sound technologies, tactics or training methods to fulfil its expectations. With little experience to draw upon, dogma was often the sole driving force in assisting the development of bomber force doctrine. That doctrine had to be

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<sup>17</sup> Robertson, *The Development of RAF Strategic Bombing Doctrine*, Appendix, Table II, p. 169.

matched by a sound operational aircrew training pipeline and, as this chapter and Chapter Seven will show, as operational experience was accrued and lessons learned, operational training became more focussed and relevant. As both advanced in parallel, it is natural for this Chapter to analyse developments in chronological terms so as to link training's response to changing threats, the adoption of new technologies and tactics, growing operational experience and, as discussed in Chapter Four, the gradual replacement of older, mid-ranking officers steeped in the traditions of the Victorian and Edwardian eras with younger and more technologically aware officers, some of whom had current operational experience.

### **1922-1934 Rebuilding the Force**

When the Secretary of State for Air, Winston Churchill, presented the *Permanent Organization of the Royal Air Force* memorandum to Parliament in December 1919, its author, CAS Hugh Trenchard, had been circumspect in not asking for large sums of money to fund the Service but instead '...laying the foundations of a highly trained and efficient force...'.<sup>18</sup> In referring to 'the extreme importance of training', Trenchard outlined the requirements for a cadet college at Cranwell, a gunnery school at Eastchurch, an 'air pilotage' (navigation) school at Calshot, a staff college at Halton (later established at Andover in 1922) and the training of technical apprentices at Halton.<sup>19</sup> Trenchard also highlighted the importance of building a reserve of pilots and this was to be done through the Short Service Commission (SSC) initiative where, after learning to fly, pilots were sent to a squadron and on retirement, remained on the reserve list where they received supplementary refresher training every year. In a paper published by RUSI in 1931, the then Squadron Leader John

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<sup>18</sup> TNA AIR 8/97, Cmd. 467. *Permanent Organisation of the Royal Air Force*, 11 December 1919.

<sup>19</sup> *Ibid.*, p.6.

Slessor said that the RAF was 'building up from the bottom a permanent regular Service out of the ruins of our great war time air power.'<sup>20</sup>

As discussed in Chapter One, the technical difference between RAF aircraft at the end of the First World War compared to those at the beginning of the Second World War was massive. During the First World War little specialist type training was required for fighter and bomber pilots. This led to the concept of the 'universal pilot' who could operate a Hawker Fury fighter or a Hawker Hart day bomber in the early 1930s, such was their similarity. By 1941, the idea of a pilot capable of successfully flying and fighting both the Spitfire monoplane fighter and Stirling heavy bomber was considered ridiculous because of their differing complexities and handling characteristics. However, as this Chapter will show, it took the RAF a considerable time to appreciate this changing technological paradigm.

The need for aircraft type training at specialist schools was clear but during the interwar years the technical differences and performance of the Fury and Hart were on par and with no real technical issues to address. The majority of operational training was conducted in the service squadrons. In many ways, this was the same training environment that existed at the end of the First World War, despite vociferous objections from Squadron Commanders in France at the time.<sup>21</sup> Pilots were trained to fly but generally received no operational training prior to their posting to their front line squadrons.<sup>22</sup> This situation prevailed until the establishment of Group Pool Squadrons/Operational Training Units in 1939 and 1940 respectively.<sup>23</sup> It is worth considering where the operational training pipeline that was managed and

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<sup>20</sup> J.C. Slessor, 'The Development of the Royal Air Force', *JRUSI*, 1 February 1931, Vol. 76, pp.324-5.

<sup>21</sup> TNA AIR 1/997/204/5/1241, AHB, Training of Pilots and Observers, February 1917.

<sup>22</sup> TNA AIR 1/1135/204/5/2224, Letter OC 22 Sqn. to HQ 9 Wg., 14 September 1917.

<sup>23</sup> TNA AIR 2/4168 loose minute from Air Commodore R.P. Willock, DSD to HQ Bomber Command, September 1939.

conducted in operational squadrons obtained its pilots and what level of experience these pilots possessed; in other words, what was the operational training pipeline entry standard?

By 1923, the RAF was getting its pilots from three main sources: the Cadet College at Cranwell, Short Service Commission (SSC) officers and Non Commissioned Officers (NCO).<sup>24</sup> Trenchard's vision was that all officers in the RAF should be trained as pilots first and then remain as pilots or undertake duties in another branch, such as engineering or armaments, before returning to flying duties. Cranwell was a two-year course that was designed to provide the RAF with its regular, permanent commissioned officers.<sup>25</sup> Following a successful entrance examination, interview and medical, students, aged 17½ to 19 years of age (later 19½), started the two year course.<sup>26</sup> The RAF was aiming to get 120 graduates from Cranwell every year and on leaving, having flown a 'service aeroplane' prior to joining their squadrons. Mansell has however stated that, between 1934 and 1939, 'Cranwell's entry consisted of 391 cadets'.<sup>27</sup> Typically, a newly commissioned pilot would arrive at his squadron with only a handful of hours as an observer and around 40 hours as a pilot, both dual and solo.<sup>28</sup> The newly commissioned regular officer would then be posted to a metropolitan or overseas squadron for a period of around five-and-a-half years where operational training would be undertaken before further postings to develop his RAF career.

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<sup>24</sup> P.B. Joubert de la Ferté, 'The Supply and Training of Officers of the Royal Air Force in Time of War', lecture given on 21 November 1923, reprinted in *JRUSI*, 1 February 1924, Vol.69, pp. 37-51.

<sup>25</sup> *Ibid.*, pp.40-43.

<sup>26</sup> Air Notes, in *JRUSI*, Volume 70, 1925, pp. 585-6. The original age requirement was 17½-19 in 1920, increasing to 19½ in 1925. For fees, see C. Finn, 'The Flight Cadet Era', in *Royal Air Force Historical Society Journal*, Volume 65, 2016, p. 43.

<sup>27</sup> A. Mansell, 'Professionals, Amateurs and Private Armies – Pilot Entry Portals in the RAF Expansion 1934 to 1939,' *The Proceedings of the Royal Air Force Historical Society*, Issue 11, 1993, p.52.

<sup>28</sup> D. Brook, 'My Father's Pilots Flying Log Book, Cranwell and India, 1920-26', *Royal Air Force Historical Society Journal*, Vol. 63, 2015, p. 130.

Turning to SSC officers in the 1920s, following an interview and medical examination, candidates were granted a probationary commission and posted to a Flying Training School (FTS) for a year's course comprising 'ground training in discipline, stores, pay, accounting, meteorology, navigation and armament,' in addition to being, 'taught to fly a Service aeroplane'.<sup>29</sup> The flying training element of the course comprised ten hours dual and 50 hours solo flying. Civilians could apply for a SSC if they were aged 19-25. Posted to a squadron for the remaining four years of their five year SSC term, the individual was promoted on the strength of the marks he obtained at FTS; a somewhat odd benchmark that failed to address leadership and organisational abilities. At the end of his operational tour, the pilot was placed on the reserve for four years and paid a £375 gratuity [worth £30,000 in 2023 prices]. During this time, he underwent annual refresher flying at a civilian flying school and had to complete 12 hours solo. For this annual training he was paid for 24 days as a Flying Officer on top of an annual bounty of £30.<sup>30</sup> With an option to extend his time on the reserve in four year periods up until the age of 40, SSC officers provided a steady source of pilots to fulfil Trenchard's vision of maintaining a reserve, at least before any expansion plans were added. Entry and training for officers from university that began in 1925 was very similar to that received by SSC officers and during the mid-1920s, the RAF aimed for 12 graduates per year but normally only 'obtaining three or four'.<sup>31</sup> The formation of University Air Squadrons (UAS) provided not only pilots but also potential engineering officers.<sup>32</sup>

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<sup>29</sup> TNA AIR 10/1772, *R.A.F. Standard Note Book for Ab Initio Flying Training Schools*, AP 1388, December 1929, provides a full syllabus.

<sup>30</sup> Joubert de la Ferté, 'The Supply and Training of the Royal Air Force in Time of War', p.44.

<sup>31</sup> *Ibid.*, p.40.

<sup>32</sup> Mansell, 'Flying Start: Educational and Social Factors in the Recruitment of Pilots of the Royal Air Force in the Interwar Years,' p.83.

NCO pilots were drawn from ground trades and their training mirrored that of SSC pilots and pilots drawn from the university stream. After flying for four to six years the NCO pilot would revert to his ground trade or, if they had lost skills in that ground trade, would become a Group Five tradesmen (unskilled) NCO or 'will be discharged' the Service.<sup>33</sup> The latter comment from Joubert de la Ferté reflects a harsh environment for NCOs and highlighted the way commissioned and non-commissioned pilots were socially stove-piped by the RAF, especially during the inter-war period. For those luckily enough not to be discharged, as of 1 January 1927, 'in order to maintain the reserve of pilots', NCO airmen will maintain flying currency, and 'in emergency, for flying duty during the remainder of their existing engagements'.<sup>34</sup> During this period, around 20-35% of RAF pilots were NCOs and this grew in the period immediately before and during the Second World War.<sup>35</sup> This early figure is supported by Wing Commander MacLean, in a RUSI lecture in November 1934, when he stated that around 20% of pilots were NCOs.<sup>36</sup>

Although the early years of the RAF have frequently been referred to as the 'uncertain years' or the 'locust years,' the Service was certainly boosted by its success in air control operations in India and the Middle East, and the call to increase the size of the metropolitan air force or Home Defence Force (HDF), in the face of a perceived threat from France.<sup>37</sup> The HDF expansion called for an additional 52 squadrons, and despite not being met in the timeframe expected, this initiative did create a need for more pilots from 1923 onwards as well as the need to boost the

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<sup>33</sup> Joubert de la Ferté, 'The Supply and Training of the Royal Air Force in Time of War', p.50.

<sup>34</sup> RAFM, AMWO 660, 9 December 1926.

<sup>35</sup> James, *The Paladins*, p.251, Table 10C.

<sup>36</sup> Wg. Comd. L.L. MacLean, 'The Royal Air Force Training Year at Home', *JRUSI*, Vol.80, 1935, p.51.

<sup>37</sup> Dean, *The Royal Air Force and Two World Wars*, pp.33-42.



reserve.<sup>38</sup> Frequently overlooked, the HDF expansion superseded a provisional scheme 'for the creation of a force of 15 squadrons for Home Defence' from the Air Staff.<sup>39</sup> This planned expansion and subsequent pilot shortage led to the Auxiliary Air Force (AAF) and Air Force Reserve Bill being passed in Parliament in March 1924 to enable the RAF to establish more squadrons.<sup>40</sup> In addition to the AAF, the Bill called for the establishment of Special Reserve Squadrons (SRS) manned by 'Special Reservists' that eventually formed cadre squadrons.<sup>41</sup>

Considering the organisations that trained the various types of pilots, Cranwell was self-contained. SSC and NCO pilots received their initial training at an FTS and by April 1920, there were six FTS, one of which was in Abu Sueir, Egypt (4 FTS). From May 1923, the first of five civilian flying schools were established to provide refresher training for SSC and other reserve pilots, most usually those that had served during the First World War. Known as Reserve Flying Schools, these organisations also undertook *ab initio* training for direct entry into the Reserve of Air Force Officers (RAFO). Training for the AAF was mostly *ad hoc* and generally undertaken within the squadrons although in theory, all applicants for AAF pilots should have possessed a pilot's licence.<sup>42</sup> SRS flying training was also conducted by the unit as was that at the UAS.

In terms of the RAF's total pilot numbers, James records the following:

1922	Regular 246	Reserve 362
1925	Regular 424	Reserve 348
1927	Regular 502	Reserve 400

<sup>38</sup> Jordan, 'The Air Defence of Great Britain: An Overview, 1920-1936', pp.147-48.

<sup>39</sup> J.C. Slessor, 'The Development of the Royal Air Force', *JRUSI*, Vol.76, February 1931, p.327.

<sup>40</sup> TNA AIR 8/97, Auxiliary Air Force and Air Force Reserve Bill, 5 March 1924.

<sup>41</sup> TNA AIR 8/97, Memorandum by the Secretary of State for Air to the Air Council, 3 March 1924.

<sup>42</sup> L. Hunt, *Twenty-One Squadrons – The History of the Royal Auxiliary Air Force 1925-1957* (London: Garnstone Press, 1972), pp.17-21.

1929	Regular 542	Reserve 490
1931	Regular 581	Reserve 569
1933	Regular 668	Reserve 586
1935	Regular 627	Reserve 578 <sup>43</sup>

So far, we have only considered the source of the RAF's pilots and their *ab initio* training; in other words, the standard thought necessary to introduce them to the operational training pipeline. By 1934, pilots were joining their operational squadrons with around 100-150 flying hours and around 300 pilots per year were graduating from Cranwell and the FTSs.<sup>44</sup> It is important to note that these pilots were trained only on single-engine aircraft and, therefore, there was a significant training gap between the newly arrived pilot in a twin-engine night bomber squadron and his ability to fulfil his operational duty, particularly in terms of long-range navigation, heavy multi-engine aircraft handling and night flying were concerned. The responsibility of closing this gap fell to the operational squadron.

### **1922-1934 Operational Training**

As highlighted above, operational training was conducted in the operational squadron. This was clearly not an ideal situation as the operational readiness of the squadron was compromised by having under-trained personnel within its order of battle. Wing Commander MacLean said in his RUSI presentation in November 1934 that the service squadron was 'saddled with a very heavy load of purely flying training before it can commence its more real work of navigation, air fighting, and bombing.' That training also included conversion to twin-engine night bomber operational aircraft, such as the Hyderabad or Heyford.<sup>45</sup> MacLean continued:

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<sup>43</sup> James, *The Paladins*, p.251, Table 10C.

<sup>44</sup> TNA AIR 10/5551, AP 3233 *Flying Training Vol. I, Policy and Planning*, p.13.

<sup>45</sup> Wg. Comd. L.L. MacLean, 'The Royal Air Force Training Year at Home', p.58.

This advanced training in flying is no negligible item in the annual training programme of the Service squadron, and falls particularly heavily on the twin-engine night flying squadrons. It will become more of a problem still if night flying becomes universal and squadrons have to train as day-night bombers, and if speed and weight of aircraft generally increase.<sup>46</sup>

Although being 'saddled' with this training role was a distraction, it had the major benefit of reducing costs and, given that the interwar RAF was under fiscal as well as political pressure, perhaps denuded operational readiness was a small price to pay for survival? As AP 3233 stated, this approach was certainly a 'further measure of economy' however there were also experiential and cultural factors at play.<sup>47</sup> This situation altered significantly with expansion from 1934 onwards and this will be examined later but it is worth noting here that not all officers had an appreciation of the importance of operational training nor the technicalities of multi-engine aircraft:

Experience in the last war showed that an officer was quite capable of carrying out the duties of a war-time pilot after a total flying time of 40 hours, which, of course, can be compressed into a relatively short space of time.<sup>48</sup>

Joubert's comments are at odds with MacLean's on advanced training and that highlighted the uncertainty of how the RAF intended to use their bomber force; day bombing, night bombing, or a combination of the two, seemed to leave all options open and therefore made defining an operational training curriculum more challenging. Such a lack of clear policy had a detrimental effect on trying to determine the training objectives and output standards of the operational training pipeline. Joubert, on the other hand, talks of a 'compressed' 40 hour flight training period that perhaps reflects the Old-Harroviaan's mindset when it came to an

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<sup>46</sup> Wg. Comd. L.L. MacLean, 'The Royal Air Force Training Year at Home', p.58.

<sup>47</sup> TNA AIR 10/5551, AP3233, *Flying Training, Volume, Vol. 1 Policy and Planning*, p.7.

<sup>48</sup> Joubert de la Ferté, 'The Supply and Training of the Royal Air Force in Time of War,' p.45.

appreciation of evolving aeronautics, emerging technologies and the delivery of technical training.<sup>49</sup>

Operational night bomber squadrons had a formal training year that began in October with individual training, leading to squadron exercises in the spring and higher formation exercises in the summer and early autumn. In theory, this was sufficient time to produce what the RAF referred to as a 1<sup>st</sup> Pilot Night that was qualified on type and able to fly at night; however, there were factors that militated against achieving that operationally trained output. The first was that the RAF's Central Flying School (CFS) did not train twin-engine flying instructors and so the instructors for the night bomber, and indeed seaplane squadrons, were found within the operational squadrons and subsequently lacked current and formalised instructional techniques.<sup>50</sup> This presents a stark contrast to the RFC/RAF's emphasis on the importance of single-engine flying instructors generated by Smith-Barry's School of Special Flying in Gosport during the First World War. The question of twin-engine flight training was not new; Air Vice-Marshal John Steel had highlighted the need for a twin-engine FTS in January 1929 when he was AOC Wessex Bombing Area. Secondly was the problem of pilot throughput.<sup>51</sup> Responding to a letter from ADGB in early February 1934, Western Area said that of the 80 pilots in the four night bomber squadrons under its command, 71 were posted away in calendar year 1933 and as it took a year to 'turn out' a 1<sup>st</sup> Pilot Night, they had 'to start all over again training new pilots'.<sup>52</sup> Clearly, the training burden faced by operational

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<sup>49</sup> *Oxford Dictionary of National Biography*, <https://www.oxforddnb.com/view/10.1093/ref:odnb/9780198614128.001.0001/odnb-9780198614128-e-34244?rskey=3U9SI&result=1>. Accessed, 12 January 2022.

<sup>50</sup> TNA AIR 16/245, Minute Sheet Folio 15, Wg. Comd, Air Ops to SASO AOC Western Area, 2 March 1934.

<sup>51</sup> TNA AIR 16/245, Steel's Letter of 16 January 1927, referred to by AOC Western Area to HQ ADGB, 19 December 1933.

<sup>52</sup> TNA AIR 16/245, Letter from HQ Western Area to ADGB, 19 February 1934.

squadrons was excessive and detrimental to achieving squadron collective training and operational readiness.

The other operational training factor that was discussed and recognised as a shortfall during the latter part of the inter-war period was night flying and where and how it should be taught. As the AOC Western Area stated in December 1933, 'the time has now come to lighten the burden of elementary training on night bomber squadrons and so enable them to devote more time to operational training.'<sup>53</sup> Wessex Bombing area ceased to exist in October 1933 and became Western and Central Areas.<sup>54</sup> Air Commodore Playfair went on to say that night flying should take place at the FTS as 'an advantage to the Service as a whole'. Like all training, it is not about the quantity but the quality of the training that is provided within the syllabus and whether that training is relevant. A study of flying hours for Western Area's night bomber squadrons, between 1 October 1932 and 30 September 1933, showed that 75% of flying took place during the day while, during night flying, a large proportion was 'spent flying round a flare path practising landing and take-off' and did not represent 'the type of flying which would have to be undertaken in war.'<sup>55</sup>

As we have already seen, the RAF was only receiving around 300 new pilots each year while refresher training for more experienced pilots also formed part of a bomber squadron's annual flying programme. The challenge present during the inter-war period was trying to identify a clear policy of what training syllabi should be adopted, how it should be taught and who was responsible for this training. Chapter Five has already highlighted that during this period, *ab initio* training came under the

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<sup>53</sup> TNA AIR 16/245, Letter from AOC Western Area to ADGB, 19 December 1933.

<sup>54</sup> 35 Squadron in ADGB. <https://35squadron.wordpress.com/2018/02/08/1933/>. Accessed, 29 March 2023.

<sup>55</sup> TNA AIR 16/245, Minute Sheet Enc. 80, SASO to Wg. Comd. Air Training 3 Group, 6 May 1936.

bailiwick of the AMP while operational training was contained within the CAS's department; and to obfuscate matters still further, the AOC-in-C ADGB was '...charged with the training of all Home Defence squadrons...'.<sup>56</sup> To support ADGB, each area, such as the Wessex Bombing Area, had a Group Captain Training that was responsible for training policy for the area's constituent squadrons. Following the Air Ministry's reorganisation of 1934, the AMP's Directorate of Training was expanded, but there was still no single and unambiguous authority responsible for training delivery and monitoring training effectiveness, or to liaise with other Air Ministry functions, such as supply and procurement or organisations such as the Central Flying School.<sup>57</sup> The decision to keep *ab initio* training under AMP and operational training under CAS ran counter to the Air Ministry reorganisation paper written by Brooke-Popham in 1933, which stated:

I feel convinced that all Flying Training should come under one member of the Air Council, and since it is obvious that advanced training must come under the Air Staff, then elementary flying Training must go there too.<sup>58</sup>

According to Walker, it was the CAS [Ellington] who decided that *ab initio* training, overseen by the DOT [Courtney], should remain under AMP.<sup>59</sup>

This fractured approach to training certainly caused frustration at the area/command and squadron levels and it was largely from here that new training initiatives emerged. One of the earliest ideas to address the question of training night bomber pilots flying twin engine aircraft came from ADGB that suggested the establishment of a specialist school, structured from operational resources, that

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<sup>56</sup> Phillpot, *The Royal Air Force – An Encyclopaedia of the Interwar Years: Volume 1, The Trenchard Years 1918 to 1929*, p. 2554.

<sup>57</sup> Walker, 'Supreme Air Command – The Development of Royal Air Force Command Practice in the Second World War,' Chapter Two.

<sup>58</sup> TNA AIR 2/673, War Organisation of the Air Ministry, 22 February 1933.

<sup>59</sup> Walker, 'Supreme Air Command – The Development of Royal Air Force Command Practice in the Second World War,' pp.37-8.

pilots would attend prior to joining their operational squadrons.<sup>60</sup> HQ Central Area was 'Very much in favour of creating a small school,' on the lines of the flying boat school at Calshot but against giving up an operational squadron to do so.<sup>61</sup> Such approaches did not have universal support. Brook-Popham felt that such schools had the disadvantage, 'namely that Officers will remain with their squadrons for a shorter length of time...Officers must look upon their work with squadrons as their normal existence and not as an interval between courses.'<sup>62</sup> Brooke-Popham had a valid point that could have been addressed by forming twin-engine FTS, and/or adding another course after FTS that specialised in converting pilots to fly twin engine 'service type' aircraft, such that when new pilots arrived in their operational squadrons they were more ready to adopt a meaningful role. The former solution was tabled by ADGB but not initially adopted by the Air Ministry. The debate in early 1934 about how twin-engine night bomber pilots were to be trained is profound and presaged the later debate concerning the establishment of Group Pool Squadrons (GPS) and later, OTU. The fact that the locus of control for operational training was contained at the area/command and squadron levels was highlighted in the Minute Sheet response of ADGB's SASO when he assured his AOC-in-C that 'we should be able to assist the A.M. [Air Ministry] in arriving at a decision' concerning operational training.<sup>63</sup> The problem had been identified by ADGB's SASO but a solution had not been agreed nor implemented and the need for such additional training had not been recognised within the Air Ministry.

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<sup>60</sup> TNA AIR 16/245, Letter from HQ ADGB to HQ Western Area, 17 February 1934.

<sup>61</sup> TNA AIR 16/245, Letter from HQ Central Area to HQ ADGB, 8 March 1934.

<sup>62</sup> TNA AIR 16/245, HQ ADGB Minute Sheet response, 23 March 1934 referring to HQ Central Area's letter of 8 March 1934.

<sup>63</sup> TNA AIR 16/245, Minute Sheet comments by Air Commodore Gossage, SASO ADGB, 23 March 1934.

## 1934 –1939 Preparing for War

The approval of Expansion Scheme A in July 1934 was the result of a number of factors including German rearmament, particularly in the air domain, and that nation's 1933 decision to leave the Geneva Peace Process and the League of Nations. One of the UK's initial responses was the setting up of the Defence Requirements Committee (DRC) in November 1933 to 'review and determine our worst case deficiencies'.<sup>64</sup> Established under the chairmanship of Sir Maurice Hankey, Smith said that the DRC was charged with identifying 'gaps in the system of Imperial defence brought about by years of neglect...'.<sup>65</sup> Perhaps the most far reaching observation by Smith concerned the recommendation that the RAF should concentrate on 'close defence of vulnerable targets' which was 'contrary to everything the RAF had been preaching since it came into existence.'<sup>66</sup> The resulting Expansion Scheme A proposed a Metropolitan Air Force, that term having replaced Home Defence Force, comprising 1,252 aircraft, to be achieved by March 1939. In many ways, the numbers matter little as the five schemes that were approved ran into each other. For example, Scheme A was superseded by Scheme C following its Parliamentary approval in May 1935, before Scheme A could be delivered.<sup>67</sup> Dick refers to these expansion measures as having a 'panicky look' to them and being inadequate but set against Britain's earlier support for the Geneva peace process and then the need to respond to Germany's aggression in the reoccupation of the Rhineland in March 1936, the Anschluss with Austria in 1938,

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<sup>64</sup> Dean, *The Royal Air Force and Two World Wars*, p.42.

<sup>65</sup> M. Smith, 'Rearmament and Deterrence in Britain in the 1930s', *Journal for Strategic Studies*, 1:3, (1978), p.315.

<sup>66</sup> *Ibid.*, p.330.

<sup>67</sup> Robertson, *The Development of RAF Strategic Bombing Doctrine, 1919-1939*, Appendix, Table III, p. 170.



and later that year, the annexation of the Sudetenland, Britain's apparently haphazard preparation for a potential future war can be seen in perspective.<sup>68</sup>

Many academics such as Dick, and military historical authorities such as the AHB, have argued that these expansion plans were mere window dressing, 'without consideration for the creation of sufficient backing to make them efficient in war...'; the key deficiency being that these extra squadrons required personnel and aircraft reserves, as well as training of the new personnel to make them efficient.<sup>69</sup> Considering new bomber aircraft during the period, initial requirements for the Handley Page Hampden, Fairy Battle, Armstrong Whitworth Whitley, Bristol Blenheim, and Short Stirling were issued in 1932, 1933, 1934, 1935 and 1936 respectively and provide a technical portent of what changes to training were required in the future.

With Expansion Scheme A now in effect calling for an extra 1,000 pilots to be trained on top of the 300 already being produced, the Director of Training, Air Commodore Tedder, put forward a plan that was designed to save money, expand the RAF's training organisation and take pressure off the operational squadrons with respect to their operational training role.<sup>70</sup> In essence, Tedder's plan saw students undertake two months *ab initio* flying training at a civilian Elementary Flying Training School (EFTS), later referred to as an Elementary & Reserve Flying Training School (ERFTS), and then spending nine months at a Service FTS (SFTS). This plan also included increasing student numbers during the SFTS phase from 80 to 96.<sup>71</sup>

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<sup>68</sup> R. Dick, 'The RAF Girds for War, 1933-1939', *Air Power History*, Spring 1994, Vol. 41, p.26 and AHB, *The RAF in the Bomber Offensive Against Germany – Vol. I, Pre-War Evolution of Bomber Command, 1917-1939*, pp.55-60.

<sup>69</sup> TNA AIR 10/5551, AP 3233 *Flying Training Vol. 1, Policy and Planning*, p.13.

<sup>70</sup> *Ibid.*, p.14.

<sup>71</sup> TNA AIR 20/1347, *RAF Training 1939-1944*, published by the Directorate of Training, January 1945, p.23.

Tedder's new organisation comprised 13 civilian-run EFTS and six SFTS but even from its inception the plan was flawed due to the training pipeline output being continually increased as new expansion schemes were implemented. From an output requirement of 1,300 pilots, following Scheme A, Scheme C required a further 2,000 pilots.<sup>72</sup> This increased output was addressed in two ways: increasing the number of EFTS and SFTS and secondly, cutting the course length from the original 12 months in 1934, to nine months and then six months. In 1945, the AMT wrote that the '[r]eduction in the length of the course must be regarded as a concession to quantity at the expense of quality.'<sup>73</sup> More importantly, and from the perspective of bomber squadrons, this new training model implemented by Tedder did not result in the SFTS having greater time 'to focus on more advanced training and so relieve front-line squadrons of these tasks and free, in turn, to employ better-prepared new pilots on operational tasks almost as soon as they joined their squadrons.'<sup>74</sup> In fact, the training of bomber pilots, so-called Group II pilots compared to Group I fighter pilots, had been retarded from where it was in 1933 as the RAF still did not have a twin-engine trainer. Additionally, the issue of a lack of night flying had not been addressed and was less likely, especially in the summer months, due to a shorter course, and, in addition, airmanship experience was reduced due to less time in the training pipeline.

The lack of twin-engine trainer aircraft 'was of immense urgency' as was a shortage of instructors.<sup>75</sup> As well as a deficit of twin-engine trainers, the RAF was also in need of a modern single-engine training aircraft. At a progress meeting of the

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<sup>72</sup> TNA AIR 10/5551, AP 3233 *Flying Training Vol. 1, Policy and Planning*, p.16.

<sup>73</sup> TNA AIR 20/1347, *RAF Training 1939-1944*, p.24.

<sup>74</sup> V. Orange, *Tedder – Quietly in Command* (London: Frank Cass, 2004), p.84.

<sup>75</sup> TNA AIR 10/5551, AP3233 *Flying Training Vol. 1, Policy and Planning*, p.16.

Expansion Measures Committee in February 1936, the minutes highlighted the need for 90 elementary trainer aircraft and 400 twin-engine trainers. The SoS for Air, Viscount Swinton, asked 'why' these aircraft were required to which the CAS, Air Chief Marshal Sir Edward Ellington, responded 'that hitherto a good deal of training had been done in squadrons, but there would be no time for this now.'<sup>76</sup> Ellington had, perhaps unwittingly, identified the RAF's growing awareness that it needed to transition from a peacetime to wartime footing. The Committee decided to approach de Havilland and Airspeed to supply aircraft for the twin-engine training role while the ill-fated de Havilland Don single-engine trainer was suffering major technical delays.<sup>77</sup> This was an important decision that marked the recognition by the Air Ministry that twin-engine training should be conducted outside of the operational squadron. Another variable afflicting the training pipeline in the winter of 1935/36 was the 'exceptionally bad weather' that affected pilot output from 'both the Service and Civil Schools...'<sup>78</sup> This situation led to waterlogged airfields and a delay in opening the Yatesbury EFTS. It also caused a commercial problem with some civilian flying schools losing money due to not being able to fly. The AMP, Air Vice-Marshal Frederick Bowhill, also added that recruitment to flying training schools had to be eased due to 'accommodation problems;' a situation that highlighted the manifold factors affecting the fragility of the training pipeline concerning the allocation of resources.<sup>79</sup>

The shortage and workload of flying instructors were also causing concerns for the Air Ministry. In June the AMP had said that the 'FTS had been working at far

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<sup>76</sup> TNA AIR 6/24, Minutes of the 25<sup>th</sup> Expansion Committee Progress Meeting, 6 February 1936.

<sup>77</sup> TNA AIR 6/29, Minutes of the 76<sup>th</sup> Expansion Committee Progress Meeting, 6 April 1937.

<sup>78</sup> TNA AIR 6/24, Minutes of the 28<sup>th</sup> Expansion Committee Progress Meeting, 28 February 1936.

<sup>79</sup> TNA AIR 6/25, Minutes of the 34<sup>th</sup> Expansion Committee Progress Meeting, 31 March 1936.

too high a pressure...’ and he was worried about, ‘instructors breaking down.’<sup>80</sup> In November 1936, Bowhill reinforced this observation when he told the Committee that EFTS and SFTS were ‘working to capacity.’<sup>81</sup> This is highlighted when considering Expansion Scheme C. To meet the RAF’s pilot training output requirements, ‘40 per cent [of experienced pilots] would have to be withdrawn from [operational] units’ to undertake flying instructor roles.<sup>82</sup> This figure was brought down to 20% by reducing the length of the flying training course and increasing the number of civilian instructors but serves as an exemplar of the finely tuned balance concerning resources and student output requirements of the training pipeline. The allocation of pilots as instructors also raises the question of suitability. Not all good pilots make good instructors.<sup>83</sup>

1936 did, however, herald some positive changes. In November, two SFTS were equipped with the Avro Anson twin-engine training aircraft.<sup>84</sup> In terms of increasing pilot numbers and easing the training burden, the new RAF Volunteer Reserve (RAFVR) gained Treasury approval in July 1936 and initial discussions were held with Canada and other Dominions about conducting *ab initio* training overseas.<sup>85</sup> Although these initial discussions were unsuccessful, they served to open a communications channel on the topic that eventually bore fruit. Another major change was the RAF’s new crewing policy that recognised the need to remove the navigation and ‘bomb dropping’ functions from the pilot and give them to the Air Observer.<sup>86</sup> This caused friction in many quarters and also highlighted the pilot-

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<sup>80</sup> TNA AIR 6/26, Minutes of the 42<sup>nd</sup> Expansion Committee Progress Meeting, 16 June 1936.

<sup>81</sup> TNA AIR 6/23, Minutes of the 58<sup>th</sup> Expansion Committee Progress Meeting, 5 November 1936.

<sup>82</sup> TNA AIR 10/5551, AP3233 *Flying Training Vol. 1, Policy and Planning*, p.18.

<sup>83</sup> T. Kern, *Flight Discipline* (New York: McGraw Hill, 1998), pp. 187-8.

<sup>84</sup> TNA AIR 10/5551, AP3233 *Flying Training Vol. 1, Policy and Planning*, p.16.

<sup>85</sup> TNA AIR 6/25, Minutes of the 31<sup>st</sup> Expansion Committee Progress Meeting, 10 March 1936.

<sup>86</sup> TNA AIR 10/5551, AP3233 *Flying Training Vol. 1, Policy and Planning*, p.19.

centric nature of the Service. This change will be examined in detail in Chapter Eight as it affects observers/navigators but it did have an effect on pilots in that although observers were trained in navigation, CAS's policy was that bombers would carry two pilots, the junior being responsible for navigation. The observer would only be responsible for navigation if the aircraft could not carry two pilots, such as in the Hampden.<sup>87</sup> This did not change until May 1939. Perhaps the final significant change was the creation of the RAF Command, Group, and Station structure, and the emergence of Bomber Command on 14 July 1936 under the command of Air Vice-Marshel Sir John Steel.

Despite these changes to organisation, significant problems remained that undermined the efficiency of the new Bomber Command and meant that operational training was still being conducted within squadrons. The debate surrounding the formation of operational training squadrons continued and was put into focus in a paper by Squadron Leader Groom, from Bomber Command's training department in November 1936.<sup>88</sup> Groom identified the fundamental element in training heavy bomber squadrons when he said that 'the work of the night bomber is essentially that of a crew...'.<sup>89</sup> Although the recruitment of pilots was going smoothly, the quality of their training was clearly failing as the Secretary of State for Air Lord Weir highlighted at the 63<sup>rd</sup> Expansion Committee Meeting in December 1936. Weir told the Committee that Winston Churchill, MP, had criticised the RAF's expansion and training processes, citing the forced landing of a number of Heyford bombers on route to Finningley from Aldergrove.<sup>90</sup> This incident, one of many at the time, again

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<sup>87</sup> TNA AIR 10/5551, AP3233 *Flying Training Vol. 1, Policy and Planning*, pp.19-20.

<sup>88</sup> TNA AIR 14/44, Training in Heavy Bomber Squadrons, a paper by Sqn. Ldr. Groom, 13 November 1936.

<sup>89</sup> *Ibid.*

<sup>90</sup> TNA AIR 6/28, Minutes of the 63<sup>rd</sup> Expansion Committee Progress Meeting, 22 December 1936.

shines a spotlight on the inadequacy of training during the years leading to the outbreak of the Second World War. The number of accidents in Bomber Command in the last quarter of 1936 totalled 96 and, in the first quarter of 1937, this had risen to 200.<sup>91</sup>

Why the concept of establishing operational training squadrons was anathema to many was perhaps rooted in two key thought processes; denial of the problem and that by re-designating operational squadrons as training squadrons, the RAF was failing to achieve its desired expansion strength. What was clear was that by shortening EFTS and FTS courses, pupils were receiving fewer flying hours – airmanship experience – and the shorter courses did not present the opportunity to add what the heavy bomber squadrons specifically wanted in the syllabus; twin-engine flying, navigation and night flying to prepare crews for operational flying. An indication of the inexperience of heavy bomber squadrons can be seen in 3 Group in November 1936. Of its 270 pilots, only 83 were classed as 1<sup>st</sup> Pilot Night, 65 as 1<sup>st</sup> Pilot Day and 122 were unqualified.<sup>92</sup> As pilot numbers increased in 3 Group, this situation worsened. In February 1937, Bomber Command's SASO, Air Vice-Marshal Evill, reported that only 50 pilots out of 350 in 3 Group were qualified as 1<sup>st</sup> Pilot Night. There was also criticism of the Avro Anson as a twin-engine trainer. '[E]xperience has shown that the Anson is of little or no help in providing the experience necessary for Service types, it seems urgently necessary for FTSs to be equipped with Service type multi-engine aircraft more appropriate to the squadrons for which their trainees are destined.'<sup>93</sup> Clearly, flying a twin-engine aircraft after

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<sup>91</sup> TNA AIR 14/53, Minute Sheet entry by Wg. Cdr. Training, HQ Bomber Command, 10 May 1938.

<sup>92</sup> TNA AIR 14/44, Minute Sheet, SASO (Evill) to AOC-in-C (Steel), 28 January 1937.

<sup>93</sup> TNA AIR 14/44, Minute Sheet comment by Sqn. Ldr. Groom, Training 2, HQ Bomber Command, 13 November 1937.

EFTS and before arriving in a bomber squadron must have been of some help, even from the experience of asymmetric flying and operating a more complex aircraft. AOC 4 Group, Air Commodore A.T. Harris highlighted that the pilot still had to undergo conversion to the operational aircraft and so, therefore, little time was saved by flying the Anson.<sup>94</sup> Again, Harris's comments highlight the conundrum being addressed at the Air Ministry and command levels surrounding quantity versus quality.

The other issue that was having a major impact on operational training was the expansion process itself. Extant operational squadrons were being used as the source of pilots and personnel in the establishment of new squadrons. In July 1937, for example, Air Vice-Marshal Playfair, AOC 3 Group, complained of having to release 25 trained pilots to the new 77, 88, 148 and 211 squadrons.<sup>95</sup> Playfair opined that 'the posting of pilots from Squadrons at short notice interferes very seriously with the efficiency of the Squadrons and the training of crews of Heavy Bomber aircraft.' Three months prior to this, Playfair had requested more senior pilots 'with the necessary night flying experience' posted to 3 Group 'without delay.'<sup>96</sup> This was to rectify a shortage in the Group of two Group Captains, 11 Wing Commanders, 18 Squadron Leaders and 37 Flight Lieutenants. One other aspect of expansion was its cost and this not only affected high budget items like aircraft and airfield construction but training. For example, in April 1937, the AMP proposed increased navigation training for 'all heavy type pilots' during the SFTS phase and at a new navigation school that could train 450-500 pilots each year.<sup>97</sup> Surprisingly, given the

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<sup>94</sup> TNA AIR 14/44, Letter from AOC 4 Group to HQ Bomber Command, 22 October 1937.

<sup>95</sup> TNA AIR 14/44, Letter from AOC 3 Group to HQ Bomber Command, 1 July 1937.

<sup>96</sup> TNA AIR 14/44, Letter from AOC 3 Group to HQ Bomber Command, 9 April 1937.

<sup>97</sup> TNA AIR 6/30, Minutes of the 82<sup>nd</sup> Expansion Committee Progress Meeting, 6 April 1937.

correspondence flowing between the Air Ministry, Bomber Command and the Groups concerning navigation being a training shortfall, the committee discussed Bowhill's proposal in terms of the costs and 'if the navigation training was required.' Two months later, the CAS (Ellington) said that the financial implications of the new navigation school needed to be studied until a 'properly costed and concrete' scheme had been worked out.<sup>98</sup>

One of the major paradoxes by early 1938 was that the RAF was facing a pilot surplus that was caused by a successful recruitment process and the length of the EFTS/FTS courses being reduced to six months. During a meeting of the Air Staff in March 1938, the AMSO (Welsh) highlighted discussions at the previous meeting of the 'possibility of a return being made to a 12 months course' to reduce this potential surplus. The AMP (Mitchell) said that if this was adopted, the RAF would not have enough pilots for Expansion Scheme K. This approach was agreed by the Secretary of State for Air (Swinton) and the CAS (Newall).<sup>99</sup> This was tacit agreement that the RAF would continue to accept undertrained pilots and that operational squadrons would have to continue to close the training gap between the FTS and 1<sup>st</sup> Pilot Night categorisation. The potential breakthrough came in November 1938 when the AMSO, Air Vice-Marshal Welsh, wrote a paper suggesting the formation of Group Pools or Advanced Training Centres.<sup>100</sup> In introducing his paper to the Expansion Committee, Welsh said:

At present in peacetime pilots were sent direct from training schools to squadrons. They had neither the general flying experience nor the proficiency in handling their equipment to make them fit for active operations. As a result their training had to be completed by squadrons

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<sup>98</sup> TNA AIR 6/30, Minutes of the 83<sup>rd</sup> Expansion Committee Progress Meeting, 1 June 1937.

<sup>99</sup> TNA AIR 6/33, Minutes of the 117<sup>th</sup> Expansion Committee Progress Meeting, 15 March 1938.

<sup>100</sup> TNA AIR 6/36, Minutes of the 141<sup>st</sup> Expansion Committee Progress Meeting, 1 November 1938.



and this tended to lower the morale of squadrons particularly when accidents, due to the inexperience of pilots occurred.<sup>101</sup>

The paper was agreed by the Air Ministry, and thereby added another important phase to the operational training pipeline. More importantly, this decision would begin to free up frontline squadrons to carry out squadron specific operational training. However, despite the call for Group Pools, six in Bomber Command, one in Coastal Command and two in Fighter Command, only one Fighter Command unit was initially established with Bomber Command, having to wait until 14 September 1939 to get its first Group Pools.<sup>102</sup> These units, or Group Training Squadrons, were formed from the 'non-mobilisable' squadrons in the five operational Bomber Command Groups and all came under the command of 6 (Bomber) Group.<sup>103</sup> One and 2 Groups had two Group Pools while 3, 4 and 5 Groups had one each.<sup>104</sup> Their task was not only to provide operational training on frontline types but also to provide an aircrew reserve, or pool, from which replacement crews could be drawn. The importance of these new units was highlighted in a Bomber Command report that stated that 'these Training Squadrons should be regarded as sacro sanct [*sic*]...with these Group Pools...being given priority over Operational Squadrons.' 3 Group Pool was offered as a blueprint for organisation that the AHB said was 'a model for future Operational Training Units.' Formed from 75 and 148 squadrons, the unit comprised four flights: a Wellington Conversion Flight (eight Wellingtons); a Navigation Flight (eight Ansons); an Armament Flight; and an Operational Flight, each with eight Wellingtons.<sup>105</sup> Such early training units give an indication of what training resources

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<sup>101</sup> TNA AIR 6/36, Minutes of the 141<sup>st</sup> Expansion Committee Progress Meeting, 1 November 1938.

<sup>102</sup> Sturtivant, *RAF Flying Training and Support Units Since 1912*, p.10.

<sup>103</sup> TNA AIR 2/4168, 'Record of a Conference Held at HQ Bomber Command on 5<sup>th</sup> September 1939 to Discuss the Provision of Group Training Squadrons for Bomber Command,' 5 September 1939.

<sup>104</sup> *Ibid.*

<sup>105</sup> TNA AIR 41/39, *The RAF in the Bomber Offensive Against Germany*, Vol. 1, p.14.

were required to service the operational training pipeline and a growing bomber force.

To summarise, the period 1934 until the outbreak of war on 3 September 1939 can be seen as a period of expansion after stagnation. Although the Air Ministry was clearly under a great deal of pressure to expand the Metropolitan Air Force to counter the growing threat from Nazi Germany and achieve parity, it had major difficulties in terms of the speed at which the British aircraft industry could produce aircraft with which to do so.<sup>106</sup> Although aircraft, such as the Whitley, Wellington and Hampden, were beginning to enter service in 1938, the RAF's intellectual and technological focus was still on the older bomber biplane types, such as the Heyford and Virginia, that both remained in service as heavy bombers until 1937.<sup>107</sup> Perhaps that was not surprising given that the RAF was still in its infancy and its senior officers were products of the Victorian and Edwardian eras without a 20<sup>th</sup> Century appreciation of technology, but the biggest shortcoming was that the RAF lacked an operational plan or doctrine as to how it was going to use its bombers; in short, nothing to drive or define the structure of the operational training pipeline. As discussed in Chapter One, doctrine should be a driver of training outcomes but by the outbreak of war the RAF was opting for quantity of aircrew over quality. It is perhaps fair to say that training had never been an issue in peacetime because pressure had never been exerted on the training pipeline. In addition, a fragmented training organisation with the CAS, AMP – with his Director of Training, ADGB/Bomber Command along with Bombing Areas/Groups and individual

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<sup>106</sup> Edgerton, *England and the Aeroplane*, pp.108-13.

<sup>107</sup> Thetford, *Aircraft of the Royal Air Force Since 1918*, pp.287-8 and pp.508-12.

squadrons having responsibility for partial areas of training was cumbersome and did not reflect the importance of training as a force multiplier.

### **Restricted Bombing and Conservation – September 1939 to August 1941**

From an operational training perspective, the declaration of war on Germany galvanised the RAF into radically altering its views on how such training should be undertaken. The frustrations and practises that had built up during the inter-war years were overtaken by new, and in many cases, innovative approaches to operational training. The so-called Phoney War period, from September 1939 until May 1940, also gave the RAF time to alter its training curricula, reorganise its training structure and learn lessons.<sup>108</sup> In hindsight, this was a critical period for Bomber Command and the RAF as a whole. As Overy has stated, ‘the early experience of the bomber force during the Phoney War confirmed the wisdom of not pressing for an immediate bombing offensive’ and this, inadvertently, provided time to Effect change.<sup>109</sup> This section will address how operational training altered during the period when Bomber Command was trying to establish new tactics, techniques and procedures. This early phase saw Bomber Command attempt attacks on precision targets as laid down in the Western Air Plans but, by mid-1940, the futility of trying to hit small targets at night was acknowledged in the switch to area bombing where Trenchard’s concept of attacking the population’s collective ‘moral’ was resurrected.<sup>110</sup> Targeting civilian morale became a common topic in Bomber Command Directives throughout 1940 and 1941.<sup>111</sup> The other imperative during this

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<sup>108</sup> Jones, *Most Secret War*, pp.117-33.

<sup>109</sup> R. Overy, *The Bombing War* (London: Allen Lane, 2013), p.242.

<sup>110</sup> RAFM, MFC 76/1/67 Trenchard Papers, Memorandum on Bombing Operations for the Supreme War Council, 26 November 1917.

<sup>111</sup> See for example, Webster & Frankland, *The Strategic Air Offensive Against Germany 1939-1945, Volume IV Annexes and Appendices*, Appendix 8, Directives of 30 October 1940, 9 July 1941, and 30 August 1941.

period was to conserve aircraft 'to build a strong force' to achieve mass and concentration that was required for an emerging policy of hitting military targets in residential areas.<sup>112</sup> In July 1940, the DCAS Air Vice-Marshal Sholto Douglas wrote to the AOC-in-C Bomber Command (Portal) to say that following a review by the Air Staff, they considered that, 'attacks on industrial objectives have hitherto been too dispersed' and 'few objectives have sustained sufficient damage to put them out of action...'.<sup>113</sup> The Air Ministry therefore wanted Bomber Command to concentrate attacks on fewer objectives. By September 1940, the Air Ministry was telling Portal, that 'disturbance and dislocation' to industry and the 'civilian population' was the 'primary aim of these attacks' on Berlin. Four weeks later the Air Ministry was directing Air Marshal Peirse, the new AOC-in-C, that although synthetic oil production was the primary target, 'if bombing is to have its full moral effect it must on occasions produce heavy material destruction...concentrated attacks' on 'objectives in large towns' became a targeting option that was growing in popularity. This shift in targeting was a clear indication of how a lack of technology and training were conspiring to prevent Bomber Command from finding and hitting precision targets. These shortcomings also drove the need to concentrate bombers over the target to achieve maximum effect and, as a consequence, the training required to achieve that concentration. In a monograph based on his PhD written in 1951, when he was with the AHB, Noble Frankland referred to Bomber Command in 1940 and 1941 as, 'little more than a shadow force' but that force was to be used as, 'a cadre of the much bigger force of the future...'.<sup>114</sup> This, argued Frankland with some

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<sup>112</sup> TNA AIR 20/6108, Directive from DCAS, AVM Bottomley to AOC-in-C Bomber Command, AM Peirse, 13 November 1941.

<sup>113</sup> TNA AIR 20/2060, Directive from DCAS, AVM Sholto Douglas to AM Portal, AOC-in-C Bomber Command. 13 July 1940.

<sup>114</sup> N. Frankland, *The Planning of the Bombing Offensive and its Contribution to German Collapse*, AHB, April 1951, p.23.

justification, was why the RAF needed 'to conserve the force' as an 'investment for the future.'<sup>115</sup> In essence, the need to 'conserve' the bomber force was created by a collective failure to provide the means to carry out that doctrine.

Three weeks after Britain declared war on Germany on 3 September 1939, Bomber Command comprised six Groups containing 33 operational squadrons. Of these, ten were single-engine Fairy Battles that formed the Advanced Air Striking Force (AASF) and was deployed to France and six were equipped with twin-engine Bristol Blenheim aircraft in 2 Group, two of which were also sent to France.<sup>116</sup> In addition, there were 13 squadrons that had been designated to form Group Pools and six cadre squadrons. As Webster and Frankland observed, 'there were, therefore, in fact only 17 operational squadrons in Bomber Command which could contribute to the strategic air offensive.'<sup>117</sup> Given the emphasis on the offensive nature of the bomber force that underpinned RAF ethos and very survival during the inter-war years, it is perhaps surprising that this formative strategy was overturned so quickly by the threat posed by Nazi Germany, and more specifically, Sir Thomas Inskip, Minister for Co-Ordination of Defence's push for fighter defence instead of the deterrence supposedly provided by bombers. 'The Air Staff reacted violently to this [Inskip's] appreciation' and the result was that from the outbreak of war until early 1942, Bomber Command had to redefine its role and how it should conduct operational training to achieve that role.<sup>118</sup> Tellingly, in referring to the strategic

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<sup>115</sup> Frankland, *The Planning of the Bombing Offensive and its Contribution to German Collapse*, p.45.

<sup>116</sup> Webster & Frankland, *The Strategic Air Offensive Against Germany 1939-1945, Volume IV Annexes and Appendices*, Appendix 38, pp.400-2.

<sup>117</sup> Webster & Frankland, *The Strategic Air Offensive Against Germany 1939-1945, Volume IV Annexes and Appendices*, Appendix 38, pp.402.

<sup>118</sup> Webster and Frankland, *The Strategic Air Offensive Against Germany 1939-1945, Vol I, Preparation*, p.77.

bomber force's doctrine during the late 1930s, Dean said that 'theory departed reality' when war threatened.<sup>119</sup>

The 'reality' of operations was quickly illuminated for Bomber Command in the opening months of the war. Despite the drawing up of the final version of the Western Air Plans in June 1939, the ability to find, hit and destroy such targets as, for example, airfields and factories (WA 1); rail, road, and communication targets (WA 4); ships and ports (WA 10), was clearly beyond the capabilities of Bomber Command due to its poor level of preparedness, equipment and training.<sup>120</sup> It is worth noting Bomber Command's initial operations highlighted this shortfall:

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|------------------|--|
| 3 Sept           | 1 Blenheim reconnaissance aircraft and bomber force of 18 Hampdens and 9 Wellingtons seek German warships north of Wilhelmshaven. The bomber force fails to find the ships.  |
| 3/4 Sept         | 10 Whitleys drop leaflets on Hamburg, Bremen and Ruhr valley. 3 aircraft force landed in France on their return.   |
| 4 Sept           | 15 Blenheims and 14 Wellingtons sent to bomb ships near Wilhelmshaven. 10 aircraft failed to find targets. 5 Blenheims shot down, 1 crashed into German ship, 2 Wellingtons shot down. A navigation error caused two bombs to be dropped on Esbjerg in Denmark, 110 miles north of the target. |
| 4 Sept to 24 Dec | Leaflet raids continue. 113 sorties. 4 aircraft lost.  |
| 29 Sept          | 11 Hampdens to bomb shipping off Heligoland. No hits on target but 5 aircraft shot down.   |
| 3 Dec            | 24 Wellingtons attacked shipping near Heligoland. No hits on ships and no losses.  |
| 14 Dec           | 12 Wellingtons attack shipping in the Schillig Roads. 5 aircraft shot down.  |
| 18 Dec           | 22 Wellingtons attack shipping, 12 aircraft shot down. <sup>121</sup>  |

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<sup>119</sup> Dean, *The Royal Air Force and Two World Wars*, p.100.

<sup>120</sup> TNA CAB 53/49, Chiefs of Staff Paper, 13 June 1939.

<sup>121</sup> Middlebrook & Everitt, *The Bomber Command War Diaries*, pp.21-27.

Despite these poor results, the leaflet raids flown by Whitley crews, so-called Nickel operations, did have the benefit of providing crews with night flying and long-distance navigation training over enemy territory. One raid, on 1/2 October, took an aircraft over Berlin and, as with all long flights prior to Germany's invasion of France, refuelling stops were made in that country on the way home.<sup>122</sup> Reconnaissance operations looking for German ships, the so-called 'North Sea sweeps' also boosted navigation skills. These early operations, alongside later operations in Norway, Denmark and France in support of the British Army, provided Bomber Command with a rudimentary benchmark with which to judge the efficacy of its training and the failure of its self-defending, daylight bombing policy.

In November 1939, the Group Pool Squadrons were officially renamed Operational Training Units (OTU) although this term did not come into widespread use until the actual formation of Bomber Command OTUs in April 1940.<sup>123</sup> On 11 April 1940, Bomber Command had nine OTUs, with three of these allocated to the Battles and Blenheims of the AASF.<sup>124</sup> Another important event during this period was the Air Ministry's recognition that flying instructors required different skills for Group I and Group II training and the Central Flying School (CFS) subsequently provided separate five week courses for the two disciplines. This enabled, after many year's discussion and argument between the Air Ministry and ADGB/Bomber Command, specialist twin-engine SFTS courses to be established. Initially set at 14 weeks in June 1940, the Group II SFTS was cut to 12 weeks in August and 10 weeks in September. These three changes were referred to as the First, Second and

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<sup>122</sup> Middlebrook & Everitt, *The Bomber Command War Diaries*, p. 23.

<sup>123</sup> Sturtivant, *Flying Training and Support Units Since 1912*, p.10. See also TNA AIR 41/39, *The RAF in the Bomber Offensive Against Germany, Vol. II*, p.13.

<sup>124</sup> TNA AIR 2/4168, HQ Bomber Command Report on a Conference, 6 June 1940.

Third Revises of Pilot Training and by the Third Revise the ten week course would see the pilot leave with around 72 flying hours before joining the OTU.<sup>125</sup> Although training time at the SFTS was cut, an additional two weeks were added to the OTU course although like SFTS, course length varied between September 1940 and January 1941 from eight to ten weeks. During the eight week course, pilots flew 55-60 hours and during the ten week course, 85-90 hours. The challenge faced by Bomber Command was replacing crew wastage through enemy action and training accidents as well as the need to give crews adequate rest periods. Like the First World War, air power was recognised as an attritional application of force. The AOC-in-C from 3 April to 5 October 1940, Air Marshal Portal, stated that each operational squadron would need eight new crews per month but this was in addition to the 'existing shortage of 258 crews' in the Command.<sup>126</sup> The decision to abandon the formation of new operational squadrons and replace them with two new OTUs to provide a source of new crews was another clear indication of the growing recognition of the importance of operational training to raise the capabilities of crews being posted to operational squadrons. Attention was also focussed on ensuring extant OTUs were up to strength and fully equipped and, as Chapter Nine will discuss, how Synthetic Training Equipment (STE) was being exploited to undertake training on the ground and therefore free up flying hours.

Two major changes to Bomber Command doctrine had a direct impact on operational training. As previously discussed, the expansion of the bomber force was already being curtailed in favour of increased numbers of OTUs and this pressure increased further with the formation of the first Stirling and Manchester squadrons in

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<sup>125</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-44*, January 1945, p. 73.

<sup>126</sup> TNA AIR 41/39, p.15.



August and November 1940 respectively.<sup>127</sup> With 6 Group then responsible for OTUs, it was felt that another Training Group should be formed to share the workload and as a result, 7 Group was formed in July 1940 to take responsibility for Blenheim and Hampden OTUs.<sup>128</sup>

The nine OTUs serving Bomber Command in April 1940 had grown to 14 by mid-1941.<sup>129</sup> Although the introduction of the OTU phase of training was designed to provide operational squadrons with better trained aircrew, a number of problems remained in ensuring these aircrew got to their squadrons in sufficient numbers. The first problem was training sufficient aircrew for the bomber offensive without 'a steady drain on the best crews of Bomber Command' being sent to the Middle East.<sup>130</sup> A partial solution to this problem was found in November 1941 with the establishment of an OTU in the Middle East but in mid-1941 Bomber Command was 210 pilots short of its establishment and that led to AMT discussing reducing the length of the OTU course with 'the pre-requisite of the new syllabus [being] that the standard of crew training prior to the OTU should be improved.'<sup>131</sup> Three weeks later AMT raised another issue with the Secretary of State when he pointed out that the number of aircrew arriving at the OTU was previously limited by numbers from the SFTS and a shortage of aerodromes; it was now a shortage of aircraft, particularly Wellingtons and Ansons, there being a deficit of 111 and 85 respectively. AMT finished by saying, 'It is only by expanding the OTUs that we can produce the crews to enable the front line to expand later.'<sup>132</sup>

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<sup>127</sup> TNA AIR 41/4, pp. 21-2.

<sup>128</sup> TNA AIR 41/4, p. 15.

<sup>129</sup> A History of RAF Organisation, [https://www.rafweb.org/Organisation/OTU\\_1.htm](https://www.rafweb.org/Organisation/OTU_1.htm). Accessed, 7 January 2022.

<sup>130</sup> TNA AIR 20/2769, Memorandum VCAS to AMT, 13 March 1941.

<sup>131</sup> TNA AIR 20/2769, Memorandum AMT to CAS, 18 June 1941.

<sup>132</sup> TNA AIR 20/2769, Memorandum AMT to SoS-for-Air, 21 July 1941.

## Conclusion

As this chapter has shown, the bomber force, later designated Bomber Command, undertook a massive expansion from 1934 onwards but had little experience on which to draw. Operational training was left to the frontline squadrons to conduct and it was not until 1936 that the issue of twin-engine training aircraft and Group II Qualified Flying Instructors started to be introduced despite being initially highlighted by Western Bombing Area in 1929 and subsequently being discussed in depth by ADGB and, from 1936, Bomber Command. Although these steps were an improvement, they still did not fully address the challenge of how Bomber Command's strategic bombing doctrine was going to be fulfilled and the training gaps associated with night flying and long distance navigation. These challenges were compounded by the arrival into service of more sophisticated aircraft such as the Whitley, Hampden and Wellington that were far more technologically advanced than their biplane forbears. The difficulty of preparing pilots for such aircraft was increased yet again with the introduction of even more complex four-engine aircraft such as the Stirling and Halifax, in 1940 and 1941 respectively.

During the period of expansion and the early years of the war, the RAF and the bomber force/Bomber Command became increasingly aware that effective training needed massive resources including manpower, aircraft and airfields. The balance between operational output and the training resources to achieve that output created friction within the Air Council, Air Ministry and frequently, in Bomber Command itself, but it was eventually agreed that there needed to be a training bridge between the twin-engine Ansons and Oxfords flown at the SFTS by Group II pilots and the operational aircraft. This led to the formation of Group Pool Squadrons that in early 1940, became Operational Training Units. Despite the adoption of these

OTUs, by late 1941 operational training still presented a number of 'training gaps'. How these training gaps were closed, including the enhancement of OTUs and the establishment of Heavy Conversion Flights, Heavy Conversion Units and Lancaster Finishing Schools along with other specialist training establishments will be analysed in Chapter Seven.

## CHAPTER SEVEN

### PILOT TRAINING - AUGUST 1941 TO MAY 1945

#### Introduction

As this thesis has already shown, 'operational training had not kept pace with the expansion, by which the RAF had trebled itself in five years [1934 to 1939], nor with improvements in organisation and equipment.'<sup>1</sup> This only partially explained the training shortfall as Bomber Command had also changed its tactics from daylight, self-defending bombers theoretically attacking precision targets to a night bombing force attacking area targets. In purely numerical terms, an analysis of this expansion highlights that, in 1934, the RAF was training 300 pilots each year and, by December 1941, this figure had grown to 22,000.<sup>2</sup> Chapter Six showed that these improvements to training did start to occur largely from 1939, especially when the responsibility for operational training moved, in theory at least, from squadrons to Group Pool Squadrons (GPS) and later, in April 1940, to Operational Training Units (OTU). In addition, the pilot cohort to feed Bomber Command's operational training pipeline increased from sources such as the Empire Air Training Scheme (EATS) and from the USA through the Arnold and Towers schemes. With Elementary Flying Training Schools (EFTS) and Service Flying Training School (SFTS) syllabi now conducted overseas, this export of training reduced the pressure on UK airspace, airfields and, in some cases, training aircraft. The crux of the problem now centred on the provision of operational aircraft types for use in the OTUs as well as the provision of twin-engine Avro Ansons that were also used by the OTUs.

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<sup>1</sup> TNA AIR 41/40, *The RAF in the Bomber Offensive Against Germany, Vol.II: Restricted Bombing, September 1939 – May 1941*, p.11.

<sup>2</sup> TNA AIR 41/4, p.28.

The implications and challenges of this aircraft production shortfall in terms of the way OTU courses were conducted for the remainder of the Second World War, largely shaped by Air Chief Marshal Sir Edgar Ludlow-Hewitt's OTU report of 25 December 1941, when he was RAF Inspector General, will be the first topic of this chapter. In addition, an analysis of two key training gaps, the need for an Advanced Flying Unit (AFU) phase for pilots returning from overseas and the need for more specialist flying skills to handle the four-engine heavy bombers will also be analysed. As Bomber Command began to expand again in the spring of 1942, following its period of conservation, other policy innovations were adopted.<sup>3</sup> These included the decision to move to single pilot operations, the development of the Pilot, Navigator, Bomb Aimer (PNB) selection and grading system, and the establishment of the Aircrew Training Conference. These will also be discussed and their impacts analysed in this chapter.<sup>4</sup> In many ways, these improvements to training proved to be a double-edged sword in that, although pilots were better trained prior to arrival at their operational squadrons, the time taken to get them there was longer and the difficulty in the integration of discrete courses within the overall training pipeline became more troublesome. Despite these deficiencies, this chapter will show that these events can be viewed as the further professionalization of operational training within the Command and the recognition of the importance of a more holistic operational training pipeline.

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<sup>3</sup> TNA AIR 20/6109, Bomber Command Directive, AVM Bottomley (DCAS) to AM JEA Baldwin, Acting AOC-in-C Bomber Command, 14 February 1942.

<sup>4</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-44*, AMT, January 1945, p.19.

## The OTU Challenge

The real problem faced by Bomber Command's OTU organisation in 1941 concerned a shortage of Wellington and Anson aircraft, the prime resources of the OTUs. This shortage of training aircraft had been present prior to the expansion schemes of course and remained a factor until mid-1943 when the output of trained aircrew began to slow, a point made by the AMT on taking office in June 1940.

The expansion of our bomber force is being restricted by (a) lack of operational type aircraft in the OTUs; (b) lack of Anson type aircraft in the OTUs. It is only by expanding the OTU.s that we can produce the crews to enable the front line to expand later.<sup>5</sup>

In many ways, this aircraft shortage epitomised the difficulties surrounding expansion and the priority given to the operational fleet over the training aircraft required to prepare crews to support that fleet. This was especially relevant during the 'period of expansion' that took place up until the middle of 1943.<sup>6</sup> In his report of January 1945, the then AMT, Air Marshal Peter Drummond, referred to this period of expansion being followed by a 'short static period' until February 1944 and finally, a 'period of contraction.'

The 16 OTUs that had been formed by March 1941 were managed by two training groups, No.6 and No.7, the latter having been formed in July 1940 to look after Hampden and Whitley OTUs before OTUs standardised on the Wellington.<sup>7</sup> The AMT, Air Marshal Garrod, had noted Bomber Command's nine Wellington OTUs should have an establishment of 432 Wellingtons and 144 Ansons; the figures on 18

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<sup>5</sup> TNA AIR 20/2769, Letter to Secretary of State for Air, Sir Archibald Sinclair, from AMT, Air Marshal A.G.R. Garrod, 24 July 1941.

<sup>6</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-44*, AMT, January 1945.

<sup>7</sup> Sturtivant, *RAF Flying Training and Support Units Since 1912*, p.11.

July 1941 were 321 and 59 respectively – a deficiency of nearly 66%.<sup>8</sup> This shortage clearly had a detrimental effect on the number of students able to pass through the training pipeline and, as we shall see later, so did issues surrounding the serviceability of those aircraft. As the number of Wellington OTUs increased to replace the Whitley and Hampden OTUs as the war progressed and these older aircraft were retired, this aircraft shortage was exacerbated further, especially considering that, in August 1941 alone, Bomber Command lost 525 aircraft through operational and training losses while monthly bomber production only reached 331.<sup>9</sup>

In August 1941 an operational training conference was held at HQ Bomber Command that highlighted a number of shortcomings concerning OTU course lengths and a disruption to the training pipeline between the Service Flying Training School (SFTS) syllabus that was being conducted overseas and OTU phase conducted in Britain.<sup>10</sup> Having finished SFTS overseas, newly graduated pilots would sail back to the UK and then be held at a Personnel Reception Centre (PRC) prior to a posting to an OTU when places became available.<sup>11</sup> The major problem causing a blockage in the training pipeline was that OTUs were keeping students for longer than the specified course lengths to train them to the standards required by the operational squadrons. Due to poor weather in the autumn of 1941, for example, a six week OTU course could often last for 12 weeks.<sup>12</sup> The other factor contributing to potential delays was OTU aircraft unserviceability. This situation resulted in a bottleneck with SFTS graduates unable to move on to the OTUs because of the

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<sup>8</sup> TNA AIR 20/2769, Letter to Secretary of State for Air, Sir Archibald Sinclair, from AMT, Air Marshal A.G.R. Garrod, 24 July 1941.

<sup>9</sup> TNA AIR 41/41, p.14.

<sup>10</sup> TNA AIR 10/5551, *Flying Training, Vol 1: Policy and Planning*, p.165.

<sup>11</sup> TNA AIR 29/479/1, Operations Record Book for 3 PRC, Bournemouth.

<sup>12</sup> TNA AIR 41/41, p.25.

delayed courses. This created its own problem in how the RAF would keep these individuals current in their flying skills as well as occupied and motivated prior to their OTU course. In many respects the failure to meet operational training outcomes, specifically in navigation and night flying as well as a lack of instructors, had been recognised as early as 1934. As Chapter Five has highlighted, little remedial action had been taken.<sup>13</sup> As the Air Ministry shortened courses to achieve throughput of pilots, the quantity versus quality argument was again aired. In his report of December 1941, Ludlow Hewitt opined that ‘...the expectation that the striking force can be expanded by cutting training to increase output is fallacious’.<sup>14</sup> Ludlow-Hewitt’s views were echoed by the AHB after the war when they reported that ‘[t]he chief difficulty about operational training was that its development directly depleted the first line.’<sup>15</sup> Despite pressure from Churchill and many members of the Air Council, Bomber Command could ‘hardly expand at all during 1941’ but this was not only caused by the need for robust and workable operational training but was also ‘coupled with a failure to build bombers as fast as had been forecast.’<sup>16</sup>

Considering what had become a perennial problem in achieving training outcomes from the OTU, it is surprising to hear the AMT, at the opening meeting of the Aircrew Training Conference in January 1942, state that:

...in the early summer of 1941...we agreed with Bomber Command to reduce the Whitley and Wellington OTU time from 8 weeks to 6 in order to have more Whitley and Wellingtons in the front line and fewer in the OTUs. That brought down the pilot’s time at the control [sic] by about six

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<sup>13</sup> TNA AIR 16/245, Minute Sheet comment from Wing Commander Air Ops to SASO 3 Group, ADGB, March 1935 provides an example.

<sup>14</sup> TNA AIR 20/2769, Report No. 218, Visits to Operational Training Units in Bomber Command – Notes by the Inspector General, 25 December 1941.

<sup>15</sup> TNA AIR 41/4, p.35.

<sup>16</sup> *Ibid.*, p.36.



hours which was proportionally less than the course length reduction because we strove to get more out of the aircraft in the reduced time.<sup>17</sup>

Although he was speaking six months after he and Bomber Command had made the decision to cut the OTU course length, Garrod perhaps showed a lack of understanding for the complexities of the bomber and the tasks that its crew had to undertake. In his defence, he realised the dichotomy raised by the challenge of trying to balance aircraft and aircrew between the operational and training requirements, an issue placed under the spotlight by the RAF's Inspector General, Air Chief Marshal Sir Edgar Ludlow-Hewitt in his report of December 1941.<sup>18</sup> A former AOC-in-C of Bomber Command from September 1937 to 3 April 1940, Ludlow-Hewitt had previously highlighted the shortcomings of Bomber Command in his reports of 1937 and 1938, and again in his Draft Operational Training Plan of 1939.<sup>19</sup> He was in many ways therefore, an ideal Inspector General, especially when it came to matters concerning Bomber Command.

Between 15 and 23 December 1941, the Inspector General visited six OTUs and two satellite OTU airfields. The original object of the visits 'was to enquire into the difficulties which are preventing the OTUs from completing their training syllabuses up in time [*sic*].' The report remarked on the 'sincere and honest effort on the part of the OTU staffs' but also on the frustration of 'senior training staff' who were 'dissatisfied with the standard of training and experience of the crews which they have up to recently been sending out to operational units.'<sup>20</sup> In his visit notes,

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<sup>17</sup> TNA AIR 20/1344, Minutes of the First Meeting of the Aircrew Training Conference Held on 23 January 1942, p.2.

<sup>18</sup> TNA AIR 20/2769, Visits to Operational Training Units in Bomber Command – Notes by the Inspector General, distributed to the Air Council, 25 December 1941.

<sup>19</sup> AHB, Ludlow-Hewitt Papers, Draft Operational Training Plan, January 1939.

<sup>20</sup> TNA AIR 20/2769, Visits to Operational Training Units in Bomber Command – Notes by the Inspector General, distributed to the Air Council, 25 December 1941, p.2.

Ludlow-Hewitt succinctly described the challenges in trying to balance quality and quantity and also highlighted some important psychological issues raised by failing to train to an adequate standard. On this topic, Ludlow-Hewitt underscored training inefficiency, leading to a loss of morale due to aircraft and crew losses within operational squadrons. Morale was also an issue with OTU training staff who were 'sending crews to operational units inadequately trained...[and this was] liable, as it did in the last war, to lead first to discouragement and finally to apathy and indifference.' Ludlow-Hewitt also identified shortcomings in the aircraft numbers at OTUs, the poor availability of aircraft due to a lack of standardised maintenance procedures and organisation, a lack of spares and a 'bottle neck' in the training caused by the problem of conducting night flying due to weather constraints. On a positive note, he referenced other changes to training adjacent to the OTU phase that would improve the situation and raise the standard of crews joining their operational squadrons. These additions were centred on the establishment of Advanced Flying Units (AFU) and Heavy Conversion Flights (HCF) and these will be examined in detail later.

It is worth considering the priority given to the production of training aircraft and operational aircraft allocated to training further. Lund has argued that 'production success is in itself meaningless' and it is not just about the number of aircraft but their technical capabilities.<sup>21</sup> The issue of training aircraft production is significant and highlights the interactive relationship of training to other elements of a nation's war time strategy. As the RAF retained its old biplane bombers well into the 1930s, it also

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<sup>21</sup> E. Lund, 'The Industrial History of Strategy: Re-evaluating the Wartime Record of the British Aviation Industry in Comparative Perspective, 1919-1945', *The Journal of Military History*, Vol. 62, Issue 1, 1998, p.75.

retained its biplane training fleet. The arrival of more complex bombers like the Blenheim, Whitley, Hampden and Wellington did not initiate a move towards more capable training aircraft despite the RAF in general, and Bomber Command in particular, going through a period of major expansion from 1934. That expansion required aircraft allocated for training but such designs received a very low priority; Sinnott, for example, focuses solely on operational aircraft.<sup>22</sup> In February 1936, the RAF's expansion progress committee was calling for 90 elementary trainers for blind flying and 400 twin-engine trainers.<sup>23</sup> In April 1937, the delay to the Don trainer was highlighted as a major shortfall.<sup>24</sup> Expansion of the front line clearly took priority and with the creation of the Ministry of Aircraft Production (MAP) in May 1940, Lord Beaverbrook ensured that 'RAF influence over the aviation industry rapidly declined,' as his industrialist appointees took over responsibility for aircraft production.<sup>25</sup> MAP's decision, 'within days' of Beaverbrook's appointment to concentrate on five aircraft types (Hurricane, Spitfire, Whitley, Blenheim and Wellington), 'would have been disastrous' and 'stultified the production of new designs...' wrote Sir Maurice Dean, the Air Ministry's most senior civil servant.<sup>26</sup> The benefit of Beaverbrook's plan was giving priority to the Hurricane and Spitfire for the forthcoming Battle of Britain and this meshed with the Minister for Coordination of Defence, Sir Thomas Inskip's 1937 plan to prioritise fighter defence.<sup>27</sup> The order was rescinded two weeks after being issued but Beaverbrook's tenure at MAP did not last long. According to Orange, he

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<sup>22</sup> Sinnott, 'RAF Operational Requirements 1923-39.'

<sup>23</sup> TNA AIR 6/24, Secretary-of-State's 25<sup>th</sup> Meeting on RAF Expansion Measures Minutes, 6 February 1936.

<sup>24</sup> TNA AIR 6/29, Secretary-of-State's 76<sup>th</sup> Meeting on RAF Expansion Measures Minutes, 25 May 1937.

<sup>25</sup> Orange, *Tedder – Quietly in Command*, p. 111.

<sup>26</sup> Dean, *The Royal Air Force and Two World Wars*, pp.137-8.

<sup>27</sup> C. Loch Mowat, *Britain Between the Wars* (London: Methuen, 1955), p.570 and Dean, *The Royal Air Force and Two World Wars*, p.100.

resigned 14 times with his last resignation finally being accepted on 1 May 1941, 'to the great relief of many harassed men in Whitehall and elsewhere.'<sup>28</sup> MAP's independent and confrontational relationship with the RAF at best created friction and, at worst, slowed expansion and hampered the delivery of training aircraft. The situation was summarised by the AHB monograph that looked at aircrew training from 1934 to 1942: 'The chief difficulty about operational training was that its development directly depleted the first line...[t]he diversion of effort was considerable...[i]n fact, Bomber Command could hardly expand at all during 1941 for this reason coupled with a failure to build bombers as fast as had been forecast.'<sup>29</sup>

### **The OTU and Beyond – (P)AFU and HCU**

The OTU phase of training was designed to meld together the individual disciplines of pilot, observer/navigator, air bomber/bomb aimer, gunner and wireless operator-air gunner as a crew. By late 1941, with the gradual disappearance of the Whitley and Hampden from operational service continuing, the majority of OTUs were using the Wellington, supplemented by the Anson. The major issue that was identified here was although the OTU courses provided an element of collective crew training, there was a growing training gap for crews moving on to heavy four-engine bombers, first the Stirling and then the Halifax and later, the Lancaster. As discussed above, the OTU course lasted anywhere between six to 12 weeks, depending on factors such as aircraft serviceability and weather, although some aircrew were present for 17 weeks.<sup>30</sup> The OTU syllabus began with converting crews onto the Wellington through

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<sup>28</sup> Orange, *Slessor: Bomber Champion* (London: Grubb Street, 2006), p. 75.

<sup>29</sup> TNA AIR 41/4, pp. 35-6.

<sup>30</sup> TNA AIR 10/5551, *Flying Training, Vol 1: Policy and Planning*, p.169.

classroom lectures and then moved on to the use of synthetic training equipment (see Chapter Nine); gunnery, including fighter affiliation and live air-to-air and air-to-ground firing; bombing; DR (Dead Reckoning) navigation, both day and night; emergency procedures; and finally, operational procedures to include the use of the Darky homing procedure.<sup>31</sup> If the call-sign Darky was heard: 'ground stations would then obtain a bearing on the signal, and comparison of the bearings from three stations would give the aircraft's approximate position'.<sup>32</sup> The OTU course usually culminated in a mission over enemy territory to drop leaflets, the so-called Nickel raid, or occasionally to drop ordnance. These were preceded by Bullseye exercises that saw bomber crews plan and conduct simulated bombing missions against UK cities. Compared to previous training experiences during the EFTS/SFTS phases, pilots were now being taught topics with a distinct operational aim. It is a truism but the very fact that Bomber Command was now over two years into the war spurred on operational training to a major degree. In many ways, the war clarified what training had to achieve and helped the Air Ministry to define desired training outcomes based on gained experience although not all met with unanimous approval.

Indeed, Harris believed that sending OTU crews on operations provided 'intangible advantages' and outweighed the 'tangible losses' incurred.<sup>33</sup> Although some disagreed, most notably the AMSO, Air Marshal Sir Christopher Courtney, on the basis of retarding the expansion of operational squadrons, the CAS, Air Chief Marshal Sir Charles Portal, 'concurred' with Harris. Between May and September

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<sup>31</sup> IBCC Digital Archive, Bomber Command Operational Procedure – Navigation, <https://ibccdigitalarchive.lincoln.ac.uk/omeka/collections/document/28282>. Accessed, 25 July 2022.

<sup>32</sup> RAFM, <https://www.rafmuseum.org.uk/research/archive-exhibitions/worth-a-thousand-words-air-diagrams/aids-to-homing/>. Accessed, 24 April 2022.

<sup>33</sup> TNA AIR 41/42, *The RAF in the Bomber Offensive Against Germany – Vol IV – A Period of Expansion March 1942 – January 1943*, pp.95-96.

1942, OTU crews took part in 'seven major operations' that involved 1,668 sorties (including the 1,000 bomber raid on Cologne). During those sorties, 107 aircraft were lost (6.4%). In addition, during that same period, 390 sorties were flown by HCF/HCU aircraft, losing 26 aircraft, a loss rate of nearly 6.7%.<sup>34</sup> The last operation to use aircraft and crews from training units was conducted against Essen on the night of 16/17 September 1942. Of the total force of 368 aircraft, 126 came from training units. Thirty-nine of the 368 aircraft failed to return, giving a loss rate of nearly 10.6%.<sup>35</sup> Considering the 126 aircraft from training units, 19 aircraft failed to return, a loss rate of 15.09%, a figure that is clearly unsustainable and perhaps the key reason that Essen was the last operational target attacked by crews under training.<sup>36</sup>

Harris epitomised the general view and frustration of many in the Air Ministry that training used so many resources at the expense of operational main force aircraft. Harris was quoted by MacNeece Foster, the AOC 6 Group, just prior to becoming AOC-in-C Bomber Command, as saying 'that the shaft of all our training organisations...was very thick and the actual spearhead of operational effort was very small.'<sup>37</sup> Although palpably frustrated by the manpower and materiel required to conduct effective operational training, Harris was under little illusion as to its importance. His work as AOC 5 Group and the development of a crew training centre at Finningley that will be examined in Chapter Eight and his views on training espoused in his *Despatch on War Operations* attest to the emphasis he personally

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<sup>34</sup> TNA AIR 41/42, p.96.

<sup>35</sup> TNA AIR 41/42, pp.206-7.

<sup>36</sup> Chorley, *Royal Air Force Bomber Command Losses, Vol. 7, Operational Training Units, 1940-1947*, pp.159-61 and *Royal Air Force Bomber Command Losses, Vol. 8, Heavy Conversion Units and Miscellaneous Units, 1939-1947*, p.30.

<sup>37</sup> TNA AIR 14/10, Harris quoted by MacNeece Foster in a memorandum, AOC 6 Group to AVM Baldwin, AOC-in-C Bomber Command, 13 January 1942.

placed on training.<sup>38</sup> This continual battle between training and operational output was reiterated by Harris' Senior Air Staff Officer (SASO), Air Vice-Marshal Saundby, during a presentation to RUSI on 8 December 1943.

A training organization on this scale is a formidable undertaking and it can be produced only by the sternest self-denial in operational strength while it is being built up. The chief difficulty is that instructors for advanced training can be produced only from aircrews. In this, as in other things, you cannot have your cake and eat it, and the more trained men you put back into the operational training organization, the smaller is the force which you can send against the enemy. For this reason alone, our bombing of Germany prior to the Summer of 1942 was on a very small scale indeed. We had to wait until the foundations of expansion had been firmly laid.<sup>39</sup>

Another training element was added in the autumn of 1941 with the formation of Blind Approach Training (BAT) Flights, later renamed, Beam Approach Training Flights.<sup>40</sup> Again, additional training was a further drain on resources but the importance of BAT was clearly a necessity. The aim of these flights was to teach pilots to land in poor weather by homing-in onto a Lorenz RF transmission glideslope generated along the line of the runway. Initially equipped with operational aircraft types, the BATs eventually standardised on the Airspeed Oxford with each flight having eight aircraft, and each aircraft having large yellow triangles painted on their wings and fuselage to show other aircraft that they could be flying 'blind'.<sup>41</sup> By March 1942 there were 26 BATs in service and these were managed by the operational bomber groups.<sup>42</sup> A BAT course normally lasted seven days and the pilot would fly approximately 12 hours with perhaps four or five hours spent as a passenger to observe blind approach procedures. Some BATs also provided around six hours in a

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<sup>38</sup> Harris, *Despatch on War Operations*, pp. 163-9.

<sup>39</sup> AVM R.H.M.S. Saundby, 'Bomber Command,' in *JRUSI*, Vol. 89, 1 February 1944

<sup>40</sup> TNA AIR 41/4, pp.335-6.

<sup>41</sup> Sturtivant, *RAF Flying Training and Support Units Since 1912*, p.11.

<sup>42</sup> TNA AIR 41/4, pp.336-7.

Link trainer.<sup>43</sup> BATs added another phase of training for Bomber Command pilots that not only taught a specific skill but also added additional multi-engine flying practise.

In the autumn of 1941 another phase of training was contemplated when the AMT proposed the formation of Advanced Flying Units (AFU) to address the problems of pilots and navigators having to operate in poor weather and blackout conditions on their return to the UK from overseas training.<sup>44</sup> This course also provided a buffer between arriving back in Britain from overseas EFTS/SFTS and starting their BAT and OTU courses. The first course began in November 1941 and by January 1942 six AFUs had been formed, which by March, had risen to ten.<sup>45</sup> AFUs were located at former SFTS airfields, these having closed down (less for Cranwell and the Polish SFTS) as SFTS training was by then taking place overseas. By the end of 1942, there were 13 Pilot AFUs ((P)AFU) in operation in the UK that provided an eight-week course that comprised 80 flying hours. Twenty of these hours were dedicated to night flying and ten hours to beam or blind approach flying. Although all flying experience was of potential value, supplementing a Group II pilot's twin-engine flying time after arriving from EATS or the US, this was not universally welcomed. At the Aircrew Training Conference in February 1942, the AMSO, Air Chief Marshal Sir Christopher Courtney, said that 'a year ago we were confident that we could maintain a trained flow from the shortened courses'. Current proposals were 'a tremendous swing of the pendulum' and he asked if we are 'now going too

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<sup>43</sup> A study of pilot logbooks at <https://internationalbcc.co.uk/history/digital-archive/>. Accessed at various dates in 2021-22.

<sup>44</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-44*, p.144.

<sup>45</sup> TNA AIR 41/4, p.27.



far in the other direction?' This view was supported by the DCAS, Air Vice-Marshal N. H. Bottomley who felt that 60 hours flying in the AFU was 'excessive'.<sup>46</sup>

As Courtney and Bottomley's comments show, there was still no clear consensus as to how the operational training pipeline should be structured and what the input standard should be or, indeed, what output standard was required. This lack of clarity afflicted both the Air Ministry and Bomber Command. For example, having apparently defined the role of the OTU, Bomber Command was becoming frustrated with the quality of crews that it was receiving from the OTUs. In February 1942, AOC-in-C Bomber Command, Air Vice-Marshal Baldwin, told AMT that that the structure of the OTUs needed reorganising and that 6 Group, in particular, was too large and its staff too busy to liaise with operational groups.<sup>47</sup> Baldwin did however admit that his training staff were also too busy to liaise with OTUs; a point perhaps reflecting Gray's observations on 'silos'.<sup>48</sup> AMT's response was a suggestion that crews should be provided with, 'some elementary crew experience at the AFU stage...' In an effort to streamline training, Garrod also proposed an Operational Training Command outside of Bomber Command or to move OTUs to Training Command, and leave the newly forming Heavy Conversion Flights (HCF) with Bomber Command.<sup>49</sup> Although these ideas had some merit, their major failing was that instead of the direct link between the OTU and Bomber Command that was overseen by AMT, the proposed restructuring would add another agency, and therefore layer, into the management structure and thereby obfuscate decision making still further. The whole issue of

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<sup>46</sup> TNA AIR 20/1344, Minutes of the Aircrew Training Conference, Pre-OTU Aircrew Training, 11 February 1942.

<sup>47</sup> TNA AIR 14/1931, Letter HQ Bomber Command, AOC-in-C AVM Baldwin to AMT, 5 February 1942.

<sup>48</sup> Gray, 'The Strategic Leadership and Direction of the Royal Air Force Strategic Air Offensive Against Germany from Inception to 1945,' p.3.

<sup>49</sup> TNA AIR 14/1931, Letter AMT to AOC-in-C Bomber Command AVM Baldwin, 9 February 1942.

friction between the training providers and the users of those trained personnel was not new and can also be seen today in many military forces and in industry; a prime example being the current UK Military Flight Training System (UKMFTS) where industry provides an aircrew flying training service for the military.<sup>50</sup> In notes made by Baldwin, he opined training was becoming 'more and more out of touch with the Operational side'. In his covering letter, Baldwin added that he 'was appalled by the wastage rates in the OTUs' and operational squadrons and felt, 'the majority of cases these come under the classification of avoidable accidents'.<sup>51</sup>

### **Heavy Conversion**

Remedies to reduce these accidents included the creation of HCFs. The first of these was formed at RAF Linton-on-Ouse in August 1941 as a trial organisation to convert crews onto four-engine heavies. The plan was for each operational squadron to create an HCF on their station using operational aircraft.<sup>52</sup> Considering the arguments discussed in Chapter Six that were made in the 1920s and 1930s by ADGB's Bombing Areas about the need to remove the training burden from operational squadrons, the initial squadron-based HCF decision must be viewed as a retrograde step in creating a distraction.<sup>53</sup> By January 1942, the HCF idea was abandoned and three independent Heavy Conversion Units (HCU) were formed that absorbed the majority of the HCFs. As more HCUs were formed, HCFs 'gradually disappeared'. By 1944 the HCU course had stabilised at five weeks with pilots flying

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<sup>50</sup> National Audit Office, *Investigation into Military Flying Training* (London: HMSO, 4 September 2019).

<sup>51</sup> TNA AIR 14/1931, Letter to AMT from AOC-in-C Bomber Command, 12 February 1942.

<sup>52</sup> Sturtivant, *RAF Flying Training and Support Units Since 1912*, p.12.

<sup>53</sup> See Chapter Six.

around 40 hours.<sup>54</sup> The syllabus included conversion to the more complex four-engine aircraft and mirrored much of the air firing, bombing, navigation and tactical exercises flown at the OTU phase but with the addition of training in electronic navigation devices such as Oboe and H2S.<sup>55</sup> Bearing in mind that the Wellington that was used at the OTU had a crew of five, one further crew member joined at the HCU phase; the Flight Engineer and one of the air gunners now had a mid-upper gun turret from which to operate.<sup>56</sup> Due to the initial shortage of Lancasters, when they first started entering service in numbers during 1942, pilots destined for the Lancaster initially completed a joint Halifax/Lancaster HCU or were trained on the Avro Manchester before flying the Lancaster. This then changed to spending 12 hours flying at a Lancaster Finishing School (LFS) before the creation of Lancaster HCUs in 1944 when more aircraft were coming off the production lines.<sup>57</sup> It is interesting to compare the number of aircraft types flown by a bomber pilot before he arrived at his operational squadron. If that pilot was destined to fly Lancasters, he would have flown one type at the PNB screening phase, one or two during the EFTS phase, two types at the SFTS phase, one type at the AFU and BAT phases, one at OTU and two types at the HCU phase prior to the establishment of LFSs; a total of eight or nine different aircraft.<sup>58</sup>

As the Air Ministry and Bomber Command struggled to find the correct balance of training to prepare the pilot for his operational squadron, it is interesting to

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<sup>54</sup> Harris, *Despatch on War Operations*, p.166.

<sup>55</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-44*, p. 171.

<sup>56</sup> Harris, *Despatch on War Operations*, p.165.

<sup>57</sup> *Ibid.*, p.166.

<sup>58</sup> See Table 4. Pilot's Flying Log Book Summary, p. 305.

compare official sources with that of a Lancaster pilot of the time and his opinion of AFU and HCU flying.

My impression was that structured flying training actually ended at the OTU. From there on, the guy in the right-hand seat wasn't an instructor, but a tour-expired pilot, screened from operations, acting as a supervisor while you circuited and bumped. Naturally, they had varying ideas about how to fly the aircraft and little notion of instructional technique. What you had to do was to read the Pilot's Notes and work things out yourself.

I must admit that I've never understood why we flew the Halifax at all. That piece of the training seemed as redundant as the (P)AFU course, where I flew 35 hours in the Oxford – no more advanced an aircraft than the twins I'd flown in America. The Halifax and the Lancaster had different flying characteristics, different cockpit layouts, different crew locations and different performances. As a lead-in to the Lancaster, the Halifax (and this is only my opinion) was of little help.<sup>59</sup>

An analysis of the training conducted by Bomber Command thus far has highlighted the changing nature of requirements due to evolution in aircraft and tactics as well as disagreements between Bomber Command, AMT's department and senior air staff officers. Fundamentally there was no agreement on how training should be structured and conducted to deliver an acceptable training pipeline output standard. In the winter of 1941 steps were taken to underpin future training design with qualitative scientific processes with the formation of a Training Research branch to work alongside the Training Progress branch.<sup>60</sup> This was later supplemented by the creation of a Training Methods branch under Professor E.A. Bott.<sup>61</sup> There was also a realisation that where the OTU course had been viewed as the end of a pilot's operational training, the addition of HCF/HCU/LFS phases heralded a change. Ludlow-Hewitt accurately captured this change when he wrote: 'I consider that an

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<sup>59</sup> J. Curry, 'Heavy Conversion Training', *Royal Air Force Historical Society*, Issue 11, 1993. p. 86. Jack Currie was a Sergeant Lancaster pilot.

<sup>60</sup> TNA AIR 20/1347, Notes on the History of RAF Training 1939-44, p.51.

<sup>61</sup> RAFM, Air Force List March 1942, p. 25h.

OTU should be thought of as the first step in a new crew's operational life, and not as at present, the last stage in his [sic] training life.<sup>62</sup>

### **Pilot Crewing Policy**

One policy change was to have a major impact on training. At the end of October 1941, Air Commodore MacNeece Foster, AOC 6 Group, wrote to Air Marshal Sir Richard Peirse, AOC-in-C Bomber Command, referring to a meeting of OTU instructors at which the topic of single pilot manning was discussed.<sup>63</sup> MacNeece Foster said that 6 Group were 'distinctly in favour of the advantage of one pilot plus "George" - an automatic pilot - over two pilots as at present.' It was argued that this new crewing policy would provide more flying hours at the OTU due to fewer pilots needing to be trained and a reduced demand on the SFTS. MacNeece Foster sent a formal proposal to HQ Bomber Command on 9 January 1942. The implications for this potential shift in policy on the pilot training pipeline were dramatic in that it would reduce by half the number of pilots required by Bomber Command. An analysis of the responses from the various Bomber Command Groups to 6 Group were generally favourable. Air Vice-Marshal Slessor, AOC 5 Group, said that four out of seven stations were in favour and suggested it was not essential for a heavy bomber to have a second pilot but highlighted the need for better trained pilots to be graduated from the OTU.<sup>64</sup> 4 Group's AOC, Air Vice-Marshal Carr reported that he was 'of the opinion that [single pilot crewing] would lead to greater efficiency...,' while 1 Group's

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<sup>62</sup> AHB, Ludlow-Hewitt Papers, Box 3, Letter from Ludlow-Hewitt to Sqn. Ldr. Donald Simmons, 30 March 1942.

<sup>63</sup> TNA AIR 14/10, Memorandum AOC 6 Group to AOC-in-C Bomber Command, 31 October 1941.

<sup>64</sup> TNA AIR 14/20, Memorandum AOC 5 Group to AOC 6 Group, 26 January 1942.

Air Vice-Marshal Oxland generally favoured the move but as a 'short term policy in order to see how the scheme works.'<sup>65</sup>

The only major criticism came from 3 Group. They argued that it was acceptable for the Wellington but not for the Stirling on the grounds that the second pilot was responsible for managing the 'flaps, engines and undercarriage'. The Group did suggest eliminating the second Wireless Operator. The responses from the groups were précised and sent to the Acting AOC-in-C Bomber Command, Air-Vice-Marshal Baldwin, and the Secretary-of-State for Air, Sir Archibald Sinclair.<sup>66</sup> At a conference held in the Air Council Rooms on 12 February, crewing policy and the output standard of OTU crews was discussed. The desired standard for crews was to be immediately able to undertake operations on arrival in the squadron. The topic of heavy bombers having a single pilot was gaining traction and at a meeting chaired by the CAS, Air Chief Marshal Portal on 29 March 1942 the crewing policy of Bomber Command was agreed. It was confirmed that bomber squadrons with an establishment of 16 IE (Initial Equipment) aircraft would have one pilot per aircraft, meaning that the then current establishment of 40 pilots would be reduced to 26. According to the AHB Narrative, this figure of 26 pilots comprised 20 fully trained pilots and six pilots being 'initiated' in the operational squadron.<sup>67</sup> This 'initiation' is an indication that despite the aim of providing squadrons with only fully trained pilots, operational squadrons still had a training role to play. As well as pilots, other crew members' roles and titles were discussed and the changes resulting from those

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<sup>65</sup> TNA AIR 14/20, Memorandum AOC 4 Group to AOC 6 Group, 29 January 1942 and Memorandum, AOC 1 Group to AOC 6 Group, 1 February 1942.

<sup>66</sup> TNA AIR 14/10, Letter AOC 6 Group to SoS-for-Air and AOC-in-C Bomber Command, 6 February 1942.

<sup>67</sup> TNA AIR 41/42, p.37.

decisions will be discussed in Chapter Eight.<sup>68</sup> Portal said that the meeting's recommendations would be sent to the Air Council for approval.<sup>69</sup>

Portal clearly recognised that although the decision taken by the meeting had clear benefits, there would be a large surplus of pilots created due to the numbers already in the system. In 1945 the AMT, Air Vice-Marshal Drummond, described this surfeit as an 'embarrassing surplus of aircrew, particularly pilots, from early 1943 onwards.'<sup>70</sup> An analysis of a selection of Bomber Command pilot logbooks flying during the Second World War and the minutes of an Air Council Meeting in February 1942 shows that on average pilots were taking around 18 to 19 months from the start of EFTS training to arrive at their operational squadrons although for some, this could be as long as 24 months.<sup>71</sup> This figure increased as the war progressed. Although eventually leading to a glut of pilots, one benefit was that the instructor shortage at OTUs could now be addressed although the Air Member for Personnel (AMP), Air Marshal Sir Philip Babbington, argued that this would not be the case due to a lack of experienced pilots in the system.<sup>72</sup> The other advantage included less pressure to push pilots through the training pipeline and the addition of courses such as the AFU and HCF/HCU phases to improve pilot quality. Typically, as the war progressed, the hours flown by a pilot before arriving in an operational bomber squadron were as follows: 1939 -150, 1940 - 207, 1942 – 370 and 1944 – 440.<sup>73</sup> An analysis of pilot flying log books from the time supports the AHB's figures. In many ways, this move

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<sup>68</sup> TNA AIR 14/1020, 'Notes of a Meeting Held in the Air Council Room at 11 a.m. On Sunday, The 29th March, 1942,' CAS to Air Council, 30 March 1942.

<sup>69</sup> *Ibid.*

<sup>70</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-44*, p.19.

<sup>71</sup> TNA AIR 20/1344, 'Notes on a Meeting held in the Air Council Room at 3.0 p.m. on Wednesday, 11<sup>th</sup> February 1942.' See also, R. Neillands, *The Bomber War*, (London: John Murray, 2001), pp. 82-3.

<sup>72</sup> TNA AIR 20/1344, Report of the 1<sup>st</sup> Aircrew Training Conference

<sup>73</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-44*, p.79.

towards single-pilot operations was supported by another AMT initiative to enhance the quality of new pilots prior to attending the OTU phase. In December 1941, Garrod launched what was referred to as the 'New Deal' where potential aircrew would attend a six week Aircrew Reception Course, a three week grading course at a UK EFTS, followed by 12 weeks at an Initial Training Wing before moving overseas to conduct EFTS and SFTS flying training.<sup>74</sup> New Deal also covered pilots attending an AFU course and OTU course on their return to the UK.

The challenges faced by the RAF in moving to single pilot operation for heavy bombers were multifaceted. During CAS's meeting of 29 March 1942 a number of options were considered to manage the flow of pilots through the training pipeline. The minutes of this meeting stated that the 'embarrassing accumulation of pilots' would be eventually slowed by increasing the overseas SFTS phase from 16 to 24 weeks. On return to Britain, EATS trained aircrew passed through No. 3 Personnel Reception Centre (3 PRC) in Bournemouth before undertaking further training and the population at Bournemouth 'would grow to between 10 to 11,000 during the course of the next nine months, which would involve a stay at Bournemouth rising to 8 months by the end of the year...'. The minutes recognised that the 'morale effect on holding pilots' would be an issue.<sup>75</sup> To overcome this surplus, Bomber Command had to decide the rate of introduction of the one pilot policy; assess methods of damping down the flow of pilots through the training pipeline by increasing course lengths at the beginning of that pipeline; and absorb surplus pilots by training them for other roles.

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<sup>74</sup> TNA AIR 10/5551, *Flying Training, Vol 1: Policy and Planning*, p.161.

<sup>75</sup> TNA AIR 20/1344, Notes of a Meeting Held in the Air Council Room at 11 a.m. on Sunday the 29<sup>th</sup> March 1942', 29 March 1942.



When Air Chief Marshal Harris became AOC-in-C on 22 February 1942, Bomber Command's training assets included 15 OTUs, three HCUs and 12 HCFs, along with 26 BATs and ten AFUs.<sup>76</sup> The number of OTUs grew and stabilised at 22.5 in December 1943 before beginning to decline in late 1944. HCUs peaked in January 1944 at 15 plus two HCF and three LFS. These training units were controlled by 6 and 7 Groups that were re-named 91 and 92 Groups in March 1942. A further indicator of the need for increased training structure saw 93 Group added in June 1942. Harris' arrival at Bomber Command occurred at an opportune time in terms of a period of operational training renaissance. Although the irascible Harris frequently complained of losing crews to the Middle East and Coastal Command, by summer 1943, favourable weather had meant the output from OTUs and HCUs was increasing.<sup>77</sup> This trend continued for the remainder of the war. In December 1943, 10,605 aircrew were holding prior to an AFU course with 5,329 waiting for an overseas course. By March 1944, 10,529 air crew were waiting for a place on an AFU course and by May, this had grown to 16,000.<sup>78</sup> In June 1944, the RAF formed the Air Crew Allocation Centre to 'receive, classify and recommend air crew other than pilots for suitable air or ground employment.'<sup>79</sup> Although the numbers of aircrew being recruited were favourable, the focus was now increasingly placed on improving the quality of recruits and their early grading to undertake specific aircrew roles.

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<sup>76</sup> Harris, *Despatch on War Operations*, Appendix F, Annexure C, Expansion of Training Units.

<sup>77</sup> Harris, *Bomber Offensive*, pp.99-100. OTU/HCU crew output increasing, TNA AIR 41/43, *The RAF in the Bomber Offensive Against Germany, Vol. V, The Full Offensive*, pp.213-4.

<sup>78</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-44*, p.66.

<sup>79</sup> *Ibid.*, p.86.

## **PNB Grading and the Aircrew Training Conference**

The adoption of grading pilots using around 12 hours flying under the Pilot, Navigator or Air Bomber (PNB) scheme was designed to reduce the 20-25% pilot wastage rate during the EFTS phase conducted overseas.<sup>80</sup> Secondly, the screening process was also aimed at raising the standards, particularly of pilots. Previously, aircrew candidates were arbitrarily selected as pilots or observers at the Air Crew Selection Board (ACSB) phase but their flying aptitude was not tested until they reached the EFTS.<sup>81</sup> With the PNB system, those accepted for aircrew at ACSB were sent to an ITW where they stated their aircrew preference with around 10% opting for navigator or air bomber. The 90% wanting to be pilots were then posted to a grading school and given around 12 hours flying, and assessments were normally undertaken after seven and 12 hours flying. Those graded highly, largely determined by how quickly they went solo, were the first to be sent overseas for flying training. These positive developments in managing the training pipeline were being driven by experience and the allocation of additional resources.

Another method designed to better prepare aircrew recruits for their overseas course was introduced in March 1943. Referred to as Preliminary Air Crew Training (PACT), this initiative was launched in Edinburgh in March 1943 to provide candidates that the ACSB thought were suitable for aircrew training but fell below educational standards.<sup>82</sup> PACT provided 33 hours of academic tutoring including maths, science, technical drawing, history, geography and English each week, plus PT sessions given by RAF instructors. Courses took place at civilian technical

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<sup>80</sup> TNA AIR 20/1344, Minutes of Aircrew Training Conference on 23 January 1942, comments by AMT.

<sup>81</sup> TNA AIR 20/1347, *RAF Training 1939-44*, pp.53-5.

<sup>82</sup> *Ibid.*, pp.257-8.

colleges or occasionally, at RAF stations and lasted for six weeks. The final PACT opened in Liverpool on 9th August 1943 and in total the RAF operated 19 PACT Centres.<sup>83</sup>

As we have seen, on return to the UK pilots would undertake an AFU/BAT course before attending the OTU and HCU phases. But wastage at these latter stages of training was also common. MacNeece Foster, AOC 6 (Training) Group, described having to undertake a 'great deal' of 'elimination of personnel' at the OTU phase, either for reasons of a lack of technical ability or 'mysterious traits and illnesses which develop in the last stages of training just before operations.'<sup>84</sup> MacNeece Foster went on to say, 'it is false economy not to weed out people in the early stages.'<sup>85</sup>

As well as these physical changes to operational training, future training would also benefit from the series of conferences and visits to training units by senior commanders and staff officers during January and February 1942 known as the Aircrew Training Conferences.<sup>86</sup> These conferences drew together personnel responsible for training from the UK, the Dominions and a US Army Air Forces delegation attending as observers. The benefit was inestimable in terms of creating a 'learning organisation' that could record, reflect and share best practise. During the first meeting, held on 23 January 1942, the Parliamentary Under Secretary of State for Air – H.H. Balfour, insisted that '...training is and must continue to be one of the

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<sup>83</sup> TNA AIR 20/1347, p.57. See also, <https://rafweb.org/Members%20Pages/Unt%20Histories/Ground%20TTraining%20Units/ITWs.htm>. Accessed, 22 November 2022.

<sup>84</sup> TNA AIR 20/1344, 'Notes on a Discussion at No. 10 O.T.U. Abingdon on Wednesday the 28<sup>th</sup> January 1942,' comments by Air Commodore W.F. MacNeece Foster.

<sup>85</sup> *Ibid.*

<sup>86</sup> TNA AIR 20/1344, Minutes of Aircrew Training Conference on 23 January 1942.

main foundations upon which air power is built.’ The AMT responded by defining the aim of the conference:

The purpose of this conference is to provide an opportunity for us, who are engaged throughout the world in this fascinating task of training, to get together and ensure that we will have the same aim and are following the same principles and methods. This is particularly important at the present moment when we have an opportunity of lengthening the courses for aircrews and thus raising the standards.<sup>87</sup>

Garrod went on to highlight the frailties of many of the current cohort of flying instructors many of ‘whom we would not accept under ideal conditions.’ He also announced his proposal to change the name of the CFS at RAF Upavon to the Empire Central Flying School and expand its responsibilities to correlate operational lessons learned and integrate these in to new training syllabi that would be standardised across all training establishments throughout the Empire. Interestingly, Garrod finished his address by informing delegates of the need for secrecy as details of ‘training are just as valuable to the enemy as details of operations.’ Garrod emphasised this point by saying the RAF’s knowledge of Luftwaffe training was ‘scrappy’ and if the RAF ‘could get more information about his training methods we should be able to judge whether we are beating him or he is beating us at this game...’ thereby encapsulating the vital and strategic importance of training. ‘The Battle of Training is just as important as the operational battle,’ he concluded.<sup>88</sup>

The importance of the Aircrew Training Conferences during January and February 1942 were significant in that as well as the meetings themselves to discuss training methods and the overall training pipeline, visits were undertaken to a number

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<sup>87</sup> TNA AIR 20/1344, Minutes of Aircrew Training Conference on 23 January 1942.

<sup>88</sup> *Ibid.*

of organisations involved in providing training. These included the Central Link Trainer School at Elstree, 10 OTU at RAF Abingdon, 6 SFTS at RAF Little Rissington and HQ Flying Training Command. Perhaps in recognition of its status as the largest consumer of aircrew, a visit was also undertaken to HQ Bomber Command where lectures were given by aircrew on the task of each crew member as well as a tour of the operations room.<sup>89</sup> To spread the knowledge gleaned during the conferences and visits, AMT decided to publish an abridged report covering these events for distribution to a wider audience throughout the RAF.<sup>90</sup> This communication was clearly designed to help define, direct and spread best practise and, although well received, it did not provide answers to all Bomber Command's training issues.

### **Challenges Remain**

By the middle of 1942, the operational training pipeline had matured to the extent that each component course was theoretically integrated with the next phase of training. In other words, the input and output standards of each phase of training were largely meshed together to ensure a coordinated whole. The operational training pipeline was now operating relatively successfully with each phase synchronised to deliver the correct output standard to start the next course, although there was normally a holding period between courses. Clearly, the decision to adopt one pilot operations dramatically eased the situation although, as we have seen, this did lead to a surplus of pilots. The manpower resources involved in providing aircrew, maintaining training

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<sup>89</sup> TNA AIR 20/1344, Note of a Visit to Headquarters, Bomber Command, on Saturday 24<sup>th</sup> January 1942, AMT.

<sup>90</sup> TNA AIR 20/1344, Aircrew Training, Abridged Report of the Conference Held in the United Kingdom, January/February 1942. Air Ministry Pamphlet 133, May 1942.

aircraft and acting as instructors for the RAF was extensive and by late 1942, the Air Council was again questioning how training was being organised and managed.

In a confidential minute, the Parliamentary Under-Secretary of State for Air, H.H. Balfour, told the Secretary of State for Air, Sir Archibald Sinclair, that he was 'not happy at the present functioning and staffing of AMT's department.'<sup>91</sup> Balfour believed the 'different stages' comprising the complete training pipeline were 'sound' linking those stages together was 'poor'. The 'phasing and co-ordination has shown itself weak', opined Balfour, stressing the overall management of the AMT organisation, 'does not command confidence'. Balfour went on to say that a backlog of aircrew were waiting to be trained and complaints would be forthcoming about 'tying up man-power for an inordinately long time'. Reinforcing this argument, he said AMT's Statistical Branch had 'fallen down' and 'shown up so weakly in certain other planning' analyses. The minute from Balfour to Sinclair was 'intercepted' by the VCAS, Air Chief Marshal Sir Wilfrid Freeman, who attached his own minute to that of Balfour.<sup>92</sup> In it, he supported Balfour's idea for an independent inquiry into AMT's department by Sir Harold Howitt but also highlighted the 'complicated task' facing the AMT and his staff, suggesting it seemed 'hardly fair to blame AMT for the fact that we have a large number of aircrew pupils on deferred service.'<sup>93</sup>

It was also ironic that Balfour chose to highlight poor statistical forecasting as one of the major failings of AMT's department considering the generally abject

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<sup>91</sup> TNA AIR 20/2402, Personal and Confidential Minute from HH Balfour to Sir Archibald Sinclair, 5 October 1942.

<sup>92</sup> TNA AIR 20/2402, Personal and Confidential Minute from VCAS, AVM Freeman to Sir Archibald Sinclair, 28 October 1942.

<sup>93</sup> *Ibid.*

forecasting by Government and the Air Ministry throughout the Second World War. In March 1940, for example, the Air Ministry estimated that to meet expansion targets over the next two years, 2,390 aircrew and 12,000 ground crew would need to be recruited each month. The figures showed that up until March 1941, 172,680 personnel would therefore have to be recruited. The actual number of personnel recruited during this period was 351,000.<sup>94</sup> The criticism levelled at AMT was also deficient when considering the responsibilities for the planning associated with training. As well as oversight by the Air Council, MAP was responsible for the production of training aircraft and AMSO responsible for the formation of training units and their establishments while AMP was responsible for manning and postings.<sup>95</sup> As we have already seen, training does not occur in a vacuum.

Poor forecasting can also be seen in the Air Ministry's complicity with the Cabinet in terms of the projected expansion of Bomber Command through Target Force 'E' that predicted 4,000 heavy and medium bombers in-service by mid-1943 and that programme's replacement, Target Force 'G' from July 1942.<sup>96</sup> Although 'E' was cancelled due to Britain not being able to utilise US aircraft production because of the latter's entry into the war, Target Force 'G' called for 2,500 heavy and medium bombers by December 1943 with 925 bombers being built in the UK every month by August 1943. The total number of bombers produced by MAP in August 1943 was 555, a shortfall of 370.<sup>97</sup> Where Balfour was correct was in identifying that individual courses within the overall holistic training pipeline were 'sound', linking the stages

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<sup>94</sup> TNA AIR 20/1347, *RAF Training 1939-44*, p.11.

<sup>95</sup> RAFM, Air Force List, March 1942.

<sup>96</sup> TNA AIR 41/42, pp. 1-2.

<sup>97</sup> NAL, JV Connolly Collection, Ministry of Aircraft Production Statistical Review 1939-1945, January 1946.

together was 'poor'. The more stages, or discrete courses that comprise the overall training pipeline, the more difficult it is to link them. The reasons for this have been examined in Chapters Two and Six and include factors including the availability of resources such as training aircraft, airfields and instructors; the adoption of new aircraft types and tactics; the debilitating effects of weather and enemy action; changes in policy and fluctuating course outputs caused by training and operational wastage. But, as highlighted earlier, in December 1943 there were 5,329 aircrew waiting to go overseas for training and 10,605 at ARCs awaiting a place at an AFU, which clearly showed that the operational training pipeline was producing sufficient aircrew.<sup>98</sup>

The other consideration that was causing difficulties was the number of additional courses that were added before a pilot arrived at his operational squadron, thereby extending the training pipeline. Table Five shows the processes/courses that a pilot would need to undertake before arriving at his operational squadron in early 1944.<sup>99</sup> In addition to the course lengths shown above, leave entitlement would also have to be added along with travel times. This could potentially add a further six to ten weeks to the tabular figures.<sup>100</sup> The other factor that we have already examined is the holding time between courses. This challenge was never really managed and remains a major factor even today in the UKMFTS programme for example.

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<sup>98</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-44*, p.66.

<sup>99</sup> Table Five, *Bomber Command Pilot Training Process Time*, p.306.

<sup>100</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-44*, and RAFM, *Pathway to Pilot 1944*, [https://www.rafmuseum.org.uk/images/online\\_exhibitions/Pilot-Progress-1944LG.jpg](https://www.rafmuseum.org.uk/images/online_exhibitions/Pilot-Progress-1944LG.jpg). Accessed, 22 June 2022.



## Conclusion

This chapter has concentrated on pilot operational training in Bomber Command from August 1941, with the formation of the first BATs and subsequent AFUs, HCFs and HCU, up until the end of the war, although operational training began 'contraction' from February 1944. These extra courses had to be integrated with an OTU system that was suffering from a lack of aircraft and inefficient maintenance support that exacerbated the aircraft shortage problem. There was also poor morale amongst staff and students. OTU courses were often extended to meet training objectives or to overcome poor weather and this had the result of restricting students joining from the AFU/BAT courses and causing bottlenecks. The efficiency of the OTUs began to improve as a result of the Inspector General's report of December 1941 as well as the forum provided by the Aircrew Training Conferences of January and February 1942 that enabled a free-flow of ideas and information within the wider training community. It is also possible that students joining from AFUs had more twin-engine flying experience and therefore were better prepared for the Wellington at OTU. This view was not universally accepted though with criticism of it from some trainees, AMSO and DCAS; the latter saying that the 60 hours additional (P)AFU flying was 'excessive'. Although there was disagreement about the effectiveness of the (P)AFU course, the HCU course was widely accepted as a welcome addition to preparing pilots for the heavier four-engine types that they would fly operationally. Like the OTU course, The HCU/LFS course also provided additional collective training opportunities for the entire crew. The real lesson here was that thorough and

effective operational training needed a major investment in resources and this lesson was only being recognised from 1938 onwards. Prior to this, poor training, and therefore operational readiness, were being hidden by the inadequate operational training being conducted in frontline squadrons.

As well as these practical changes to the training pipeline, policy changes also had an impact; most notably the move to single-pilot operations and the launch of the PNB process. The former significantly reduced the number of pilots to be trained and thereby freed up pilot training resources while the latter, through its grading system for pilots, increased standards and reduced wastage rates at the EFTS phase of training. As this chapter has shown, the more constituent courses that create the overall operational training pipeline are problematic when it comes to linking them together. By 1944 it was taking over two years for a pilot to move through the training pipeline and, as discussed in Chapter Two, this meant that any change to policy or training methodology that was introduced took a considerable time to become effective as it worked through the system. Although Bomber Command's operational training pipeline for pilots was far from perfect it evolved to deliver enough pilots to meet operational needs.

In comparing that training pipeline to that of the Luftwaffe to reflect Garrod's comments on 'the Battle of Training' that he made in January 1942, Kreipe and Koester have said of the Germans, 'It was a vicious circle...inadequate training led to high losses in aircraft; these losses resulted in a lack of aircraft at the front; and because of the need for aircraft at the front, there were none available for assignment to the training programme.' This lack of aircraft made it, 'simply impossible to give

students the training they needed.’<sup>101</sup> In comparison, the RAF and in particular, Bomber Command, epitomised professional training excellence.

This thesis will now move on to discuss two additional and vital elements of Bomber Command’s operational training pipeline. The first is the training provided for rear-crew specialists such as air gunners, bomb aimers, navigators, wireless operators and flight engineers; the second is how these aircrew were integrated as a holistic crew at the OTU and HCU stages.

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<sup>101</sup> W. Kreipe & R. Koester, *Pilot and Aircrew Training in the Luftwaffe 1921-1945*, USAAC Report (MLRS Books, 2006), pp.363-3.

## CHAPTER EIGHT

### TRAINING OTHER AIRCREW

#### **Introduction**

As already discussed, the capabilities of the bomber force altered radically between 1922 and 1942 due to the technological transformation of aircraft from two-seater biplane light bombers to four-engine, multi-crew, heavy bombers. Sinnott described this period as representing a 'very rapid advance in aeronautical engineering'.<sup>1</sup> That technology, as Walker stated, 'was transforming the potential of warfare' but a key factor was the human dimension and how the RAF leadership at squadron, group, command and Air Ministry levels provided and directed operational training to exploit those technological changes through doctrinal development.<sup>2</sup> As we have seen with Chapters Six and Seven in discussing pilot training, that human dimension, especially in terms of leadership, management and the ability to link technological changes to both training and the development of operational doctrine initially fell short of expectations. As Gray has argued, the RAF faced 'real dilemmas' in addressing 'the linkages between people, processes and technology' and this became apparent in the Service's challenge to define the composition and roles of an individual crew member in a multi-crew aircraft such as the Stirling, Halifax or Lancaster.<sup>3</sup>

This situation was made worse by the pilot-centric nature of the Service that had been reflected in James' description of the RAF as a 'Pilots' Air Force'.<sup>4</sup> An

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<sup>1</sup> Sinnott, 'RAF Operational Requirements 1923-39,' p.13.

<sup>2</sup> Walker, 'Supreme Air Command – The Development of Royal Air Force Command Practice in the Second World War,' p.22.

<sup>3</sup> Gray, 'The Strategic Leadership and Direction of the Royal Air Force Strategic Air Offensive Against Germany from Inception to 1945,' pp.11 and 36.

<sup>4</sup> James, *The Paladins*, p.151.

exemplar of this pilot-centric view was provided by Air Chief Marshal Ludlow-Hewitt when he wrote as late as May 1939 that only the 'captain of the aircraft' [the pilot] can undertake the task of navigation and not the air observer'.<sup>5</sup> Rather ironically, Ludlow-Hewitt had previously referred to the 'phenomenally slow progress' made in navigation training due to 'reactionary tendencies' and 'ignorance' in his Bomber Command annual report for 1938.<sup>6</sup> As Monahan has stated, the 'aviator identity was enormously important in the development of attitudes, assumptions and deep cultural structures of the RAF' and, as such, was a key determinant in driving how training was conducted.<sup>7</sup> The omnipotent pilot class, literally and figuratively, was in the driving seat. Mahoney, in discussing the formation of the RAF's General Duties (GD) Branch, referred to the RAF showing 'an evidential preference for pilots' and the GD Branch, that to which pilots are assigned, used to 'nurture...future leaders'.<sup>8</sup> As such, pilots became 'the dominant tribe or subculture' of the RAF.<sup>9</sup> It was from this pool that that senior officers, the majority of whom gained their pilot's wings before and during the First World War, dictated the crewing policy of the RAF in the lead-up to the Second World War. As this chapter will show, that policy was often frequently misplaced, confused and led to major inefficiencies and disruption to the training pipeline.

How the transformation of training from two-seater bombers to seven-crew heavy four-engine bombers took place will be the subject of this chapter. With a

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<sup>5</sup> AHB, Ludlow-Hewitt Papers, Box 2, Letter to Under Secretary of State for Air from AOC-in-C Bomber Command, 25 May 1939.

<sup>6</sup> TNA AIR 14/57, Bomber Command Annual Training Report – 1938, 23 January 1939.

<sup>7</sup> Monahan, 'The Origins of the Organisational Culture of the Royal Air Force,' p.44.

<sup>8</sup> R. Mahoney, 'The Forgotten Career of Air Chief Marshal Sir Trafford Leigh-Mallory, 1892-1937: A Social and Cultural History of Leadership Development in the Inter-War Royal Air Force' (PhD Thesis, University of Birmingham, March 2014), p.111.

<sup>9</sup> R. Mahoney, 'Trenchard's Doctrine: Organisational Culture, the "Air Force spirit" and the Foundation of the Royal Air in the Interwar Years', *The British Journal of Military History*, Vol. 4, No.2, 2018, p.145.

backdrop of technological change within a pilot-centric Service, this chapter will discuss three key periods as part of the theme of collective crew training. The first will be the First World War and experiences up until 1934 where the majority of non-pilot aircrew training was conducted in squadrons with part-time aircrew. This period reflects a time of peace, financial austerity, a largely stagnant bomber force, a lack of urgency generated by the Ten Year Rule and the absence of doctrinal clarity as far as the operational role of the bomber was concerned. The second period of analysis will cover the start of expansion in 1934 until 1942 with reference to individual aircrew trade training. This phase highlights the crewing challenges that were being presented by the modern bombers then entering service during what the AHB Narrative refers to as a *Period of Expansion and Experiment*.<sup>10</sup> The Chapter will then conclude with what can be termed as the full professionalization of training for aircrew other than pilots that was initiated by the Air Ministry's 'Composition and Training of Aircrews in Medium and Heavy Bombers' meeting of March 1942. The chapter also focuses on collective training provided to the complete crew at the Advanced Flying Unit (AFU), Operational Training Unit (OTU) and Heavy Conversion Unit (HCU) stages.<sup>11</sup> These three periods will be analysed through the prisms of the RAF's culture, training methodologies and resource management within the overall requirement for a robust operational training pipeline.

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<sup>10</sup> TNA AIR 41/42.

<sup>11</sup> TNA AIR 20/1344, Minutes of the Composition and Training of Aircrews in Medium and Heavy Bombers held in the Air Council Room, 11 March 1942.

## Post-War Inaction

As discussed in Chapter Three in examining the training legacy of the First World War, the RFC and, when combined with the RNAS in April 1918, the RAF, realised the need for and importance of, what would be referred to today as 'rear crew'. What it did not recognise was how to identify the role and functions of these additional aircrew members, especially as the RAF expanded as the threat from Nazi Germany increased exponentially. Initially, this role was multifaceted but by 1915 it was recognised that the function of the 'observer' was aerial gunnery, being able to use the 'RFC camera successfully' and to 'send and receive wireless' at six words per minute with 98% accuracy.<sup>12</sup> The observer was also responsible for dropping bombs. Brooke-Popham went on to say that the observer would ideally undertake artillery cooperation work in addition to his other tasks but added, 'although it is undesirable to lay down any hard and fast rules as regards the qualification of Observers, it is considered that the same general standard of proficiency should be maintained throughout the RFC.'<sup>13</sup> Why it was 'undesirable' to define the role of the observer and then design a syllabus with clear training objectives and outcomes is difficult to understand even with hindsight. The multiple roles undertaken by the observer in a two-seat aircraft implied a heavy workload and the policy that there were no 'hard and fast rules' about qualification, and therefore training meant that standards varied widely. That was hardly surprising given that until late-1915, observer training was solely delivered in squadrons prior to schools being established in Britain.<sup>14</sup> This

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<sup>12</sup> TNA AIR1/748/204/3/57, Minute from Lt Col Brooke-Popham HQ 3<sup>rd</sup> Wing to HQ RFC, 2 August 1915.

<sup>13</sup> *Ibid.*

<sup>14</sup> TNA AIR 1/683/21/13/2234, Training of Observers, Paper by Wing Commander J.A. Chamier, 11 January 1919.

unstructured approach to training continued into 1916 with some observers being trained by their squadrons in Britain prior to 'mobilising for France.' Chamier's report concerning observer courses highlighted the requirement for the addition of an 'observers' section' to the Wireless School at Brooklands and recommended adding gunnery training and 'artillery co-operation work' to the syllabus.<sup>15</sup> As the war progressed, further courses were offered at the Reading and Oxford RFC Schools of Instruction as well as at the Aerial Gunnery School at Hythe. Although this was of benefit, there was no holistic, coordinated or common standard for observer training throughout the war.

The socio-relational aspect associated with the arrival of rear crew members is also worth considering in that it is a recurring theme throughout this thesis.

Observers were generally speaking officers and although not considered fully on par with pilots, many saw the observer role as a stepping stone to becoming a pilot.<sup>16</sup> Barker referred to a 'feeling of inferiority inherent in the relative status of pilot and observer.'<sup>17</sup> Even though officer observers were still viewed as inferior by the pilot, at least they lived, socialised and messed together. Despite this social interaction, the gulf between pilot and observer was exacerbated further by poor observer training. In March 1917, for example, V Brigade complained about the poor state of gunnery of newly arrived observers and their inability 'co-operate' with the pilot.<sup>18</sup> III Brigade also complained about the poor standard of gunnery with too few trainee observers having completed the Brooklands training course; even those that had, attended for

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<sup>15</sup> *Ibid.*

<sup>16</sup> Jefford, *Observers and Navigators and Other Non-Pilot Aircrew in the RFC, RNAS and RAF*, pp. 17-18.

<sup>17</sup> R. Barker, *The Royal Flying Corps in France* (London: Constable, 1996), p.123.

<sup>18</sup> TNA AIR 1/1135/204/5/2224, Letter V Brigade to HQ RFC, 19 March 1917.



only four days.<sup>19</sup> Some trainee observers did not undertake firing practise in the air and II Brigade complained of inconsistent training.<sup>20</sup> With the RFC's casualty rate rising in 1917 and many officer observers re-mustering as pilots, increasing numbers of NCO observer/gunners were being used to fill the shortfall and here the social and class-based values of the day were brought to the fore. Jefford has argued that 'some of the more Edwardian (even Victorian) minded among the officers found it difficult to accept the presence of NCOs, let alone private soldiers, on anything like equal terms.'<sup>21</sup> This class distinction was made worse by the poor training being provided to aerial gunners and the associated lack of respect that this derived from the pilots although, as we have seen in Chapter Three, the standard of pilot training during 1917 was also variable. The pre-eminence of the pilot was reinforced with the publication of Trenchard's *Permanent Organization of the Royal Air Force* memorandum in November 1919.<sup>22</sup> Although Trenchard highlighted the centrality of pilots to the RAF and the requirement for all officers to be pilots, the document contains no mention of observers.

Following the First World War, the roles of the observer and gunner were initially undertaken by pilots or commissioned Air Observers but, from 1921, ground tradesmen could be employed as part-time gunners. This was especially relevant for the RAF's seaplane squadrons that could have a crew of three or four.<sup>23</sup> It should also be pointed out that many RAF officers interchanged the words gunner and observer during this post-war period to mean the same role. This was both

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<sup>19</sup> TNA AIR 1/1135/204/5/2224, Letter III Brigade to HW RFC, 19 March 1917.

<sup>20</sup> TNA AIR 1/1135/204/5/2224, Letter II Brigade to HW RFC, 19 March 1917.

<sup>21</sup> Jefford, *Observers and Navigators and Other Non-Pilot Aircrew in the RFC, RNAS and RAF*, p.41.

<sup>22</sup> RAFM, Trenchard Papers, MFC 76, *Permanent Organization of the Royal Air Force*, 25 November 1919.

<sup>23</sup> RAFM, AMWO, 8 January 1920.

inaccurate and unfair to the 23 Observer Officers, veterans of the First World War that were still serving in 1926 although, as we have seen, no new Air Observer officers were being trained.<sup>24</sup> This mixing of terminology was a typical pilots' reference to 'the man in the back' who undertook all the tasks not carried out by the pilot. It was clear that the early years of the RAF were ones of confusion when it came to the collective development of aircrew. As to volunteer gunners, tradesmen were sent to the Armament and Gunnery School at Eastchurch for a six week course, with a refresher course undertaken every three years. From April 1921, these part-time gunners were awarded an extra 6d per day when employed on gunnery duties.<sup>25</sup> Bearing in mind the financial pressure that the RAF was under, the expedient of using part-time gunners can be fully understood, but the negative side to the arrangement was that ground tradesmen would be absent from their primary place of work and the use of part-time gunners did little to cement the concept of an holistic, collective and well-trained aircrew system. The other issue was that in the early 1920s the majority of the RAF's operational squadrons were employed overseas and squadrons were reluctant, or found it difficult, to send ground tradesmen back to Eastchurch for a six-week gunnery course and refresher training every three years.<sup>26</sup> The result was that squadrons undertook their own training and according to Jefford, this led to issues of training consistency and quality.<sup>27</sup>

Throughout the 1920s, the RAF used a range of twin-engine day and night bombers, such as the Boulton Paul Sidestrand, Handley Page Hinairi and

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<sup>24</sup> Jefford, *Observers and Navigators and Other Non-Pilot Aircrew in the RFC, RNAS and RAF*, p.136.

<sup>25</sup> RAFM, AMWO, 14 April 1921.

<sup>26</sup> RAFM, *Air Force List*, December 1922.

<sup>27</sup> Jefford, *Observers and Navigators and Other Non-Pilot Aircrew in the RFC, RNAS and RAF*, p.133.

Hyderabad and the Vickers Virginia.<sup>28</sup> All of these aircraft had a crew of four that comprised a pilot, a co-pilot acting as navigator and bomb-aimer and one gunner; or a pilot and three gunners. As discussed earlier, there was little direction from the Air Ministry as to the composition of crews or to their training, which was left to the operational squadrons to determine. One of the challenges faced by these squadrons in 1926 was that, with the demise of the Observer Officer, gunners were being called upon to undertake more tasks and becoming *de facto* airmen observers. In late 1926, Air Vice-Marshal John Steel, AOC Wessex Bombing Area, highlighted to the CAS that the decision to remove Officer Observers meant that 'air gunners' would need to be taught 'bomb aiming, air pilotage, and photography in addition to their duties as gunners.'<sup>29</sup> In fact, many air gunners were having their gunnery duties supplemented by these tasks already while wireless operators were now also being used as air gunners in bomber aircraft to exploit their radio communications skills. In April 1926, with the demise of the Officer Observer, the RAF was providing an Air Gunnery and Armament Course for pilots and airmen 'air-gunner/observers', but the training of non-pilot aircrew remained haphazard and incoherent. Five Air Gunnery and Armament Courses were planned each year for 30 pupils per course and would last for eight weeks.<sup>30</sup> Part of the course saw airmen observers operating the Course Setting Bomb Sight (CSBS) to enable them to drop bombs. A year later it was decided to employ some full-time air gunners in an attempt to increase the number of air gunners and improve levels of training.<sup>31</sup> Although the employment of these full-

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<sup>28</sup> Thetford, *Aircraft of the Royal Air Force Since 1918*, pp.114, 285, 283 and 508.

<sup>29</sup> TNA AIR 8/1359, Memorandum AOC Wessex Bombing Area to CAS, Air Marshal Sir Hugh Trenchard, undated.

<sup>30</sup> RAFM, AMWO, 15 April 1926.

<sup>31</sup> RAFM, AMWO, 14 July 1927.

time air gunners boosted the professionalism of rear-crew aviators, it still left the pilot with a heavy workload that included navigation although, as AOC Wessex Bombing Area highlighted above, gunnery, bomb-aiming and communications were still the responsibility of the air gunner.

One of the key shortfalls facing the RAF during the inter-war years was in navigation. Then referred to as 'Air Pilotage', the first interwar school, the Air Pilotage School, was not established until November 1931 at RAF Northolt as a trial before moving to RAF Andover in May 1933, ironically taking the place of the defunct School of Air Pilotage that was formed in 1919 and finally closed in 1922.<sup>32</sup> Offering two-week courses, Andover was supplemented by the School of Aerial Navigation at Calshot, formed in 1920, primarily to teach long-range navigation to seaplane pilots but increasingly accepting bomber pilots during an eight month Special Navigation Course or three month regular navigation course.<sup>33</sup> Although these courses were for pilots only, the creation of formal air navigation training was intrinsic to the re-establishment of the Air Observer, and later, in 1942, the Navigator. The train of events leading to the creation of full-time air observers started in August 1934 with when the Air Council formally addressed the issue:

It has been for some time clear that the present system of providing for observer duties in the Royal Air Force by the employment of airmen as air gunners, mainly on a part time basis, has been becoming increasingly inadequate for the fighting requirements of the services as the work of squadrons increases in complexity and as the organisation of the crews of aircraft developed.<sup>34</sup>

The issue here was that the new Air Observer would replace 'the existing full-time air gunner'. The Air Ministry Working Order stated that part-time air gunners would not

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<sup>32</sup> Sturtivant, *RAF Flying Training and Support Units Since 1912*, p.8.

<sup>33</sup> Jefford, *Observers and Navigators: And Other Non-Pilot Aircrew in the RFC, RNAS and RAF*, p.143.

<sup>34</sup> RAFM, AMWO, 9 August 1934.

be required apart from those in flying-boat, two-seater fighters and some Army Co-Operation squadrons. Unfortunately, this recognition of the importance of the specialist Air Observer was diluted by a lack of clarity as to the Air Observer's role and then, having recruited and trained a specialist member of aircrew, potentially under-using those skills when employing the individual in a pure air gunner role.

In summarising the period following the First World War up until Expansion Scheme A, announced in 1934, this was a relatively benign era for the RAF with the majority of their squadrons located overseas throughout the Empire. In terms of resources, it was a period marked by economic stasis and, as such, the RAF had to cut its cloth accordingly, as reflected in the training methods that it adopted. Culturally, it was a pilots' air force with training policy dictated by senior officers brought up and educated in an environment defined by Victorian and Edwardian social and class values. As Britain was not facing any real military threats at home or overseas, there was little pressure to make that training efficient and the majority was conducted within operational squadrons. The problem here was that training methods and standards varied widely but there was no concise central guidance from the Air Ministry to improve that situation. As far as rear crew were concerned, these were found from within the squadron by misemploying ground trades and using them as gunners and observers on an *ad hoc* basis. With the commencement of the RAF's major expansion from 1934, to counter the threat posed by Germany, rear-crew training methods began to change but as this thesis will show, that was a slow process.

## Expansion and Confusion, 1934-1942

In his Memorandum to accompany the Air Estimates for 1935, Lord Londonderry, Secretary of State for Air, wrote:

The system of providing for observer duties in the Royal Air Force by the employment of airmen as air gunners, mainly on a part-time basis, has become inadequate to the requirements of the service, as the work of squadrons has increased with the complexity and the organisation of crews of aircraft has developed. It has accordingly been decided to introduce a new type of air observer who will replace in large part, the present air gunner. These observers will be drawn from airmen of the trades recruited through the aircraft apprentice and boy entrant schemes – mainly for the armament, signal and photographic trades, the duties of which are most closely connected with the work of squadrons in the air.<sup>35</sup>

This statement marks an important shift in the Air Ministry's thinking concerning operational training. Firstly, it recognises the need for specialist aircrew other than pilots. It also acknowledges that by recruiting tradesmen from three core trades – armaments, signals and photographic – would result in a more professional output from the training pipeline. Not all squadrons were keen to offer up their specialist ground tradesmen for a full-time air observer role and the Air Council highlighted that some squadron commanding officers were 'slack in not putting people forward'.<sup>36</sup>

This period also marked 'the substitution of the term "Air Navigation" for "Air Pilotage"'.<sup>37</sup> In January 1936, the first Air Observer School (AOS) opened at North Coates Fittes to conduct eight week courses for airmen observers.<sup>38</sup> This course primarily focussed on armament training with navigation training still undertaken in squadrons. This approach resurrected the old problem of a lack of standardisation and depth of what was being taught. As discussed in Chapters Six and Seven,

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<sup>35</sup> University of Birmingham, Store, Box 707, Memorandum to Accompany Air Estimates 1935 by the Secretary of State for Air, Cmd. 4822, 27 May 1935. (TNA T/161/658/4).

<sup>36</sup> RAFM, AMWO, 14 March 1935.

<sup>37</sup> RAFM, AMWO, 24 January 1935.

<sup>38</sup> TNA AIR 10/5551, *Flying Training, Vol. I, Policy and Planning*, p.19.

navigation was barely taught to pilots and the RAF was suffering from a major training gap as far as the subject was concerned. During an Expansion Progress Meeting (EPM) in 1937, to discuss the establishment of a second navigation school, the CAS opined that 'less than 20% of pilots in the Royal Air Force are properly trained in navigation...'<sup>39</sup> This situation was partially addressed when the School of Air Navigation opened at Manston in January 1937.<sup>40</sup> Again, the cultural aspect came to the fore with the RAF placing the emphasis on the pilot for the responsibility of navigating his aircraft with the air observer being, in effect, the pilot's assistant as far as this skill was concerned. However, the pressure was building through the Expansion Schemes to train more pilots and observers to meet the growth in squadron numbers. In February 1936, the Air Council set a target of 1,316 new observers to be trained by April 1939.<sup>41</sup> The need for the observer was recognised by the RAF with the re-introduction of the Observer's brevet in October 1937, but the role and qualifications required of that individual would remain unclear.<sup>42</sup>

The production of observers at North Coates was being hampered by a shortage of Avro Anson training aircraft, but one positive point was that the RAF was looking at 'increasing the amount of navigation training given to Air Observers at the armament school at the expense of air bombing which would be given at units instead in view of the increasing demands in squadrons for observers who were trained navigators.'<sup>43</sup> Like Air Chief Marshal Sir John Steel before him, Air Chief Marshal Sir Edgar Ludlow-Hewitt held strong views on how Bomber Command

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<sup>39</sup> TNA AIR 6/33, 90<sup>th</sup> EPM Minutes, 6 March 1937.

<sup>40</sup> Sturtivant, *RAF Flying Training and Support Units Since 1912*, p.9.

<sup>41</sup> TNA AIR 6/24, 25<sup>th</sup> Expansion Progress Meeting (EPM) minutes, 6 February 1936.

<sup>42</sup> Jefford, *Observers and Navigators: And Other Non-Pilot Aircrew in the RFC, RNAS and RAF*, p.157.

<sup>43</sup> TNA AIR 6/31, 94<sup>th</sup> EPM Minutes, 28 September 1937.

should be manned and its crews trained. Shortly after his appointment as AOC-in-C in September 1937, Ludlow-Hewitt expressed his concerns at the air observer situation to the Secretary-of-State for Air. The new AOC-in-C said that Bomber Command needed ‘...a more realistic Aircraft Crew policy, with the object of providing efficient crews, adequate to the tasks required of them in War,’<sup>44</sup> He went on to argue:

I strongly recommend that the present policy of using highly skilled tradesmen as air observers should now be abandoned, and that every effort be concentrated on training an air observer to fill all the functions required in an aircraft outside that of piloting, namely, air gunnery, bomb dropping, navigation, photography and wireless operator [*sic*].

Ludlow-Hewitt was right to champion the cause of a dedicated air observer although he seemed not to recognise the immense workload and training burden associated with conducting gunnery, bomb aiming, wireless operation and navigation. In contrast, the pilot had simply to fly the aircraft. Ludlow-Hewitt’s call for eradicating the air observer tradesman in favour of DE, or direct entry, observers was heeded and promulgated by the Expansion Progress Committee on 21 June 1938, albeit awaiting ‘Treasury approval’.<sup>45</sup>

Although air observers were now DE sourced, in theory at least, Bomber Command was still utilising ground tradesmen to carry out some air gunnery and wireless operator functions but, as the bomber force expanded, air crew shortages remained a problem. ‘There is a very serious shortage not only of pilots who are fully fit to undertake war operations but also of air observers, WT operators and air gunners,’ the CAS (Newall) reported to the Air Council in late 1938. ‘In one Bomber

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<sup>44</sup> TNA AIR 2/2058, Letter from AOC-in-C Bomber Command to Secretary of State for Air (Viscount Lister), 10 November 1937.

<sup>45</sup> TNA AIR 6/32, 127<sup>th</sup> EPM Minutes, 21 June 1938.



Group of 176 aircraft there were only 27 complete crews fit to take part in active operations.<sup>46</sup> Despite these issues, steps were being taken to crew modern bombers with well-trained and competent crews but it remained a question of quantity versus quality. The previous policy of using ground tradesmen as part time air observers, according to the AMP, Air Marshal Sir William Mitchell, 'had proved uneconomical' and 'it was obvious that the status of observers would have to be improved. In large modern aircraft their work tended to become as important as that of the pilot.'<sup>47</sup> Despite the goal of using DE air observers, a number of wireless ground trades were still being recruited to fill the growing number of vacancies, causing some friction in terms of promotion. DE air observers would be promoted to sergeant after training while ground tradesmen fulfilling that role were only eligible for promotion to sergeant after six years. This situation left the AMSO, Air Vice-Marshal Welsh, 'not too happy'.<sup>48</sup> Welsh's frame of mind was perhaps boosted when the RAF decided that they would no longer use part-time aircrew from November 1938 and that all air gunners would be trained as wireless operators.<sup>49</sup> Training in navigation was improved slightly in 1938 with the formation of four Civil Air Navigation Schools (CANS), later becoming Air Observer and Navigation Schools (AONS) that were operated by industry.<sup>50</sup> CANS were operated at Prestwick, Yatesbury, Desford and Ansty by Scottish Aviation, The Bristol Aeroplane Company, Reid & Sigrist and Air Service Training respectively.<sup>51</sup> On completion of the CANS course, observers would

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<sup>46</sup> TNA AIR 20/228, Report for the Air Council on the September 1938 Emergency, by the Chief of Air Staff, ACM Sir Cyril Newall.

<sup>47</sup> RAFM, 140<sup>th</sup> EPM Minutes, 25 October 1938.

<sup>48</sup> *Ibid.*

<sup>49</sup> TNA AIR 41/40, p.11 and 15.

<sup>50</sup> TNA AIR 6/51, EPM Minutes, 15 November 1937.

<sup>51</sup> Jefford, *Observers and Navigators: And Other Non-Pilot Aircrew in the RFC, RNAS and RAF*, pp.168-9.

attend an Air Observer School for a three-week bombing course, a three-week gunnery course and an additional six-week navigation course to supplement the CANS course.

In November 1938, the CAS, Air Chief Marshal Newall, said that he wanted some observers to be commissioned 'for the efficiency of the Royal Air Force'.<sup>52</sup> The EPM minutes do not explain Newall's reasoning behind this rather vague request; however, one can surmise that with the growing number of observers entering the service a structured hierarchy was required to lead and manage this cohort. Again during this meeting, the pre-eminence of the pilot was underpinned when the Under Secretary-of-State for Air, Sir Donald Banks, stated that the aircraft should only ever be captained by a pilot and not an observer – as was German practise. Status aside, the challenge facing the RAF was recruiting enough personnel to fill its growing aircrew vacancies. In November 1938, the recruitment of wireless operators was falling behind schedule and the RAF was finding it difficult to find men 'of the necessary educational standard,' said the AMP. AMSO asked if the standard could be lowered but squadrons were already 'complaining' that wireless operators, posted in to them, 'had not sufficient technical knowledge'.<sup>53</sup> By January 1939, the Treasury agreed to fund a print advertising campaign for the RAF to attract pilots and observers.<sup>54</sup> Another option to boost recruitment was suggested by the Air Member for Development and Production (AMDP), Air Marshal Sir Wilfrid Freeman, who contributed 'that it would help recruiting if drinking was forbidden in Royal Air Force

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<sup>52</sup> RAFM, 141<sup>st</sup> EPM Minutes, 1 November 1938.

<sup>53</sup> RAFM, 144<sup>th</sup> EPM Minutes, 23 November 1938.

<sup>54</sup> RAFM, 149<sup>th</sup> EPM Minutes, 11 January 1939.

messes'.<sup>55</sup> Here was a further indication of perhaps, of how out-of-touch the Victorian senior officer was with the modern RAF and society in general. More concrete measures were being taken by offering observer entry in the RAF Volunteer Reserve (RAFVR). These men would undertake a six month air observer course and 'active steps [were] being taken to increase training facilities for air observers and air gunners, and additional schools will start functioning shortly.'<sup>56</sup> Despite these active steps, there remained a shortage of training facilities and those that existed were 'working at capacity'.<sup>57</sup>

Although recruitment was going well, training was being retarded for two main reasons. Firstly, the Air Ministry and Bomber Command in particular, had no clear concept of what they expected from their aircrew in terms of their roles, functions and how they interacted with their fellow crew members in respect to individual responsibilities and collective crew efficiency. Allied to that and as described above, schools were being re-named and curricula changed throughout the inter-war period and this led to upheaval and confusion within an already chaotic environment. Freeman was correct when he said that Air Observer training facilities were 'working at capacity', although how much of that was due to inefficiency and how much due to sheer numbers entering the training pipeline is open to debate. An example of boosting capacity can be seen in November 1938 when the RAF began to recruit observers and air gunners through the RAF Volunteer Reserve, but resource issues remained.<sup>58</sup> The RAF simply lacked sufficient qualified instructors, training aircraft

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<sup>55</sup> *Ibid.*

<sup>56</sup> AIR 20/228, Directed Letter from CAS to ACAS, 14 January 1939.

<sup>57</sup> RAFM, 151<sup>st</sup> EPM Minutes, 24 January 1939.

<sup>58</sup> TNA AIR 6/28, EPM 16(37) Minutes, 26 January 1937 and Jefford, *Observers and Navigators: And Other Non-Pilot Aircrew in the RFC, RNAS and RAF* p.213.

and ranges to train air observers and gunners to a high standard. Training was clearly not keeping pace with the changes occurring in Bomber Command and those changes were encapsulated by Ludlow-Hewitt in his Bomber Command Annual Training Report for 1938. After referring to a shortage of 'trained observers and wireless operators' being a 'serious handicap', the AOC-in-C went on to say:

One characteristic of the past year has been the gradual realisation of the need for new methods to match our new equipment, and we are slowly waking from obsolete habits of thought and method to an appreciation of the considerable readjustments which are required if efficient solutions to our new problems are to be found, introduced and applied.<sup>59</sup>

Those 'obsolete habits' clearly covered training. Not just methods but, more importantly, content. In this report and the one for 1937, as well as in numerous letters, Ludlow-Hewitt was determined to point out the training shortcomings of Bomber Command. Although Hastings dismisses these communications as 'relentless pessimistic minutes,' Ludlow-Hewitt had a duty to point out the shortcomings of his command, no matter how unpopular they were with the Air Council, and have an expectation that his criticisms would be addressed.<sup>60</sup> He wasted no opportunity to highlight the poor state of air gunnery for example – 'the weakest point of our bomber force' - and navigation.<sup>61</sup> Ludlow-Hewitt's observations certainly elicited a response with the CAS (Newall) opining that Ludlow-Hewitt was 'trying to clear himself in the event of a catastrophe' while AMSO said that 'the letter was a definite challenge to the policy of expansion.'<sup>62</sup> Called to the Air Ministry to answer these charges, Ludlow-Hewitt, reiterated his concerns over inadequate air

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<sup>59</sup> TNA AIR 14/57, Bomber Command Annual Training Report – 1938, 7 January 1939.

<sup>60</sup> Hastings, *Bomber Command*, p.54.

<sup>61</sup> AHB, Ludlow-Hewitt Papers, Box 2, letter from AOC-in-C Bomber Command to Under Secretary of State for Air, 25 March 1939.

<sup>62</sup> RAFM, 176<sup>th</sup> EPM Minutes, 18 July 1939.

gunnery training that was 'giving Bomber Command a great deal of anxiety'. They had received new and highly complicated equipment, and no instructions as to how it could be best used.' Bomber Command, he bemoaned, had to rely for its operation 'on air gunners who were drawn from a comparatively uneducated class of society,' and called for a special air gunnery school to be established.<sup>63</sup> It would appear that Ludlow-Hewitt got his way because the Central Gunnery School was established at Warmwell in November 1939.<sup>64</sup> Interestingly, this centralised organisation clearly required management and leadership of Bomber Command's air gunners and its formation led indirectly to the commissioning of a small number of air gunners following the example of commissioning small numbers of observers.<sup>65</sup> One of the benefits of this move was the creation of commissioned Gunnery Leaders in operational squadrons and to undertake staff appointments.<sup>66</sup>

As far as the debate as to who should navigate the aircraft was concerned, the argument was beginning to shift in favour of the air observer mainly due to the increased navigation responsibility being given to Air Observers compared to pilots. In a Bomber Command minute sheet to SASO and Group Captain Training from the Wing Commander Navigation in April 1940, the unidentified writer said that although there was theoretical navigation training at ITW (see Chapter Seven), practical training at EFTS and SFTS was 'poor' and navigation training was being left to the OTU phase. Noting the difference with Air Observers, the writer said, 'I am not so worried about Observers. An improvement is already being noticed in 6 Group

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<sup>63</sup> RAFM, 179<sup>th</sup> EPM Minutes 4 August 1939.

<sup>64</sup> R. Sturtivant, *RAF Flying Training and Support Units Since 1912*, p.10.

<sup>65</sup> C.G. Jefford, 'The Air Gunner', *RAFHS Journal* 55, 2013, pp.104-5.

<sup>66</sup> R.C. Rivaz, *Tail Gunner* (Stroud: Sutton Publishing, 2003). Rivaz was a Squadron Gunnery Leader and an instructor at the Central Gunnery School.

[responsible for OTU training], and the new syllabus at A.O.N.S.'s, combined with the general boosting which is already taking effect, should raise the standard considerably.<sup>67</sup> Clearly, Bomber Command had identified that the navigational expertise was shifting from the pilot to the observer due to the improved and more in-depth training being provided to the latter. Less than a week later, SASO sent a minute to the new AOC-in-C Bomber Command, Portal, who had just replaced Ludlow-Hewitt and said bomber aircraft should be navigated by the air observer and that the pilot only required 'basic training in navigation to enable him to supervise the work of the air observer and to bring the aircraft home should the air observer be disabled.'<sup>68</sup> This was a major shift in attitudes, both operationally and socially. Although Portal did not disagree with this assumption, he argued that the pilot should have 'enough knowledge of navigation to detect any major error, and many of the minor errors, that may be made by an inexperienced air observer.' There was still a core of senior officers that believed only the pilot should undertake the navigation of the aircraft. One of those was Ludlow-Hewitt who had previously said:

The idea that is getting about from Air Ministry sources that the air observer is to be regarded as the navigator of the aircraft is already undermining the principle, which has at long last been fully accepted and established in this command, that the efficient navigation can only be realised if the Captain of the Aircraft himself is fully navigating his aircraft.<sup>69</sup>

With this as the background, it is little wonder that Ludlow-Hewitt's notes, written after a visit to 6 Group at RAF Abingdon when he was Inspector General, continued his attack on air observers that he referred to as the 'weakest link of the crew.' He went

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<sup>67</sup> TNA AIR 14/507, Minute Sheet, Wing Commander Navigation to Wing Commander Training and SASO, Bomber Command, 29 April 1940.

<sup>68</sup> TNA AIR 14/507, Minute Sheet, SASO to AOC-in-C Bomber Command, 2 May 1940.

<sup>69</sup> AHB, Ludlow-Hewitt Papers, Box 2, letter from AOC-in-C Bomber Command to Under Secretary of State for Air, 25 March 1939.

on to say that, 'the pupils, who have been through the course at the AONS, are not fully trained and are especially weak at map reading.'<sup>70</sup> Air Marshal Richard Peirse, who replaced Portal as AOC-in-C Bomber Command in October 1940, expressed the view that with three aircraft being lost over England to every one lost over enemy territory, '[a] principal factor contributing towards these losses is the lack of navigation supervision by Captains of aircraft'. To overcome this, pilots should get more navigation training<sup>71</sup>. Clearly, these views on the omnipotent pilot did not correlate with those of the Wing Commander Navigation at Bomber Command nor did they recognise the shortage of RAF training resources. Dogma seemed to be over-ruling common sense and the availability of training resources. Peirse also did not seem to appreciate that air observers were getting more navigation training than pilots and by adding increased navigation to the EFTS/SFTS/AFU syllabi for pilots would soak up yet more training resources and extend the overall time that the student spent in the training pipeline.

One of the major benefits to operational training during 1939 and 1940 was the establishment of Group Pool Squadrons, later referred to as Operational Training Units (OTU). These training organisations are covered in-depth in Chapter Seven but it is worth reiterating that the OTU phase brought together the complete crew for the first time to undertake collective training.<sup>72</sup> Although this was a benefit in terms of melding individual crews together, an unintended consequence was that the OTU provided an experimental environment that allowed Bomber Command to evaluate its

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<sup>70</sup> AHB, Ludlow-Hewitt Papers, Box 2, Notes following a visit to RAF Abingdon, 22 November 1940.

<sup>71</sup> TNA AIR 14/507, Letter to Under Secretary of State for Air from AOC-in-C Bomber Command, 26 December 1940.

<sup>72</sup> TNA AIR 41/39, p.13.

hitherto disjointed crewing policy and how that policy was adopted for the different aircraft in Bomber Command's fleet. As noted in Chapter Five's analysis of the RAF's training organisation, the pressures created by expansion and war had not been addressed until the appointment of a senior air officer at Air Council level which did not occur until July 1940 with the appointment of Air Marshal Guy Garrod as the Air Member for Training (AMT).<sup>73</sup> Garrod seems to have been well suited to the job as, according to Maurice Dean, the Air Ministry's senior civil servant throughout the interwar and war years, Garrod was 'restrained, friendly and courteous' and 'an enthusiast for pressing new ideas to practical conclusions.'<sup>74</sup> These qualities were clearly a benefit when dealing with the many agencies that could dictate training outcomes and more pragmatically, in providing a focal point for all aircrew training matters. On his appointment, Garrod was given three priorities by the Secretary of State for Air, Sir Archibald Sinclair, all of which had a bearing on rear crew members: to increase the output of wireless operators/air gunners (WOp/AG); to increase the number of OTUs; and to reappraise the Empire Air Training Systems (EATS).<sup>75</sup> One of Garrod's greatest successes was the establishment of the Aircrew Training Conferences, the first taking place in January 1942, that brought together organisations that had responsibilities for training.<sup>76</sup> These conferences were not just 'talking shops' as each meeting was followed by a visit to a unit that had a responsibility for training so that the conference members could speak directly to those delivering and receiving training.

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<sup>73</sup> TNA AIR 2/4550, Notes on a Meeting Held on the 21 June 1940 at the Air Ministry, 24 June 1940.

<sup>74</sup> <https://www.oxforddnb.com/view/10.1093/ref:odnb/9780198614128.001.0001/odnb-9780198614128-e-33338?rskey=52kGkF&result=2>. Accessed, 12 October 2022.

<sup>75</sup> TNA AIR 2/4550, Notes on a Meeting Held on the 21 June 1940 at the Air Ministry, 24 June 1940.

<sup>76</sup> TNA AIR 20/1344, Minutes of the Aircrew Training Conference, 23 January 1942.



Three months after Garrod was appointed in July 1940, Portal was made CAS. Dean describes him as a man 'of action' and an 'excellent judge of character', considering that 'everything he did, he did well'.<sup>77</sup> Dean went on to say that Portal was, 'calm', 'detached' and 'cool'.<sup>78</sup> Terraine expanded on this, describing Portal as 'cold, remote, enigmatic, but obviously of high intelligence...' It was probably these characteristics that enabled him to take a dispassionate and objective view of training and provide Garrod with clear guidance as to improving Bomber Command's training pipeline efficiency.<sup>79</sup> Despite the appointment of an AMT, deficiencies remained. In mid-1941, for example, Bomber Command was short of 210 pilots, 107 observers, 117 WOp/AGs and 13 straight air gunners. Asked why, AMT's response to CAS provides an excellent example of what was afflicting Bomber Command's operational training pipeline at the time.<sup>80</sup> AMT said that these shortages were 'foreseen' but continued that the observer shortage was due to a lack of Avro Anson training aircraft and the process of combining AONS and Bombing and Gunnery School courses to create a new integrated and shorter (12 week) course, 'in order to improve training and economise in aircraft.' AMT went on to say that the deficiency of WOp/AGs was due to poor training and 'the first 600 to arrive from Canada (through the EATS system) proved to be below the standard necessary for OTU intake,' and therefore had to undertake a refresher course. This situation highlighted the precarious nature of the training pipeline in two ways. Firstly, training had a vital link to aircraft production and the continued shortage of training aircraft showed a major staff failing

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<sup>77</sup> Dean, *The Royal Air Force and Two World Wars*, p.307.

<sup>78</sup> *Ibid.*, p.308.

<sup>79</sup> Terraine, *The Right of the Line*, p.684.

<sup>80</sup> TNA AIR 20/2769, Memorandum, Crew Surpluses/Deficiencies as of 7 June 1941, AMT to CAS, 18 June 1941.

and 'stove-piping' between the AMSO, MAP and AMT departments. Secondly, as highlighted in Chapter Two, the success of the complex training pipeline requires the clear definition of input and output standards for each phase.

This period was a difficult one for Bomber Command as it commenced operations with four-engine bombers with their seven-man crews. Although the Short Stirling had entered service in 1940 for trials, they were not used in any significant numbers until mid-1941, real expansion not happening until November 1941.<sup>81</sup> With Handley Page Halifax operations beginning to gain momentum in mid-1941, these four-engine aircraft gradually replaced the Armstrong Whitworth Whitley and Handley Page Hampden with their five and four man crews respectively.<sup>82</sup> Reflecting on these changes, AMT said that Bomber Command would suffer 'a bad patch' in the summer of 1942 when the heavies start arriving in numbers.<sup>83</sup> This conference also highlighted the need to provide Advanced Flying Unit (AFU) training for Air Observers after they had arrived back in the UK following initial training in Canada as part of EFTS. As Chapter Six has already examined, this also applied to pilots to acclimatise them to European weather and flying conditions. AMT said that four observer AFUs were planned to provide 'acclimatisation, map reading, black out experience, and also more night flying experience which is inadequate at present.'<sup>84</sup> Another crucially important discussion emerged during this first conference concerning air gunners. AMT noted that the turrets at air gunnery schools were different to those used in operational squadrons, leading to 'negative training,' a situation where false lessons

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<sup>81</sup> J. Falconer, *Short Stirling Units of World War 2* (Oxford: Osprey Publishing, 2018), pp. 9-13.

<sup>82</sup> Thetford, *Aircraft of the Royal Air Force Since 1918*, p. 31 and p. 295.

<sup>83</sup> TNA AIR 20/1344, 'Aircrew Training Conference, London, January/February 1942. First Meeting held in the Air Council Room, King Charles Street, at 1200 hours on 23.1.42.'

<sup>84</sup> TNA AIR 20/1344, Aircrew Training Conference, First Meeting Minutes, 23 January 1942.

are learned during training that cannot be applied to the operational environment. Professor E.A. Bott, AMT's Advisor on Training Methods, added that there needed to be more emphasis on selecting air gunners as 'less attention is given to the selection of air gunners than any other category.'<sup>85</sup>

Prior to the four-engine Stirling starting to enter trials, in January 1940 the Director of Operational Requirements (DOR), Air Commodore Robert Saundby told a meeting that Bomber Command would need specialist aircrew to man the aircraft's dedicated flight engineer station.<sup>86</sup> Given that the Stirling evolved from an Air Staff requirement, Air Ministry Specification B.12/36, issued in July 1936, it is surprising that more work had not been undertaken to define the role of the flight engineer and design a curriculum specifically for that role.<sup>87</sup> Like the air observer and air gunner before them, the role of flight engineer went through an iterative yet circuitous development process. The initial idea was to use an air gunner that had come from the fitter trade. It was then decided to use an air gunner that would be trained as a flight engineer within the squadron. As the Stirling and Halifax began to enter service, the *ad hoc* use of airman fitters was initially adopted.<sup>88</sup> For example, the first raid conducted by the Short Stirling on 10 February 1941 featured Leading Aircraftsmen (LAC) fitters as flight engineers. Formalised training for flight engineers did not commence until May 1942 with the first course at RAF St Athan. This coincided with the removal of the second pilot from bomber aircraft as part of AMT's 'new deal' initiative and the increase in flight hours for pilots and observers before they arrived

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<sup>85</sup> *Ibid.*

<sup>86</sup> TNA AIR 14/9, Minutes of a Meeting of 8 January 1940 DOR in the Chair, 27 January 1940.

<sup>87</sup> Thetford, *Aircraft of the Royal Air Force Since 1918*, p.459.

<sup>88</sup>RAF Flight Engineer & Air Engineer Association, <https://raffeaea.com/history-2/formalisation-of-duties-training/>. Accessed, 18 October 2022.

in their operational squadrons.<sup>89</sup> AMT's aim was clear in that he wanted to improve training to 'reduce wastage of aircrew and aircraft' as well as to 'increase training efficiency'.<sup>90</sup>

In assessing AMT's first aircrew training conference in respect to the training of aircrew other than pilots, it can be seen that the idea of an integrated, cohesive and collective crew concept was beginning to become clearer to the Air Ministry. It was realised that EATS, or indeed the navigation being taught in the US, was not a panacea. Shortfalls in Canadian trained Air Observers included poor map reading, log keeping, astro-navigation and familiarity with new devices and radio aids.<sup>91</sup> The US navigation course being taught in Miami was also considered a disappointment with 'the air exercises given in Miami' based on 'the Flying Classroom principle, a procedure that has been tried many times in this country and rejected as being unsound.'<sup>92</sup> This begs the question as to why the AMT's staff did not have a greater grasp of the syllabus before sending observer students to undertake the course. The other challenge here was that although this overseas training was being refined in the UK on the student's return during the AFU and OTU phases, both organisations were suffering from a lack of manpower and resources with which to carry out that additional training. During a meeting in February 1942, it was stated that AFUs required an increase of 83,000 officers and men and more aircraft to enable them to meet current training demands. AMP suggested it would be 'necessary to make a

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<sup>89</sup> TNA AIR 6/61, AMT's Memorandum to the Air Council, 6 December 1941.

<sup>90</sup> TNA AIR 20/1344, Notes on a Meeting held in the Air Council Room at 3.0 P.M. on Wednesday, 11 February 1942 – Pre-O.T.U. Aircrew Training, 11 February 1942.

<sup>91</sup> TNA AIR 20/1344, Notes on a Visit to Headquarters Flying Training Command, by AMT Training Conference members, 30 January 1942.

<sup>92</sup> TNA AIR 20/1344, Notes on a Visit to Headquarters Flying Training Command, by AMT Training Conference members, 30 January 1942.

high level approach to the Ministry of Labour in view of the large number of personnel required,' while AMSO would approach MAP for additional aircraft.<sup>93</sup>

During the period from the adoption of Expansion Scheme A in 1934 to early 1942, Bomber Command took major steps to formalise and streamline its operational training pipelines. There was a recognition that the training systems in place in 1934 could not cope with the expansion measures being proposed and that new training methodologies needed to be adopted. Perhaps more importantly, the hitherto accepted culture of the omnipotent pilot was being gradually eroded as the importance of other aircrew members became recognised. A significant reason fuelling the need for specialist aircrew roles initially came from Ludlow-Hewitt's 1937 and 1938 reports on Bomber Command despite his later reticence to using the observer as the prime navigator. The crewing debate was then advanced by 6 Group's AOC, MacNeece Foster, and then through the creation of the AMT post as part of the Air Council. Of particular note was AMT's Aircrew Training Conferences where the crewing debate was aired. The other factor to come into play was the appointment of Harris as AOC-in-C Bomber Command in February 1942 who unsurprisingly, had strong views on crew composition for the emerging numbers of four-engine heavies, especially given his experience with 5 Group's aircrew training school at RAF Finningley when he was C-in-C. The availability of training resources remained an issue until the middle of 1944, specifically instructors and aircraft but the export of training as part of BCATP from 1939, clearly enhanced Britain's ability to generate sufficient aircrew despite shortcomings in early courses. The period from

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<sup>93</sup> TNA AIR 20/1344, Notes on a Meeting in the Air Council Room at 3.0 P.M. on Wednesday 11 February 1942 – Pre-O.T.U. Aircrew Training, 11 February 1942.

early 1942 can be seen as one where the RAF, and in particular, Bomber Command, was honing its training methods and this will now be discussed.

### **March 1942 to December 1944 – The Professionalisation of Rear Crew Training**

With the final Aircrew Training Conference taking place on 18 February 1942, Bomber Command now appeared to be in a position where it could finally make decisions on the crew composition of its heavy bombers.<sup>94</sup> As discussed in Chapter Seven, a key element of this discussion was the suggestion from Air Commodore MacNeece Foster, AOC 6 Group, that bomber aircraft should only have one pilot that was initially aired in October 1941.<sup>95</sup> If adopted, this approach would have a major impact on Bomber Command's pilot training pipeline by nearly halving the number of pilots that it required along with a concomitant reduction in scarce training resources such as aircraft, instructors, airfields and fuel that could be used for rear crew training. 6 Group then made a formal proposal to Bomber Command and after discussions with the operational groups at Bomber Command, a suggested solution was sent to the Secretary of State for Air and HQ Bomber Command on 6 February 1942. This was likely to have been the catalyst for the discussions during an Air Council meeting chaired by CAS on 12 February when Bomber Command's SASO (Saundby) said that 'squadrons had an establishment of 40 pilots against an establishment of 16 I.E. (Initial Equipment) aircraft...' that was resulting in '40% of the total squadron flying time...being devoted to training' the second pilot to give, 'him the experience to qualify as first pilot'.

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<sup>94</sup> TNA AIR 20/1344, Aircrew Training Abridged Report of the Conference held in the United Kingdom, January/February 1942 (AM Pamphlet 133), May 1942, p.14.

<sup>95</sup> TNA AIR 14/10, Memorandum from AOC 6 Group to AOC-in-C Bomber Command, 31 October 1941.

Four weeks later, following 6 Group's single pilot initiative, the Air Council met again to discuss the composition and training of Bomber Command's medium and heavy bomber aircrew.<sup>96</sup> Chaired by the DCAS, Air Vice-Marshal Norman Bottomley, the meeting was called to discuss a letter from Air Marshal Harris that was sent five days into his new appointment of AOC-in-C Bomber Command. During the meeting, and raising the potential negative impact on the training pipeline, AMT pointed out that 'the decision to adopt the single pilot crew policy would be practically irrevocable,' as it would take up to three years 'to increase the flow of pilots' to return to two pilot crews. As well as advocating single pilot operation, Harris called for a 'pilot's mate' who could be trained as a flight engineer, opining that individual could also be trained as a spare gunner. Again, like many other senior officers, Harris seems not to recognise the complexity and resources required to undertake such multifaceted training for an individual. This is surprising given his work at Finningley with the 5 Group Crew Training School. There was also discussion about the need for a separate air bomber (also referred to by some at the time as a bomb aimer).<sup>97</sup> Harris rightly argued that a dedicated bomb aimer was required because the current procedure saw the air observer (navigator) dropping the bombs, and after leaving the navigator's 'cubby hole', that individual needed time to 'get accustomed to darkness'.<sup>98</sup> Garrod suggested training the WOp/AG as a 'relief navigator' so 'the observer could do the bomb aiming'. Saundby could not be blamed for disliking the idea given the extra training needed for WOp/AG trades and the general over-

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<sup>96</sup> TNA AIR 20/1344, Composition and Training of Aircrews in Medium and Heavy Bombers, Minutes, 11 March 1942.

<sup>97</sup> Bomb Aimer became the increasingly accepted term and more accurately describes the role undertaken by this crew member and so will be used throughout this thesis.

<sup>98</sup> TNA AIR 20/1344, Composition and Training of Aircrews in Medium and Heavy Bombers, Minutes, 11 March 1942.

complication of aircrew roles that at long last, seemed to be inching towards clearer functions and therefore, more clearly defined training pipelines. The other seductive element of Harris's suggested alterations to crewing policy that would lessen the training burden was to reduce the number of WOp/AGs in 16 I.E. aircraft squadrons from 40 to 26 or possibly 20. This spare manpower could then be trained as 'straight air gunners'.<sup>99</sup>

There is no doubt that Harris was the man with the clearest vision when it came the composition of heavy bomber aircrew even though it took a number of iterations of thought to get there. In March 1942 the Air Council met to finalise the crewing policy for heavy bombers. The main points to emerge from this meeting were the need for straight air gunners, specifically for dorsal and tail gunner positions; the adoption of a specialist bomb aimer would mean that 'bomb dropping' would be removed from the observer's course; that the flight engineer would be an 'emergency air gunner' but only receive ground training; and finally, that the observer would henceforth be known as the navigator.<sup>100</sup> It is interesting to consider the terminology used for crew positions. CAS wanted the bomb aimer to be known as the 'bombardier,' as used by the US Army Air Corps, but 'bomb-aimer' and 'navigator' had been used by the RAF from as early as 1934 in a RUSI lecture by Wing Commander MacLean.<sup>101</sup> The major benefit of this new crewing policy was that it did not add to the training burden in terms of needing additional resources but redistributed them between disciplines and, in the case of WOp/AG role, eliminated

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<sup>99</sup> *Ibid.*

<sup>100</sup> AIR 20/1344, Note of a Meeting Held in the Air Council Room at 11 a.m. on Sunday 29 March 1942 – Composition and Training of Aircrews in Medium and Heavy Bombers, 29 March 1942.

<sup>101</sup> Wg. Comd. L.L. MacLean, 'The Royal Air Force Training Year at Home,' p.54.



around 50% of wireless operator training. The biggest saving, (discussed in Chapter Seven), was the reduction in pilots. The only training course that was added was for the bomb aimer. The initial cadres were obtained by retraining surplus WOp/AGs.<sup>102</sup> These were trained in Air Bomber Training Flights, established in June 1942 but disbanded in March 1943, with bomb aimers then undertaking dedicated *ab initio* courses. Some bomb aimers were also initially found by switching surplus observers to bomb aimers during their observer training courses.<sup>103</sup> From August 1942, bomb aimers were found through the PNB scheme that was discussed in Chapter Seven.

At this stage of the crewing debate, Bomber Command had a clear vision of what it wanted but it appeared that the Air Council were yet to be convinced. During the Air Council meeting of 29 March, AMP (Babbington) said that there was currently a surplus of WOp/AGs and therefore, 'there was not much point in replacing WOAGs. by [*sic*] a straight air gunner'. Bomber Command's SASO (Saundby) responded by saying that only one WOp/AG operated the radios and therefore the other two would not 'practise wireless operator skills', rendering it a 'waste of time' training them for wireless operator duties.<sup>104</sup> Saundby also argued that the straight air gunners needed more training because they would man the more operationally significant dorsal and tail turrets. CAS 'expressed doubt' that straight air gunners needed more training, but Bomber Command did manage to extend the gunnery course for these straight air gunners by the formation of Bomber Gunnery Flights equipped with Martinets and Lysanders as target towing aircraft and Defiants to undertake fighter affiliation

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<sup>102</sup> TNA AIR 41/43, p. 213.

<sup>103</sup> T. Docherty, *Training for Triumph* (Bognor Regis: Woodfield Publishing, 2001), p.173.

<sup>104</sup> TNA AIR 20/1344, Composition and Training of Aircrews in Medium and Heavy Bombers meeting, Minutes.

exercises from mid-1942.<sup>105</sup> Despite the changes to the structure and operational training of the heavy bomber crew, figures from February 1943 indicated that the various training pipelines were successful, with a surplus of 312 navigators, 358 WOp/AG, 257 air gunners and 91 flight engineers. The only rear crew shortage at the time was a deficit of 61 bomb aimers.<sup>106</sup>

The other significant event to occur in 1942 that shaped future aircrew training was the Ottawa Air Training Conference, held between 19 May and 6 June 1942. Like AMT's Air Training Conferences of January and February 1942, the Ottawa conference brought together representatives from BCATP training organisations as well as delegations from China, Norway and the Netherlands who also had small aircrew training schools in the US.<sup>107</sup> Although the main purpose of the conference was to ensure the 'continuation and extension of the plan', launched by the Riverdale Mission to Canada in September 1939, beyond 31 March 1943 when that agreement expired, there were other changes that specifically affected rear crew training.<sup>108</sup> These included an expansion to navigator training, the merging of RAF schools in Canada with BCATP and the expansion of bomb aimer and straight air gunner training capacity.

To examine holistic crew training, this thesis has already discussed AFU, OTU, HCF/HCU and LFS training in some depth in Chapters Six and Seven as they pertained to pilots. Together these courses provided the environment for collective training for the complete crew. The OTU phase was preceded by the (P)AFU and

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<sup>105</sup> TNA AIR 29/870/8, 1481 Bomber Gunnery Flight Operational Record Book and TNA AIR 41/43, p.218.

<sup>106</sup> TNA AIR 41/43, p.213.

<sup>107</sup> TNA AIR 10/5551, *Flying Training, Vol. I, Policy and Planning*, pp.203-4.

<sup>108</sup> TNA AIR 20/340, A Report on Lord Riverdale's Mission to Canada, undated.

(O)AFU phases to 'acclimatise' pilots and navigators (and later, bomb aimers) respectively to blackout and weather conditions in Europe. By mid-1942, crewing-up took place at the OTU when pilots, navigators, bomb aimers, WOpAG and air gunners met *en masse* for the first time. This OTU training was undertaken in the twin-engine Wellington. Crewing-up was not a process dictated by Bomber Command. Instead, individuals met each other at the beginning of the course and then informally formed a crew based on personalities and individual character.<sup>109</sup> OTU training included cross-country navigation both day and night, fighter affiliation, live firing at drogue targets, bomb dropping and possibly conducting leaflet dropping raids (so-called Nickelling missions) over Europe. Another part of the course was the Bullseye missions where crews would plan missions to UK cities to carry out simulated bombing missions.<sup>110</sup> Crews would then move on to the HCU phase where they would operate a four-engine bomber for the first time; it was at this stage that the flight engineer would join following his individual training course at RAF St Athan. The other crew member to join was the second straight air gunner to operate the dorsal (mid-upper) turret to complete the seven man crew. The reason for this was the lack of dorsal turret on the Wellington. The HCU syllabus was similar to that of the OTU. Prior to the availability of sufficient Lancasters, HCU training was conducted on the Stirling or Halifax prior to final conversion to type course at a Lancaster Finishing School for those crews destined for Lancaster squadrons. As the war progressed, sufficient Lancasters were being produced to equip dedicated HCU. In terms of hours flown by a navigator during his training in the first ten months of 1944 back in the UK, a typical training cycle during the post-AOS course

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<sup>109</sup> Charlewood, *No Moon Tonight*, pp.25-6, provides a good example of the process.

<sup>110</sup> Harris, *Despatch of War Operations*, p.165.

would be around 35 hours at an (O)AFU, 40 hours at the OTU, 38 hours at the HCU and 14 hours at the LFS.<sup>111</sup> The 18 week AOS course, normally held in Canada, that preceded the UK courses would be around 100 hours' duration and cover basic navigation skills such as dead reckoning, log keeping and meteorology. The total hours flown by Hoare were fairly typical of the period and are reflected in navigator log books of the period.<sup>112</sup>

By December 1944, Bomber Command was at 'the peak of its strength' with 85 heavy bomber squadrons and 17 Mosquito-equipped light bomber squadrons. With a declining loss rate and associated reduction in wastage of aircrew, the training organisation began to be scaled down.<sup>113</sup> In comparison to the other two periods analysed in this chapter, the period from early 1942 until the end of 1944 marked a number of changes to the RAF's culture, training methods and allocation of resources to training. In terms of culture, the influx of RAF Volunteer Reserve and NCO pilots and other NCO aircrew changed the dynamic of the public school dominated Regular and Special Reserve Commission (SRC) officer cohort that dominated during the interwar period. Perhaps even more importantly, the rise in the numbers of specialist navigators, flight engineers, wireless operators and gunners highlighted the importance of aircrew other than pilots. As well as cultural change, there was also a change to training methodologies as a result of the clearer definition of aircrew roles and this of course ensured the better allocation of centrally controlled

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<sup>111</sup> P. Hoare, 'Navigating Lancasters in WWII', *The Journal of Navigation*, Vol. 60 (2017), p.201.

<sup>112</sup> IBCC. Navigator's Log Book of Sgt I.G. Henderson and, Sgt. J.F.D. Jarmy, <https://ibccdigitalarchive.lincoln.ac.uk/omeka/collections/document/27101> and <https://ibccdigitalarchive.lincoln.ac.uk/omeka/collections/document/25214>. Accessed, 28 October 2022.

<sup>113</sup> TNA AIR 41/56, *The RAF in the Bombing Offensive Against Germany, Vol. VI: The Final Phase, March 1944 – May 1945*, p.264.

resources. The benefit here was that, over time, training in operational squadrons was being reduced thereby allowing these squadrons to focus on their operational roles.

### **Training in the Operational Squadron**

As this thesis has shown, Bomber Command was eventually keen to move as much training as possible away from the frontline squadron to allow that squadron to focus on operations. Despite this aim, the aircrew leaving the HCU were entering a new environment and so there was a period of adjustment and acclimatisation for new crews before they embarked on their first operational flight. An example of this squadron training can be seen in 4 Group, operating Bomber Command's Halifax fleet. 'By the end of 1943 the loss rates in respect of Halifax II and V were becoming excessively high,' which particularly affected new crews.<sup>114</sup> 4 Group had been monitoring loss rates of its crews and concluded that 'there was a marked experience effect in the early operations during a tour.' They referred to this as the 'Halifax Fresher Problem' which became particularly acute when crews were pushed into operations early after arrival for 'maximum effort' raids without pilots having the opportunity to undertake a raid as a second pilot.<sup>115</sup> 'The ideal scheme for was for a Squadron to give new crew a certain amount of ground training and then a cross country and finally a Command Bullseye exercise. This later exercise was at night and covered a round trip over Britain and was the nearest approach to an operational sortie.' There were problems of pilots reaching altitude on Bullseye (the case cited

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<sup>114</sup> NAL, Report on the Work of O.R.S. Representative at No. 4 Group Headquarters, July 1943 to June 1945, F.J. Lloyd to AOC, AVM C.R. Carr, undated, p.5.

<sup>115</sup> *Ibid.*, p.9.

said that the pilot could not get to 20,000 ft in an unladen aircraft). The report suggested that all crews should fly a fully laden aircraft before their first operational trip. This was adopted by 76 Squadron and their fresher loss rate subsequently dropped and this additional training was adopted by all 4 Group squadrons until it was dropped with the arrival of the Halifax III with its improved climb rate.

Bomber Command's Operational Research Section (ORS) report also recommended increased fighter affiliation training both at the HCU and within the squadrons. Between January and March 1943, the HCU provided 168 fighter affiliation sorties and the squadron, 179. During the same period in 1944, HCU's were providing 882 sorties and the squadron, 255. According to the ORS, HCU's were aiming to provide crews with three fighter affiliation exercises per course.

Interestingly, this increased fighter affiliation training resulted in the 'ratio of missing to attacked' aircraft falling from 1.5, during the period of October to December 1943, to 0.7 from April to June 1944. Although impressive, this drop in over 50% in the missing rate also coincided with ground lectures on Fishpond and Monica. The former was a radar warning system added to the H2S ground mapping radar and the latter, a tail-mounted, range only radar warning unit that was introduced in June 1943.<sup>116</sup>

## **Conclusion**

In basic terms, the RAF moved from a standpoint of not believing in the need for specialist trained aircrew in 1934, to a recognition in 1942 that specialist aircrew were vital to the success of Bomber Command's operations. As this chapter has shown,

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<sup>116</sup> Withington, 'Bomber Command's Electronic Warfare Policy and Suppression of Enemy Air Defence Posture During the Second World War,' p. 163.

the RAF's reticence to accept the concept of specialist rear crew aviators and design bespoke training pipelines for them was due to a number of factors that included the pilot-centric nature of the interwar Service, a lack of resources due to financial constraints, and a failure to grasp and define the training outcomes that were emerging with the development of four-engine heavy bombers, alongside improvements to aviation technology in general. Nowhere was this more apparent than when it came to navigation training and the arguments between Bomber Command and the Air Ministry as to who should navigate the aircraft led to the duplication of training and therefore a waste of resources. The financial constraints, combined with a paucity of dedicated training aircraft and schools, precipitated an emphasis on a great deal of what could be termed intermediate training being conducted in the operational squadrons, and, as Chapter Six showed with reference to pilots, this led to poor operational efficiency at the front line. Prior to the rise of Nazi Germany, this inefficiency was considered a small price to pay if it saved money.

By early 1942 a number of factors conspired to change this situation, which included the much overdue appointment of an Air Council member with a dedicated department to oversee training. Although appointed in July 1940, the AMT'S department only became fully functional in late 1941 and the Aircrew Training Conferences of January and February 1942 must be seen as a great catalyst for change that was boosted by the Ottawa Air Training Conference later that year. Harris has seldom been given credit for his innovative work as a training practitioner, firstly with the 5 Group aircrew training school at RAF Finningley when he was AOC (as detailed in Chapter Seven) and then as AOC-in-C but, as this chapter has shown,

he was frequently one step ahead of the Air Council in terms of specialist crewing concepts for the four-engine heavies and defining training requirements. In 1942, when operational training was gaining increasing momentum, the four-engine heavy bombers, especially the Halifax and Lancaster, were beginning to be produced at a growing rate and fortunately output from the training pipeline was able to meet crewing needs. By late 1942, Bomber Command's aircrew training structure was largely defined and continued to grow until the autumn of 1944 when it gradually declined as aircraft losses fell and the number of aircrew increased beyond requirements.

The other factor to highlight here is the importance of the Operational Research Section and its impact on training. By feeding back 'lessons learned' directly to the operational squadrons and sharing this information with other Groups, Bomber Command was able to develop best practise and improve training methods while at the same time, increasing operational efficiency and reducing wastage rates.

One of the major successes of Bomber Command's training system during the Second World War was the use of Synthetic Training Equipment. This thesis will address this topic in the next chapter and examine how STE became central to a number of different training pipelines.



## CHAPTER NINE

### SYNTHETIC TRAINING EQUIPMENT – ITS ROLE IN OPERATIONAL TRAINING

#### Introduction

In discussing the use of Synthetic Training Equipment (STE) to enhance training within Bomber Command, there has been a tendency for historians to mention the ubiquitous Link Trainer in passing and ignore other training systems or training methodologies that used STE.<sup>1</sup> The importance of the Link Trainer should not be underestimated and it certainly was not by the former RAF Director of Training, and later RCAF Chief of Air Staff, Air Marshal Robert Leckie, who said that '[t]he Luftwaffe met its Waterloo on all the training fields of the free world where there was a battery of Link Trainers.'<sup>2</sup> But it was not all about the Link Trainer as, by 1942, 'no less than 200 training devices had been invented and put into use' by the RAF with some of the most sophisticated of these being used by Bomber Command.<sup>3</sup>

As well as the invention and development of these training systems, the RAF, again with emphasis on Bomber Command, was making significant intellectual investment in examining how STE could be used to improve operational training at the individual and collective training levels; the latter being especially important in considering the seven man crew of the heavy bombers that begin to enter service from 1941. As will be seen below, the adoption of what were considered by some as unproven technologies to improve training and assist in taking pressure off an increasingly overworked training pipeline were, with few exceptions, broadly

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<sup>1</sup> TNA AIR 10/5551, *Flying Training Volume 1, Policy and Planning*, p.27. As to the US use of the Link Trainer see for example, K.P. Werrell, 'Flying Training: The American Advantage in the Battle for Air Superiority against the Luftwaffe', *Air Power History*, Vol.61, No.1, Spring 2014, p.37.

<sup>2</sup> <https://comoxairforcemuseum.ca/heritage-team-project-link-trainer/>. Accessed, 15 February 2021 and taken from L. Kelly, *The Pilot Maker* (New York: Grosset & Dunlap, 1970), p.68.

<sup>3</sup> TNA AIR 41/4, p.563.

accepted by the Air Ministry, Bomber Command and the operational groups. The aim of this Chapter is to highlight the role that STE played in enhancing Bomber Command's operational training by considering how it assisted in closing a number of training gaps and provided an innovative training medium that was repeatable, scalable and safe. The chapter will also argue that Bomber Command's use of STE marked a major evolution in the way it conducted operational training and, as such, was one of the key drivers in developing new training methodologies. The Chapter will firstly consider the context of STE and then examine how STE policy was developed, how STE was managed and procured, and how synthetic training devices were used by Bomber Command to support operational training before concluding that simulation was a key element that helped to drive the overall success of operational training in Bomber Command.

Returning to the Link Trainer, the great misconception surrounding this device is that it was the first ground-based training simulator that was ever used for pilot training. In fact, ground-based training systems actually evolved in parallel with the development of aircraft. In discussing the training experiences and legacy left by the First World War, Chapter Three briefly discussed systems used for air-to-air gunnery, the direction of artillery fire and bombing training. More widely, Baarspul described the Sanders Teacher and Eardley Billings training devices of 1910 as 'aircraft attached to the ground' and mounted on a 'universal joint' to enable pilots to experience the effects of elevator, rudder and aileron or wing warping control.<sup>4</sup> The problem with these early devices was that they were reliant on wind strength to make them function and therefore their use was limited. Later in 1910, this limitation was

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<sup>4</sup> M. Baarspul, 'A Review of Flight Simulation Techniques', *Progress in Aerospace Sciences*, Vol.27, No. 1, 1990, p.7.

overcome by the French Antoinette trainer that featured the pilot sitting in a cockpit that had been crafted from a half wine barrel fitted to a swivel mechanism.<sup>5</sup> A horizontal bar was located on the front of the cockpit and, through the use of his controls, the pilot had to keep the bar on the horizon as instructors on the yaw, roll and pitch axes moved the cockpit by means of poles to alter the status quo. What the Link Trainer did achieve during its development between 1927 and 1929 was to provide a pneumatically operated 'efficient aeronautical training aid' that could be operated by a single instructor and the student, which was not dependant on wind strength.<sup>6</sup> Patented in 1930 by the Binghamton, New York-based Link Company, the Link Trainer's 'roll pitch and yaw movements were initiated using pneumatic bellows for actuation. The various control valves, operated by the stick and rudder, were fed by an electronically driven suction pump, mounted on a fixed base.'<sup>7</sup> The Link Trainer formed the basis for a number of different training device variants that were used for operational training but in its basic form, the device was used for elementary and intermediate flight training as well as continuation training. One example of the latter saw a device installed at HQ Bomber Command to allow pilots carrying out staff functions to retain key airmanship skills.<sup>8</sup> The Link Trainer's importance is that when it entered service with the RAF it was at the forefront of simulation technology and subsequently provided the catalyst and inspiration for the Service's further investment and interest in STE following the adoption of training systems in the period before the Second World War.

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<sup>5</sup> R.L. Page, *Brief History of Flight Simulation*, paper delivered at SimTect Conference, Feb 2000.

<sup>6</sup> Baarspul, 'A Review of Flight Simulation Techniques,' p.8

<sup>7</sup> *Ibid.*, pp.8-9.

<sup>8</sup> TNA AIR 2/3940, Letter from AOC-in-C Fighter Command to AOC-in-C Bomber Command discussing the joint servicing of the devices at Bentley Priory and Uxbridge, 26 May 1939.

## STE in Context

Before considering the policy, management and procurement, and application of STE within the Bomber Command between 1922 and 1945, some terms and parameters need to be defined; primarily, why the use of STE became so prevalent? This can be mainly attributed to the increasingly technical nature of the modern bomber, the roles that it had to undertake, the sheer throughput of students that required training and logistic issues. Addressing training issues facing the US Navy in 1941, but no less applicable to the RAF and Bomber Command in 1938 and beyond, Dawson said that 'the traditional training methods...were incapable of providing the thousands of newly trained personnel...' that were required due to a lack of training aircraft and other resources such as airspace, airfields and ranges.<sup>9</sup> Rolfe and Bolton reinforced the 'shortage of training resources' argument for the growth of STE when they stated that: 'By 1940 the pattern of the war in the air was such that difficulties were being realised in finding aircraft and flying hours for training. Moreover the training task was growing. The need to replace airborne training was seen to be an important requirement.'<sup>10</sup> STE became a method of supplementing those conventional live training processes by allowing students to learn in a virtual environment, albeit, when compared with modern STE, frequently somewhat crude.

One of the other catalysts for the increased adoption of synthetic training was the growing complexity of modern combat aircraft, the so-called 'technical revolution' in aircraft.<sup>11</sup> This 'training gap' could be seen when considering the Hart and Whitley

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<sup>9</sup> P. Dawson, 'Luis de Florez and the Special Devices Division' (PhD Thesis, George Washington University, 2005), p.86.

<sup>10</sup> J.M. Rolfe & M. Bolton, 'Flight Simulation in the Royal Air Force in the Second World War', *RAeS Aeronautical Journal*, October 1988, p.315.

<sup>11</sup> TNA AIR 10/5551, *Flying Training Vol. 1, Policy and Planning*, p.8.

bombers, both in service at the same time during the early war years.<sup>12</sup> The Whitley featured retractable landing gear, a cantilever wing, constant speed propellers and variable position flaps.<sup>13</sup> This 'training gap' is exemplified when considering the differences between the Second World War Spitfire and the Lancaster and the First World War SE5 and DH9. The latter fighter-bomber combination could be flown by a 'universal pilot'; while the former aircraft were technically far more complex, therefore requiring training specialisation.<sup>14</sup> The result was an increased emphasis on cockpit drills, especially as far as single-pilot aircraft were concerned. Issues such as taking off with course pitch selected or landing without lowering the under carriage were costly in terms of pilots and aircraft. This particular training requirement led to the development of the Hawarden trainer for use by Fighter Command.<sup>15</sup> This was a fuselage trainer that allowed pilots to practise cockpit and emergency drills and, by the end of 1940, the use of these type of trainers was growing such that, by May 1941, there were shortages.<sup>16</sup>

Chapter One has already addressed the differences between individual and collective training and Chapter Four considered how this training was managed within the Air Ministry's Air Member for Personnel (AMP) and CAS's Director of Training (DoT) staff organisations and, from July 1940, the Air Member for Training (AMT) organisation.<sup>17</sup> Despite the emergence of ground based training aids, the RAF had a 'marked preference for giving as much instruction as possible in the air.'<sup>18</sup> Air

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<sup>12</sup> Thetford, *Aircraft of the Royal Air Force Since 1918* provides service details of the aircraft.

<sup>13</sup> *Ibid.*, p.15.

<sup>14</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-44*.

<sup>15</sup> TNA AVIA 15/1428, Minutes of the 5<sup>th</sup> Meeting of the Synthetic Training Committee, 6 September 1940.

<sup>16</sup> TNA AVIA 15/1428, Minutes of the 13<sup>th</sup> Meeting of the Synthetic Training Committee, 2 May 1941. For the growth of such devices, see TNA AIR 20/1348, Minutes of the 7<sup>th</sup> Meeting of the Synthetic Training Committee, 8 November 1940.

<sup>17</sup> TNA AIR 2/4550 Amendment to the Air Council Act dated 26 June 1940.

<sup>18</sup> TNA AIR 41/4, *AHB Narrative – Aircrew Training 1934-1942*, p.560.

Ministry policy was that such systems were 'to assist but in no way replace aircrew training in the air.'<sup>19</sup> Given the preponderance of pilots filling senior staff appointments during the interwar years and the general pilot-centric approach of the Service, this was hardly surprising. Although this policy worked well up until the acceleration of the RAF's expansion schemes where the throughput of trainees threatened to overwhelm the training system.<sup>20</sup> The relatively small size of the inter-war RAF and the 'peace-time [*sic*] economy complex' meant that the output of pilots to feed the service did not require a particularly sophisticated training pipeline.<sup>21</sup> In 1933, for example, the RAF was training 300 pilots a year; by the end of 1941, this figure had risen to 22,000 pilots and 18,000 other full time aircrew trades.<sup>22</sup> The growth in use of STE between 1937 and 1944 to meet this added training burden needs to be placed into the context of the technology available during this period as well as its application to enhance training.

The importance of synthetic training systems to Bomber Command was highlighted by the AOC 6 (Training) Group, Air Commodore MacNeece Foster, during a visit to 10 OTU at RAF Abingdon by members of the Aircrew Training Conference on 28 January 1942. After telling delegates that the RAF should be sending its best pilots to Bomber Command in light of the complex nature of the four-engine aircraft types that they operated and the need to fly long range missions at night, he moved on to discuss a topic that he referred to as 'half-true'.

One such slogan is, "Nothing can take the place of hours in the air". That is...true, but is at the same time quite untrue. You cannot give the hours in the air necessary to give every member of a crew his full training.

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<sup>19</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-44*.

<sup>20</sup> RAFM. A look at the Air Force Lists during the inter-war and early war years shows that pilots were undertaking all key staff functions.

<sup>21</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-44*, refers to the reduction in the training organisation to the minimum and subsequent lack of investment.

<sup>22</sup> TNA AIR 10/5551, *Flying Training, Vol I, Policy and Planning*, p.8.

Consequently, you have got to use every ingenuity on the ground so that when they go up in the air, they have reached that acquaintance with their subject which ensures they can take full advantage of their air training.<sup>23</sup>

Today, the use of complex digital simulators is quite common both for military and commercial airline pilot training. The fidelity of the modern simulator is so great that commercial airline pilots can undertake conversion training to a new familial type of aircraft in the Full Flight Simulator (FFS) such that the first time that they fly the actual aircraft it will contain fare-paying passengers.<sup>24</sup> From a modern military perspective, a number of established air forces now conduct 50% of their training in the flight simulator with the German Air Force seeking to undertake 95% for its Airbus A400 flight crew in the near future.<sup>25</sup> A simulator is defined as 'a device that imitates the dynamic behaviour of a real system' to give 'the illusion...of responding like the real system...'<sup>26</sup> The simulator can therefore be described as an holistic training device capable of high-fidelity replication that draws together sub- or part-task training events. Such a sophisticated and all-encompassing solution was not available in the period before and during the Second World War and the terms trainer, training device and synthetic trainer or synthetic training device were more common than simulator. These training devices were clearly not carrying out the full spectrum of training that would be the case in a modern FFS and so they are best considered as Part Task Trainers (PTT). The word 'simulation' was used initially by the RAF to describe the collective use of such training devices, but then replaced by

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<sup>23</sup> TNA AIR 20/1334, Aircrew Training Conference, Minutes of the Opening Meeting held in the Air Council Room, on 23 January 1942, p.4.

<sup>24</sup> Nash and Ebbut (eds.), *IHS Jane's Simulation & Training Systems 2015-2016*, p.357. Referred to as zero flight time training and conducted on a FAA Level D full flight simulator.

<sup>25</sup> <https://www.shephardmedia.com/news/training-simulation/premium-new-a400m-simulator-opens-network-opportun/>. Accessed, 19 March 2021.

<sup>26</sup> JSP 822, Part 2, *Training and Education Glossary*.

'synthetic training' from May 1940.<sup>27</sup> According to Director of War Training & Tactics (DWTT), the term 'synthetic training' was first coined by Air Vice-Marshal Ludlow Hewitt in 1940.<sup>28</sup>

As the pressure built on the training pipeline, in parallel with subsequent expansion schemes in the lead up to the Second World War, the RAF rapidly turned towards the increased use of synthetic training to download specific training tasks from the aircraft, or to improve training transfer. The latter can be defined as 'the degree to which trainees effectively apply the knowledge, skills, and attitudes gained in a training context to the job and maintained over time'.<sup>29</sup> As previously discussed and as policy dictated, synthetic training was not designed to replace time in the air, at least theoretically, but to make the time in the air more productive and thereby improve efficiency and reduce training costs. This idea of STE not replacing time in the air was perhaps semantical in that if a student pilot in a Link Trainer could master flying from Airfield A to Airfield B in instrument conditions, he would, *de facto*, require less time in the aircraft to do it for real. In other words, time in the Link Trainer had reduced time in the air. The other key benefits afforded by synthetic training were that training could be undertaken in all weathers day and night; this meant night and instrument flying could be carried out on a bright sunny day or when inclement weather prevented flying. Training could be made scalable in that the difficulty of the training task could be increased in line with the pupil's growing proficiency; and finally; that the training was repeatable such that training tasks could be reproduced using the same parameters.<sup>30</sup> This would allow students from the same cohort to

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<sup>27</sup> TNA AIR 20/1347 contains the Minutes of the Air Ministry's Simulation of Air Training on the Ground Committee.

<sup>28</sup> TNA AIR 2/8644, Minute Sheet, DWTT to ACAS(T), 20 February 1940.

<sup>29</sup> <https://research-methodology.net/forms-of-training-transfer/>. Accessed, 23 March 2021.

<sup>30</sup> Nash and Ebbutt (eds.), *IHS Jane's Training and Simulation Systems 2015-2016*, pp. 16-18.



receive exactly the same lesson so instructors could undertake comparative analysis as well as repeating exactly the same exercises for students that found initial assimilation difficult. It is also a truism, as Caro has stated, that the real aircraft provided a 'poor learning environment' and that the training device was better 'from the transfer-of-training standpoint.'<sup>31</sup> This 'transfer-of-training' was not only relevant to the individual but was also vital in respect to training large crews to work together, as in the case of heavy bombers.

The RAF fully understood the benefits of STE from before the war but this was made clear from the collective training standpoint as it affected Bomber Command in early 1942. As this statement in the RAF's *Illustrated Catalogue of Synthetic Training Devices* highlighted:

Synthetic training is the exercising on the ground of air crews in their different roles in conditions as similar as possible as those met in the air. The object is to avoid unproductive time in the air by first making crews as conversant as possible with their air duties on the ground.<sup>32</sup>

The first major steps in adopting flight simulation in the RAF were taken in October 1935, when the Director of Training, Air Commodore Tedder, sent three officers to the United States to examine US Army Air Corps (USAAC) training methods.<sup>33</sup> The cost saving benefits of the Link Trainer, that 'ingenious American invention,' were not lost on Lord Swinton, Britain's Secretary of State for Air between 1935 and 1938.<sup>34</sup>

Sitting in a cabin in a room, for the cost of a few pennyworth of electricity, the pupil pilot can sit at the controls and drive [sic] his plane [sic] on a long journey under artificial conditions which reproduce the conditions he would encounter on a voyage of a thousand miles.<sup>35</sup>

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<sup>31</sup> P.W. Caro. 'Aircraft Simulators and Pilot Training', *Human Factors*, Vol. 15 No. 6, 1973, p. 6.

<sup>32</sup> TNA AIR 20/6058, *Illustrated Catalogue of Synthetic Training Devices*, AMT, May 1942.

<sup>33</sup> Orange, 'Tedder and the Air Ministry,' p.230.

<sup>34</sup> Montgomery Hyde, *British Air Policy Between the Wars: 1918 – 1939*, Appendix III.

<sup>35</sup> Lord Swinton, *I Remember* (London: Hutchinson, undated), p.124, quoted by Orange in 'Tedder and the Air Ministry.'

The Link Trainer was the turning point in the RAF's recognition of the benefits of using ground based training devices (examined later) although it was not the first major system to be introduced. The 'Bombing Teacher' was the initial major synthetic training system to be adopted by the RAF and, 'provided an excellent method in training personnel in the use of the bombsight without the necessity of going up in the air, thereby saving time, wear-and-tear on an aircraft and flying hours.'<sup>36</sup> It was also fundamental in providing a training medium to counter-balance the shortage of bombing ranges in the UK.<sup>37</sup> As far as the importance and future applicability of synthetic training equipment was concerned, the RAF was again quick to realise innovation could assist in training delivery.

Invented by Leonard Charles Bygrave and manufactured by the Vickers-Bygrave consortium, later versions of the Bombing Teacher, referred to as the Air Ministry Laboratory (AML) Bombing Teacher, were housed in a specially constructed one-and-half storey building. This featured a 'powerful projector' fixed above a hole in the first floor that projected the image from a glass slide onto the white painted ground floor.<sup>38</sup> The Bombing Teacher was designed to teach 'air navigation and bomb dropping under conditions that give a realistic representation of those experienced during flight.'<sup>39</sup> The AML variant of this device entered service in 1934 and allowed observers, who were then responsible for dropping bombs, to use their bomb sights; however, earlier versions were in service from at least 1925.<sup>40</sup> The bomb sight was fixed on a gantry at a representative height of between 8,000 to

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<sup>36</sup> TNA AIR 20/1347, *History of RAF Training 1939-1945*, AMT, January 1945.

<sup>37</sup> L.A. Pattinson, 'The Training of a Royal Air Force Pilot', *RUSI Journal*, 83 Feb/Nov 1938, p.16.

<sup>38</sup> Historic England, *RAF Davidstow Moor, Air Ministry Bombing Teacher* at [www.historicengland.org.uk/listing/the-list/list-entry/1403173](http://www.historicengland.org.uk/listing/the-list/list-entry/1403173). Accessed, 16 August 2016.

<sup>39</sup> Anon. 'Bombing Instruction – A brief description of the Vickers-Bygrave Bombing Teacher', *Flight*, 3 May 1934, p.434.

<sup>40</sup> TNA AIR 10/1184 contains A.P.1183, *Notes for the Use of the A.M.L. Bombing Teacher*, 1925.

9,000 feet and, as the observer looked through the sight's eyepiece, the glass plate was moved by an electro-mechanical linkage in the projector housing by the instructor, acting as a pseudo pilot in response to the observer's commands.<sup>41</sup> The whole effect created the impression that the observer was flying over the ground. According to Holman, the observer's gantry could be shaken by the instructor to simulate turbulence or the effects of flak. This device proved highly successful and, when the opportunity to procure the Link Trainer came along, the RAF already had a clear appreciation of the benefits of STE; the latter proving to be 'an important development in the field of training equipment [that] lessened the gravity of the lack of suitable modern [training] aircraft.'<sup>42</sup> The irony with the AML was it was designed to teach daylight bombing, a tactic that was rapidly discarded early in the war.

Following its visit to the USA to view the Link Trainer, the Air Ministry ordered 51 devices that AMT's *Notes on the History of RAF Training 1939-44* claimed entered service in September 1937.<sup>43</sup> According to correspondence between J.V.W. Corporation, the US manufacturer of the device on behalf of the Link Corporation, with the Commissioners of Customs & Excise, none of the 51 devices had been delivered by October 1937.<sup>44</sup> Given that they were still being manufactured – ten at Binghamton, New York and 41 in a new factory at Gononoque in Canada – and that they had to be shipped to and then erected in the UK, the chances are that the initial devices did not in fact enter service until early 1938.<sup>45</sup> The author of the letter stated that, 'the need for haste as regards a decision [on custom dues], may I suggest, is

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<sup>41</sup> Holman, *Airminded – Airpower and British Society 1908-1941*. [www.airminded.org/2007/02/28/the-bombing-teacher/](http://www.airminded.org/2007/02/28/the-bombing-teacher/). Accessed, 17 August 2020.

<sup>42</sup> TNA Air 10/5551, *Flying Training Vol. 1 Policy & Planning*, p.27.

<sup>43</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-44*, p.272.

<sup>44</sup> TNA CUST 49/2131, Letter from Mr P. Fellows, the Sales Manager to the British Empire, to The Commissioners of Customs & Excise, 20 October 1937.

<sup>45</sup> TNA AIR 10/5551 *Flying Training Volume 1, Policy and Planning*, says all 51 devices were in service by December 1937. This is perhaps a little over optimistic.

great as the Air Ministry requirements for these Trainers is extremely urgent.<sup>46</sup> The closing sentence of Fellow's letter may be ascribed to an over-zealous sales technique but, by 1937, the RAF had realised that its standard of instrument flying was poor, there was a shortage of training aircraft; notably with the Don and Magister that were suffering from design issues; and that the formation of the RAFVR in 1936 combined with successive expansion schemes had placed increased strain on the training pipeline.<sup>47</sup> During a meeting of the Air Council in April 1938, the AMP, Air Marshal Sir William Mitchell, stated that aircraft shortages were impacting training, 'leading to a measure of stagnation.'<sup>48</sup> In short, 'training expansion [was] not keeping pace' with the rapidly increasing size of the RAF.<sup>49</sup> The Link Trainer therefore provided a method of addressing some of these issues but its adoption was not without challenges, particularly as far as how the trainer was to be used, how it was to be maintained, and how the provision of instructors to operate them was concerned.<sup>50</sup> Many of these issues took nearly a year to resolve but this did not stop the RAF ordering another 150 Link Trainers on the basis that 'it was soon found that the standard of instrument flying was being steadily improved as a result of this synthetic device; although it does not assimilate flying conditions in the same manner as an aircraft, e.g. absence of noise, it served and still serves well for instrument flying practice.'<sup>51</sup> This observation, written in 1944, highlighted the RAF's enthusiasm for the Link Trainer and this appreciation of synthetic training provided the impetus for the development of nearly 200 different trainers by 1942. An

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<sup>46</sup> TNA CUST 49/2131, Fellows letter, 20 October 1937.

<sup>47</sup> TNA AIR 6/33, Minutes of the 117<sup>th</sup> EPM of 15 March 1938.

<sup>48</sup> TNA AIR 6/33, Minutes of the 121<sup>st</sup> EPM of 12 April 1938.

<sup>49</sup> TNA AIR 10/5551, *Flying Training Volume 1, Policy and Planning*, p.28.

<sup>50</sup> TNA AIR 2/3940, contains considerable correspondence between the Air Ministry Director of Training, 26 Group, Commands and the Under Secretary of State for Air dated between October and December 1938 concerning the establishment and support for Link Trainers. A conference was held at the Air Ministry on 14 November 1938 'to discuss the basis of establishment of link [*sic*] trainers.'

<sup>51</sup> TNA AIR20/1347, *Notes on the History of RAF Training 1939-44*, p.272.

exemplar of such enthusiastic innovation and adoption was in the creation of the 5 Group Bomber Command's Crew Training School (CTS) at RAF Finningley in January 1940 that was designed for crew (collective) training within the Group.<sup>52</sup> The formation of the school also highlighted how seriously Bomber Command and the wider RAF viewed synthetic training and how it was contributing to evolving and enhancing operational training.

As this chapter highlights, the RAF, and Bomber Command in particular, embraced the use of STE throughout the war. According to Kreipe and Koester, this was not the case with the Luftwaffe, although many of the training shortfalls seen in Germany mirrored those of the RAF, such that: '...operational readiness within the flying units was extremely uneven. The most significant gaps in training were those felt by the bomber units, primarily as a result of insufficient training in night and instrument flight.'<sup>53</sup> As to the use of STE, German *ab initio* flying training schools [so-called A and B schools] 'had fuselage models [mock ups] with which to drill students' and limited numbers of Link Trainers 'for preliminary training in instrument flight'.<sup>54</sup>

Link Trainers were mainly used at the multi-engine, or so-called C Schools.

Unfortunately, there was not enough of these valuable machines [Link Trainers] available. They did have certain defects, of course, and because of this their use was opposed by some, but they were extremely useful in teaching the student to think in terms of his position in space and in preparing him for practical flight training in real aircraft. Their use saved a good many flight hours.<sup>55</sup>

C School students, the majority of which were to be bomber pilots, also used refurbished crashed aircraft that were re-wired 'so that the students could practice all

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<sup>52</sup> TNA AIR 2/8645 and AIR 2/8646 contain correspondence between AOC 5 Group, HQ Bomber Command, Director of War Training & Tactics and CAS.

<sup>53</sup> Kreipe and Koester, *Pilot and Aircrew Training in the Luftwaffe 1921-1945*, p.47.

<sup>54</sup> *Ibid.*, p.134.

<sup>55</sup> *Ibid.*, p.234.

the manual operations required for take-offs and landings and learn to work the landing flaps and tail-gear'.<sup>56</sup> Indeed, according to Adams, it was the C Schools that provided 'the only instance in which the Link Trainer [was] used in instruction courses for the German air force,' an opinion at variance with Kreipe and Koester's account.<sup>57</sup> In *Fighter*, Deighton claimed pilots arriving in operational bomber squadrons had 250 flying hours and '50 hours of simulated blind flying on the Link trainer.'<sup>58</sup> Deighton's source was C.G. Grey, editor of *The Aeroplane*, who visited the Luftwaffe in 1935.<sup>59</sup> The use of STE in the Luftwaffe was never exploited like the RAF and that, in part, led to the Luftwaffe's 'generally inadequate training program [sic],' that failed due to a lack of, 'uniform guidance and supervision'.<sup>60</sup> In comparison, the RAF used the Link Trainer at every stage of its training process from the Elementary Flying Training School, including during holding at an Aircrew Personnel Reception Centre and in the operational squadron. Typical total Link Trainer hours following the end of an operational tour varied from over 60 hours to 70 while a pilot, then posted to become an instructor, would expect to accumulate over 90 hours in the Link Trainer.<sup>61</sup>

In comparison, the lead service for STE in the US was the US Navy and work on the topic was carried out in the Special Devices Section, later to become the Special Devices Division, part of the Bureau of Aeronautics (BurAe) and the direction that it took was clearly based on the experience of the RAF. Much of the information to enable the development of US Navy STE policy was furnished by a Special Naval

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<sup>56</sup> Kreipe and Koester, *Pilot and Aircrew Training in the Luftwaffe 1921-1945*, p.311.

<sup>57</sup> J.E. Adams, 'The Luftwaffe', *Flying Magazine*, March 1944, p.51.

<sup>58</sup> L. Deighton, *Fighter* (New York: Alfred A. Knopf, 1978), p. 109.

<sup>59</sup> NAL, C.G. Grey Papers, Section 11, letter to General Milch, 1935.

<sup>60</sup> Kreipe and Koester, *Pilot and Aircrew Training in the Luftwaffe 1921-1945*, pp.282-3.

<sup>61</sup> Pilot Flying Log books for Flt Lt J. Cox, Sqn. Ldr. M. Beetham and W/O C. Goff <https://internationalbcc.co.uk/history-archive/digital-archive/>. Accessed, 15 January 2021.

Observer attached to the US Embassy in London in October 1941. Commander Luis de Florez had ‘the primary goal of studying and observing the British approach to synthetic flight training devices and training methods’.<sup>62</sup> Upon his return to the US, he documented his findings in a *Report on British Synthetic Training*. De Florez’s observations and his findings greatly influenced the future of the Special Devices Section. In the report, de Florez cited several key benefits of synthetic training. He wrote that: ‘...synthetic training increased the quality and quantity of training by providing familiarization with operational equipment to the point of instinctive response; allowed instructors to handle large numbers of students and allow them to “freeze” the action to point out student errors; constant practice on the ground trainers permitted crews to be sent into actual conditions far more safely than other techniques; valuable equipment would not be tied up as training aids.’<sup>63</sup> The importance of de Florez to the development of US Navy air training policy and delivery can be seen today in the fact that the US Naval Air Warfare Center Training Systems Division (NAWCTSD) headquarters in Orlando is housed in the de Florez complex.<sup>64</sup>

### **Development of RAF STE Policy**

The creation of a coordinated STE policy had its roots in the establishment of the 5 Group Crew Training School at RAF Finningley that was announced by AOC 5 Group, Air Vice-Marshal A.T. Harris, on 18 January 1940.<sup>65</sup> The high-level discussions surrounding the school did much to frame the RAF’s policy towards STE and promote the topic to a wider audience. In a typical forthright Harris

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<sup>62</sup> P. Dawson, ‘Luis de Florez and the Special Devices Division,’ p.99.

<sup>63</sup> *Ibid.*, p.100.

<sup>64</sup> <https://www.navair.navy.mil/nawctsd/node/511>. Accessed, 15 February 2021.

<sup>65</sup> TNA AIR 2/4168, Letter from AOC 5 Group to HQ Bomber Command, 18 January 1940.

communication, the AOC 5 Group was not asking permission from the Air Ministry to establish the new training school but declaring that a 'proposed' Elementary Ground Training Organisation was to be 'immediately introduced within the resources of this Group,' so as to put all crews 'through their individual procedure under realistic conditions on the ground,' before crews reported to their operational squadrons. Harris' aim was to remove the training load from the squadrons and 'to get crews "pat" with the latest procedure and tactics...'<sup>66</sup> The drills were to be repeated until every crew was 'procedure perfect.' As part of the Crew Training School, as Finningley was to become known, Harris requested the recruitment of three school masters that have 'the inborne [*sic*] ability and qualities to apply and instil knowledge and that this type of instruction cannot be done by the ordinary RAF personnel who has [*sic*] little or no knowledge in the art of teaching.' Combined with the RAF's established recognition of the benefits of the Link Trainer, the correspondence generated by Harris' Crew Training School circulating at Air Council level led the Chief of Air Staff and AOC-in-C Bomber Command staffs to start to define a policy for the use of STE.

This ground training school was an interesting development in terms of how it reflected the innovation of the RAF at the time. Personnel would recognise a 'training gap' and design and develop their own training aids to fill it. Although a commendable approach, it did have shortfalls, particularly concerning maintaining common standards in training and not adopting best practice solutions; the latter with the possibility of creating to so-called 'negative training.' Harris' ground training school was not only innovative but highlighted his ability to identify a training problem and then find a solution; for example, using an old Hampden fuselage and a Link

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<sup>66</sup> TNA AIR 2/4168, Letter from AOC 5 Group to HQ Bomber Command, 18 January 1940.



Trainer, the CTS provided a collective training environment for the complete crew. In providing an environment to practise individual skills, the CTS was also the catalyst for the training regime later adopted by the Group Pools/Operational Training Units. Each three week course comprised 12 pilots and 12 WOp/AGs and, with a new intake every week, the CTS contained 72 aircrew. Initially the CTS drew considerable support when with the Director of Staff Duties, Air Commodore R.P. Willock, said that 'A.V.M. Harris is well known for producing bright ideas...and that the CTS, should be adopted in Operational Training Units.' Willock finished by saying that '[m]y contention has always been that the more training that can be done on the ground to simulate conditions in the air, the higher standard we shall attain.'<sup>67</sup>

Although clearly a significant concept that addressed the need to coordinate the training of multi-crew aircraft, the CTS faced a number of hurdles. The first of these was ironically provided by Harris who originally stated that the CTS would be staffed from 5 Group resources but then requested an establishment of 13 officers and 19 other ranks to run the facility.<sup>68</sup> The second retardant to the project came from 6 Group – Bomber Command's Group Pool Squadron organisation (Group Pools were renamed Operational Training Units in early April, 1940), which was formed on 16 September 1939. The Group considered that the CTS course was 'too complicated and tends to restrict the flow of trainees unduly'. Although somewhat contradictory, 6 Group also said that it would keep the same training but alter the syllabus.<sup>69</sup> This was perhaps damning by faint praise, but the third factor casting doubt on the CTS was that the three-week course took place after the GPS/OTU

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<sup>67</sup> TNA AIR 2/8645, Minute Sheet comments by DSD, 5 February 1940. This minute sheet comment referred to a letter from HQ Bomber Command to 5 Group, dated 1 February 1940, giving authority for the CTS.

<sup>68</sup> TNA AIR 2/8646, Letter to Air Ministry from HQ Bomber Command, 25 May 1940.

<sup>69</sup> TNA AIR 2/8646, Letter from HQ Bomber Command to Under Secretary of State for Air, 18 May 1940.

phase and thereby delayed even longer, the time taken for aircrew to reach their operational squadrons.<sup>70</sup>

Considering these newly formed Group Pools had to evolve to become effective before a working syllabus could be defined, it was clear that 5 Group's CTS was well advanced in providing ground based synthetic training, but it was not unique in providing innovative STE solutions. At RAF Harwell, for example, 3 Group Pool, which became 15 OTU in April 1940, designed a wireless operator training device that was to become known as the Harwell Box.<sup>71</sup> This provided the wireless operator with 'similar conditions to the aircraft' that included sound effects to provide a realistic environment for him to practise obtaining fixes, using the aircraft's DF loop antenna, operating his radio and conducting fault-finding. Along with the Link Trainer, Bombing Teacher and the Harwell Box, Group Pools/OTUs, gunnery schools and operational squadrons were equipped with different types of turret trainers that fired live rounds on outdoor ranges or indoors using cine films to allow gunners to track targets.

According to Rolfe and Bolton, 'The suggestion was made ...that Finningley should become the Central School for Synthetic Training...[but]...The proposal was not approved.'<sup>72</sup> Considered on balance, an extra three weeks training; the establishment of 32 personnel to run the CTS and the retention of 72 aircrew in the training pipeline, when there was a major shortage of aircrew not only within Bomber Command but the RAF in general, meant that the 5 Group CTS was untenable. What it did achieve, however, was to highlight the need for a policy to try and

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<sup>70</sup> TNA AIR 6/33, Minutes of 149<sup>th</sup> EPM held on 11 January 1939.

<sup>71</sup> TNA AIR 41/40, pp. 14-15.

<sup>72</sup> Rolfe and Bolton, 'Flight Simulation in the Royal Air Force in the Second World War', p.316.

standardise STE delivery and, to an extent, the design of STE, leading to the establishment of a number of committees to oversee the growing enthusiasm now being shown towards simulation. Harris, however, continued to lobby for his Group's CTS.

In a letter to Willock, Harris offered what was clearly a bribe when he agreed to release, on posting, an officer from CTS, requested by the Air Ministry, in exchange for Willock pushing the 'establishment through, which is held up by some lethargical [sic] office wallah [sic] in some pigeon hole or another...'<sup>73</sup> In this letter, Harris made some interesting observations about synthetic training as well as showing much of his character.

Incidentally, although I do not mind for myself [he clearly did], I would suggest that a word of appreciation on the efforts made here to institute synthetic training and to design and organise the first of the synthetic trainers would surely not be out of place. At the present time, one hears all sorts of sideways references as to the value of these new methods of training, and the ingenuity displayed by those who thought of it and first put it into force. Unfortunately, signs are not wanting that although I originated it in my office, in conference with a few of my staff, and then proceeded in conjunction with the C.O. at Finningley entirely off our own bats to institute the whole business, there are a most astonishing number of claimants in the field already, outside the Group, to having thought of it and instituted it first.<sup>74</sup>

Harris' comments on 'a word of appreciation' clearly got through as, later that month, Group Captain Maycock, the Station Commander and its parent CTS, received a letter from the Air Council saying that 'their attention [had] been drawn to the noteworthy services which you [had] rendered.'<sup>75</sup> Harris' initiative may have been recognised but the pressures on the CTS were too great and, perhaps ironically, proceeding the Air Council's letter of recognition, DWTT stated that the CTS could

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<sup>73</sup> TNA AIR 2/8646, Letter from AOC 5 Group to DSD, 2 June 1940.

<sup>74</sup> *Ibid.*

<sup>75</sup> TNA AIR 2/8646, Letter from Air Council to OC 106 Squadron, RAF Finningley, 26 June 1940.

not be established and the training developed at Finningley should be transferred to the bomber OTUs.<sup>76</sup> This was a major policy decision that began to define the future roles of the newly established OTUs.

Harris's CTS initiative still retained support, at least in HQ Bomber Command. The AOC-in-C Bomber Command, Air Marshal Portal, told the AMSO, Air Marshal Courtney, that the CTS 'was quite indispensable at present and I must ask you at all costs to let it be established temporarily,' and that the school had a 'far reaching effect throughout the Air Force,' which provided a stay of execution. Portal argued that closing the CTS would be 'false economy' as it was 'preventing the loss of crews' and 'increasing operational efficiency.'<sup>77</sup> This appreciation of Harris's efforts and support shown to him is illuminating given Portal's patience with him in the latter stages of the war when Harris attacked the transportation plan in the run-up to D-Day in favour of continued strategic bombing.<sup>78</sup> Although the CTS worked on using its own resources for a number of months, the subsuming of OTUs within 6 Group and the adoption of the synthetic training methods developed by 5 Group within the OTUs gradually reduced the need for the extra training.<sup>79</sup> Combined with the arrival of more Link Trainers, 5 Group's creation of a range of other synthetic ground-based trainers, and the disagreements between HQ Bomber Command, DWTT and AMSO on how such training equipment should be used, the Air Ministry decided to create a committee to focus on synthetic training to better define its application and to formalise STE policy. Initially, Ludlow Hewitt, AOC-in-C Bomber Command,

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<sup>76</sup> TNA AIR 2/8646, Letter from DWTT to HQ Bomber Command, 19 June 1940.

<sup>77</sup> TNA AIR 2/8646, Letter from AOC-in-C Bomber Command to AMSO, 26 June 1940.

<sup>78</sup> Harris, *Despatch on War Operations*, p.23

<sup>79</sup> TNA AIR 41/4, p.238. The term OTU replaced Group Pool from April 1940. 6 Group took over responsibility for Group Pools, later OTUs, from September 1939. See TNA AIR 2/4168 Loose Minute from DSD to HQ Bomber Command, 9 September 1939.

suggested forming a separate branch of the Air Ministry to coordinate synthetic training policy, but this idea was subsequently dismissed by Willock as DWTT and it was decided to opt instead for a committee.<sup>80</sup> As a result, the 'Simulation of Air Training on the Ground Committee' held its first meeting on 11 March 1940.<sup>81</sup> The creation of this committee was a significant step by the Air Ministry and highlighted how seriously it viewed the adoption of synthetic training equipment. With the DDWTT, Group Captain H.G. Crowe, as its chairman, the aims of the committee were defined as to:

- a. Study the requirements of aircrew training and determine what training devices could be used, 'including cinematography.'
- b. Prioritise the development of synthetic training equipment.
- c. Issue recommendations on the provision and installation of synthetic training equipment.
- d. Liaise with the Army and Royal Navy concerning their use of synthetic training equipment.<sup>82</sup>

From the third meeting in May 1940, the committee had grown from 18 members at the March meeting to 27 and had changed its name to the Synthetic Training Committee.<sup>83</sup> DWTT Air Commodore Willock stated that now the war 'had started in earnest, the necessity for conserving petrol, engine hours, and operational aircraft, was of vital importance' and there was a requirement, 'to make the greatest possible

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<sup>80</sup> TNA AIR 2/8644, DWTT comments on Minute Sheet, 20 February 1940.

<sup>81</sup> TNA AIR 20/1348, Minutes of the Simulation of Air Training on the Ground Committee, 1<sup>st</sup> Meeting held on 11 March 1940 in Harrow.

<sup>82</sup> TNA AIR 20/1347, *Notes on the History of RAF Training, 1939-1944*, January 1945.

<sup>83</sup> TNA AIR 1348, Minutes of the Synthetic Training Committee Meeting, 16 May 1940.

effort towards the introduction of further facilities for synthetic training.<sup>84</sup> These 'further facilities' were certainly forthcoming, either as a result of individual or unit innovation to address a specific training need, or through the procurement of synthetic training equipment from industry. In short, 'the diversity of suggestions, ideas, and methods increased steadily.'<sup>85</sup> It could be argued that the RAF was pursuing the adoption of this synthetic training equipment with single-minded zealotry. The challenge that they faced however was twofold; firstly, the manufacture of training equipment 'was on a low priority'; secondly, equipment designed by individuals and units was not standardised and was therefore frequently being 're-invented'. In addition, it did not take advantage of pooled best practice in terms of design knowledge, technology or policy.<sup>86</sup>

The power of the Synthetic Training Committee was boosted from June 1940 with the creation of a new Air Council post, the Air Member for Training, who would now assume responsibility for the Committee. At an Air Council Meeting of 21 June 1940, the Secretary of State for Air, Sir Archibald Sinclair, said that 'the biggest question of all' faced by the Air Ministry 'was the production of pilots and crews'.<sup>87</sup> The importance of this task was reflected by the appointment to the Air Council of an officer 'who would be in executive control of training in all its aspects' who had 'direct access to the Secretary of State'. The new Air Member for Training would take over the Air Ministry's Directorate of Training and 'certain branches of DWTT (TW 1, TW 2, and TW 3)'. The position of Air Member for Training was officially established by

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<sup>84</sup> TNA AIR 1348, Minutes of the Synthetic Training Committee Meeting, 16 May 1940.

<sup>85</sup> TNA AIR 41/4, p.562.

<sup>86</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-1944*.

<sup>87</sup> TNA AIR 2/4550, Notes of a Meeting Held on the 21 June 1940, 24 June 1940.

an Order in Council dated 26 June 1940 and Air Vice-Marshal A.G.R. Garrod was appointed to the post by Sinclair on 28 June 1940.<sup>88</sup>

In January 1941, the coordination of synthetic training was being managed within the AMT's T.O. 5 branch.<sup>89</sup> Synthetic training methods were becoming increasingly popular such that the STC meeting in early March 1941 drew 45 attendees, 'many of whom could not get near the table.'<sup>90</sup> As popular as synthetic training was becoming, standards applied to its use were problematic. In his report following visits to Bomber Command OTUs in December 1941, the RAF's Inspector General, Air Chief Marshal Ludlow-Hewitt, said that '[i]t is very gratifying to note how well synthetic training has developed at these OTUs.' but warned that 'some are much better than others' and officers that are responsible for synthetic training should visit the better OTUs, 'to see how it should be done.'<sup>91</sup> There were also problems of supply and demand. Priorities and production difficulties limited the amount that could be turned out, either by RAF units or by manufacturers, and the introduction of synthetic training was, in consequence, severely handicapped throughout 1940 and 1941.<sup>92</sup> Another example of this shortfall was the use of sodium flares with which to practise night landings during the day. According to Ludlow-Hewitt's report, following his visit to OTUs in December 1941, a shortage of sodium flare training systems, combined with aircraft serviceability issues, were the reasons for, 'the main bottle-neck delaying the completion of the flying syllabus at OTUs...' <sup>93</sup>

The sodium flare training devices featured the pilot wearing smoked lens goggles

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<sup>88</sup> TNA AIR 2/4550, Order in Council, 26 June 1940.

<sup>89</sup> TNA AIR 41/4, *AHB Narrative, Aircrew Training 1934-1942*, p. 561.

<sup>90</sup> TNA AIR 2/8645, Memorandum T.O.5 to S.2.A., 10 March 1941.

<sup>91</sup> TNA AIR 20/2769, RAF Inspector General Report No. 218, Visits to Operational Training Units in Bomber Command, 15-23 December, 25 December 1941.

<sup>92</sup> TNA AIR 41/4, *AHB Narrative, Aircrew Training 1934-1942*, p.563.

<sup>93</sup> TNA AIR 20/2769, RAF Inspector General report No. 218, Visits to Operational Training Units in Bomber Command, 15-23 December 1941, 25 December 1941.

that blacked out normal vision less for the sodium flares and the system therefore simulated landing using a flare-path at night. The issues surrounding the shortage of such training systems were already being communicated between April and June 1941. In a letter to Director General of Production – Aircraft Equipment - DGP (AE), AMT Air Vice-Marshal Garrod said that ‘serious concern is being felt by the restriction on the expansion of our Bomber Force’ by a lack of ‘sodium flare paths’.<sup>94</sup> To address these difficulties, the terms of reference for the Synthetic Training Committee were altered in March 1942, giving it greater control over its decisions. The additions included ‘laying down policy,’ to ‘approve final specifications and to recommend scales of issue,’ and to ‘direct the programme of work at the STDU [Synthetic Training Development Unit],’ and the ATDU [Armament Training Development Unit].<sup>95</sup> The result was a tightening of the STC’s grip on synthetic training policy and management. The delays in providing STE, in this case, sodium flare paths, also highlighted how easy it was for the training pipeline to be disrupted by what on the surface, was a minor occurrence.

### **Procurement and Management of STE**

The majority of the STE to enter service with Bomber Command was domestically made and so to overcome the locally made unit device issues, the RAF began to issue Synthetic Training Committee Papers (STCP) that could be used by units to build standardised devices to a common design. This initiative was supplemented by the creation of the Navigation Synthetic Training Development Unit (NTSDU) that was collocated with the Phillips & Powis factory at Woodley aerodrome in April 1941.

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<sup>94</sup> TNA AIR 14/1931, Letter to DGP (AE) from DOT, 28 June 1941.

<sup>95</sup> TNA AIR 2/8785, Letter DOT, Air Commodore E.S. Goodwin to Under Secretary of State for Air, 24 March 1942.



Comprising three officers and seven civilian draughtsmen, engineers and a secretary, the organisation was tasked with designing and building training devices for map reading, dead reckoning navigation, astro-navigation and 'incidental devices'.<sup>96</sup> A number of devices were designed by the unit and these included the Air Navigation Instructor, the DR Instructor, the Celestial Observer Stellascope, the Practice Drift Indicator and Pictorial Britain; not all were accepted by the RAF. The NSTDU changed its name to the Synthetic Training Development Unit (STDU) in early 1942 where its role was broadened.<sup>97</sup>

The STDU had three main aims: to develop synthetic training devices for aircrew, with the exception of armament, signals and radar; to examine and filter new ideas and assist in the development of those approved; and, finally, to standardise training devices 'as far as possible.'<sup>98</sup> The STDU's efficiency was questioned due to a failure to prioritise training system development and its role was subsumed within the Ministry of Aircraft Production and the Training Aids Development Unit was established at RAF Cardington in April 1943.<sup>99</sup> The real issue faced by the RAF, with this rapid adoption of synthetic training equipment, was a lack of knowledge as to the manpower requirements involved in terms of maintenance support and the provision of instructors. This issue was highlighted with the Link Trainer where these challenges – along with the scale of issue of trainers - were addressed in late 1938, but it took until 1942 for the challenges to be fully resolved.<sup>100</sup>

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<sup>96</sup> TNA AIR 32/113 Navigation Synthetic Training Development Unit notes, undated.

<sup>97</sup> TNA AIR 20/1347, *Notes on the History of RAF Training 1939-1944*, January 1945.

<sup>98</sup> *Ibid.*

<sup>99</sup> Rolfe and Bolton 'Flight Simulation in the Royal Air Force in the Second World War,' p.316.

<sup>100</sup> TNA AIR 2/3940, Notes on a Conference Held at the Air Ministry on Monday 14 November, 1938, to discuss the basis of establishment of link [*sic*] trainers, 14 November 1938.

Although the STC was providing STE policy, the management involved in controlling production, standards, testing and quality assurance was clearly lacking. This applied to both the unit manufactured devices contained in the STC Papers and the more formal manufacturing processes seen with the NTSDU/STDU organisation, and later, when it was subsumed into the MAP TADU conglomerate. Although UK process had clear issues that impacted how STE was managed and procured, Dawson has argued that it had advantages over the US 'sequential design, test, redesign' approach before 'manufacturing and procurement' started.<sup>101</sup> Although the British process was more risky, de Florez decided to adopt it in the US Navy's Special Devices Section, 'to save time' and foster innovation.

One key factor to affect overseas procurement concerned the growth of the US Army Air Corps (USAAC) and its subsequent call on the Link company for synthetic training equipment. It is highly likely that the US President's policy, 'that powerful United States Air Forces must be created and maintained and that every appropriate aircraft built in the United States should be manned and fought by American crews,' also had an impact on STE.<sup>102</sup> Already successful in selling Link Trainers around the world to countries such as Japan, Germany, the USSR and France, a growing focus on the home US market meant that the RAF suffered increasing supply issues.<sup>103</sup> By early 1941, the RAF's adoption of the Link trainers was being retarded by a lack of spares and a failure by the Link company to meet deliveries.<sup>104</sup> The issue of Link prioritising US orders over those of the UK can be

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<sup>101</sup> Dawson, 'Luis de Florez and the Special Devices Division,' p.101.

<sup>102</sup> 'The American-British Memorandum of Agreement dated 21 June 1942 – The Arnold/Towers/Portal Agreement.' <https://history.state.gov/historicaldocuments/frus1941-43/d299>. Accessed, 9 March 2021.

<sup>103</sup> Baarspul, 'A Review of Flight Simulator Techniques,' p.9.

<sup>104</sup> TNA AVIA 38/769, Secret Cypher from BAC to MAP, 21 March 1941.

seen with the development of the Link Crew Trainer – initially referred to by Link as the Starglobe.<sup>105</sup> Again, Harris played a central role in the development of STE in Bomber Command through his assistance in procurement of this device following his posting to the US as the head of the RAF delegation to the British Military Mission after commanding 5 Group and holding the post of DCAS.<sup>106</sup> This device, also referred to earlier by the RAF's preferred nomenclature, the Celestial Navigation Trainer, was developed by the Link Company in conjunction with the RAF and was designed to train pilots, navigators and bomb aimers in long range navigation – a critical skill as part of the strategic bomber offensive as well as in ferrying aircraft from the US across the Atlantic.<sup>107</sup> Service trials on the device were conducted at No. 31 School of Air Navigation at RAF Port Albert in Ontario.<sup>108</sup> In his covering letter to the official Celestial Navigation Trainer trials report, head of the British Air Commission, Air Marshal Sir Roderic Hill, highlighted the need to place orders before factory output went to the US Navy and US Army Air Corps. 'The necessity for placing an early order for these Trainers cannot be over emphasized in view of the fact that it is understood that 90 of these Trainers are being ordered by the U.S. Army and Navy.'<sup>109</sup>

The report itself was highly supportive of the device and stated that it was 'an ideal instrument for the training of air observers and crews. Its immediate adoption in the RAF is most strongly recommended.' The report continued that, 'a large proportion of the air observer training may be carried out better in this instrument

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<sup>105</sup> TNA AVIA 38/769, Telegram from Air Ministry to British Purchasing Committee, 30 August 1940.

<sup>106</sup> H. Probert, *Bomber Harris His Life and Times* (London: Greenhill Books, 2006), p.116.

<sup>107</sup> TNA AVIA 15/38, Secret Cypher from BAC to MAP, 25 August 1941.

<sup>108</sup> TNA AIR 20/4113, The Link Celestial Navigation Trainer - Report of a Trial done at No. 31 School of Air Navigation, RAF Port Albert, Ontario, 1 September 1941.

<sup>109</sup> *Ibid.*

than it can be in the air' and that the device will 'improve vastly the quality of graduates and will enable their training to reach a standard that has hitherto been impossible.' With the Celestial Navigation Trainer 'dramatically' reducing flying time and reducing 'considerably the cost of training,' it is perhaps surprising that the device was not bought in larger numbers; here, financial pressure and poor project management were at the root of the problem.<sup>110</sup>

The device was housed in a 45 feet high octagonal building and saw a larger version of the Link Trainer mounted between the dome ceiling that resembled 'something like a planetarium' and the floor.<sup>111</sup> The cockpit was mounted to a universal joint on a 'rotatable tower'.<sup>112</sup> The dome rotated to replicate any time in the northern hemisphere. Images of the ground were projected through glass painted plates onto a screen just below the cockpit; the fuselage contained the pilot, navigator, radio operator and bomb aimer.<sup>113</sup> The primary uses of the device were to train astro-navigation, dead reckoning navigation and 'bomb dropping'.<sup>114</sup> On the surface of the dome appeared all 'major constellations', 350 other stars and 11 major navigation stars that were collimated to allow accurate astro fixes to be taken.<sup>115</sup> In a covering letter to the report by Air Marshal Roderic Hill from the BAC in Washington, Hill said Ed Link visited the trials and that the report was typed before the device was

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<sup>110</sup> TNA AIR 20/4113, The Link Celestial Navigation Trainer - Report of a Trial done at No. 31 School of Air Navigation, RAF Port Albert, Ontario, 1 September 1941.

<sup>111</sup> P. Saxton, 'A History of Navigation in the Royal Air Force,' *RAFHS Seminar*, held on 21 October 1996. <https://www.rafmuseum.org.uk/documents/research/RAF-Historical-Society-Journals/Journal-17A-Air-Navigationin-the-RAF.pdf>. Accessed, 21 May 2022.

<sup>112</sup> TNA AIR 20/6058 *Illustrated Catalogue of Synthetic Training Devices*, May 1942.

<sup>113</sup> J.M. Rolfe & K.J. Staples (eds.) *Flight Simulation* (Cambridge: Cambridge Aerospace, 1986), p.26.

<sup>114</sup> TNA AIR 20/4113, The Link Celestial Navigation Trainer - Report of a Trial done at No. 31 School of Air Navigation, RAF Port Albert, Ontario, 1 September 1941.

<sup>115</sup> TNA AIR 20/6058, *Illustrated Catalogue of Synthetic Training Devices*, May 1942.

re-named the Link Crew Trainer. Some archive material refers to the Link Crew Trainer as the Link Bombing Crew Trainer or Link Bombing Trainer.<sup>116</sup>

The RAF dithered in ordering the device for a number of reasons. The major issue was the 'prohibitive cost' of the device at £80,000 each (this equates to £5.17 million in 2023 prices).<sup>117</sup> In his Minute Sheet comments, Air Commodore Huskinson, Director of Armament Development (D Arm D), the initial Air Ministry procurement authority for the Link Crew Trainer, also highlighted an 18-24 month delivery schedule and that such a timescale would mean that the device, in D Arm D's mind, would have 'missed its usefulness as far as our war effort is concerned.'<sup>118</sup> This comment was clearly loaded with the foresight that it did not merit. Further negativity was added with the comment that 'the U.S. Government will probably obtain priority' for the devices. Here another reason emerges for failure to procure the devices earlier.<sup>119</sup> In support of D Arm D's views, a cipher from the British Air Commission in Washington to the Air Ministry in February 1941 had stated that the US Army and Navy were about to place an order for 70 Link Crew Trainers, further adding to the idea that the RAF 'had missed the boat'.<sup>120</sup> This caused little alarm within the Air Ministry as in March 1941 MAP had refused to sanction orders until the trial had been completed in Canada.<sup>121</sup> This risk-averse view was not universal. AMT, Air Marshal Garrod, sent the Head of RAF Staff in Washington, Air Vice-Marshal Harris, a cipher in August 1941 recommending ordering the devices and saying that he was

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<sup>116</sup> TNA AIR 20/4113, The Link Celestial Navigation Trainer - Report of a Trial done at No. 31 School of Air Navigation, RAF Port Albert, Ontario, 1 September 1941.

<sup>117</sup> TNA AIR 20/4113. Minute Sheet comment by D.Arm.D., 25 April 1941.

<sup>118</sup> Probert, *Bomber Harris – His Life and Times*, p.117 and 420. Harris was Head of British Air Staff in Washington from 27 May 1941 until 22 February 1942. Harris worked closely with the British Air Commission, the purchasing agency for US aircraft and equipment that represented MAP.

<sup>119</sup> TNA AIR 20/4113. Minute Sheet comment by D.Arm.D, 25 April 1941.

<sup>120</sup> TNA AIR 20/4113, Secret Cipher from BAC to Air Ministry, 15 February 1941 and Secret Cipher from the US Air Attaché to Air Ministry, 15 February 1941 .

<sup>121</sup> TNA AIR 20/4113, Minute Sheet comment by A.D.T.O., 6 March 1941.

looking for a funding stream for procurement.<sup>122</sup> In September, Harris wrote to Air Commodore Cochrane, the Director of Training under AMT, to inform him that he was attending a meeting and that it was 'most urgent' that he be told how many devices the RAF required. Harris continued that he needed an 'immediate decision' but 'feared it might already be too late.'<sup>123</sup> The response again highlighted financial issues: 'it is not practicable to give speedy decisions. Haven't got two-and-a-half million dollars.' The Air Ministry went on to say that 'if they are to be obtained at all' it will have to be through 'lend-lease arrangements.'<sup>124</sup>

The lend-lease requisition, BSC.6464, was filed by the BAC for 100 Link Crew Trainers on 21 October 1941. The first deliveries were expected to commence in June 1942 and proceed at a rate of five per month.<sup>125</sup> This number was later reduced to 60 with the first device not being fully ready for training until early 1943.<sup>126</sup> The problem was that of output as the US had placed requisitions for 87 for the US Army Air Corps and 34 for the US Navy.<sup>127</sup> According to Rolf and Staples, not all of those devices destined for the UK entered service with some passed back to the US under the terms of reverse lend-lease.<sup>128</sup>

### **Application of STE**

STE was being slowly adopted by the RAF ever since the introduction of the camera gun during the First World War. Developed at the School of Aerial Gunnery in Hythe, the device was a camera built to represent the .303 Lewis machine gun and so when

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<sup>122</sup> TNA AIR 20/4113, Secret Cipher AMT to Head of RAF Staff BAC Washington, 27 August 1941.

<sup>123</sup> TNA AIR 20/4113, Secret Cipher Head of RAF Staff BAC Washington to DOT, Air Ministry, 17 September 1941.

<sup>124</sup> TNA AIR 20/4113, Secret Cipher Air Ministry to Head of RAF Staff BAC Washington, 20 September 1941.

<sup>125</sup> TNA AIR 20/4113, Secret Cipher from BAC to MAP, 27 November 1941.

<sup>126</sup> TNA AIR 2/8785, Agenda for 33<sup>rd</sup> Synthetic Training Committee Meeting, March 1943.

<sup>127</sup> *Ibid.*

<sup>128</sup> Rolf & Staples, *Flight Simulation*, pp. 26-27.

mounted on the Scarff ring, the observer could aim the 'weapon' and fire it like a normal machine gun. The camera-gun could also be mounted on the upper wing of an aircraft like the SE5A, and be fired by the pilot by a Bowden cable. The 14-exposure, 2¼ inch film was wound on by means of the cocking handle and indication of the gunner changing magazines was made by a pin making a small hole on the edge of the film. The optics also contained an aiming reticule that was superimposed on the film print.<sup>129</sup> Around 5,000 of these Hythe camera guns were manufactured and were used up until the start of the Second World War. In a RUSI lecture in 1938, Air Vice-Marshal L. A. Pattinson, AOC 23 (Training) Group, told attendees: 'Camera gun practice for fixed and free gunnery is another extremely useful thing. The pilot [or observer] can practice manoeuvre and aiming, get a picture of the target, and work out where his shots would have gone.' The problem with the Hythe camera gun was that it only took still photographs and therefore, no consideration for 'lead' could be made. That shortfall was overcome with cine camera guns such as the G42B and G45 that were both widely used at Bomber Command armament schools.

Before the Bombing Teacher entered service with the RAF, the Service was using the camera obscura during the First World War and it remained in-service up until 1939. According to Pattinson, '[the] pupil flies over the camera obscura which throws an image of his aircraft on to a table. He makes a bomb dropping signal [normally a light or radio signal], and that is plotted in the camera obscura office, and the man operating the camera obscura will tell the pilot where his bomb would have gone.'<sup>130</sup> According to the Operational Record Book of 12 (Bomber) Squadron,

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<sup>129</sup> [http://www.earlyphotography.co.uk/site/entry\\_C497.html](http://www.earlyphotography.co.uk/site/entry_C497.html). Accessed, 2 March 2021.

<sup>130</sup> L.A. Pattinson, 'The Training of a Royal Air Force Pilot', *JRUSI*, 83 Feb/Nov 1938, p.16.

camera obscura exercises would normally last a week.<sup>131</sup> To achieve correction for wind direction and strength, the camera obscura operator marks 'the point at which the image of the machine appears on the chart at the time of the signal is noted' before calculating the aircraft's height and speed along with wind strength and direction.<sup>132</sup> Being such a small and portable device, camera obscura were frequently located in towns to make the training exercises more realistic.<sup>133</sup> Although the camera obscura remained in service up until 1939, STE, such as the Bombing Teacher, and later, Celestial Navigation Trainer, overtook the earlier device. Larger bomber crews also meant that the need arose to conduct collective training that involved the complete crew.

In that regard, one of the most significant training exercises to emerge from Finningley and that was later to be adopted by all bomber OTUs was the Ground Operational Exercise (GROPE).<sup>134</sup> GROPEs took place in a Crew Procedures Trainer (CPT) that comprised cubicles for each crew member and frequently a Link Trainer for the pilot. The cubicles contained the main equipment and instrumentation for each discipline, with hydraulic and electrical power being provided from 'external sources'. The exercise was managed from a control table at which sat the exercise controller, a signaller and a plotter. Although perhaps considered crude in comparison with today's networked computer constructive simulators, the GROPE exercise featured sound effects, navigation plots shown on an epidiascope and bright lights to simulate searchlights. Throughout the exercise, engine noise as well

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<sup>131</sup> TNA AIR 41/39, *The RAF in the Bomber Offensive Against Germany – Vol 1, Pre-War Evolution of Bomber Command 1917 to 1939*, p.44.

<sup>132</sup> Wonders of World Aviation published Part 22, 2 August 1938, <https://www.wondersofworldaviation.com/mobile/auxiliary.html>. Accessed, 9 March 2021.

<sup>133</sup> For example, 57 Sqn. undertook bombing exercises between 17-19 October 1932 over Northampton, Portishead and Cardington. <https://57squadron.wordpress.com/between-the-wars/>. Accessed, 8 March 2021.

<sup>134</sup> TNA AIR 20/6056, *Bomber Command Synthetic Training Manual*, published 1943.



as that of simulated flak where appropriate, was fed into the cubicles via speakers. Each exercise was conducted with what is now referred to as a Master Events List (MEL) that drove the scope of the exercise and crews went through the whole process of pre-flight briefings, the flight itself and then post-flight debriefings. The introductory briefing paragraph of GROPE No. 5 is shown below and describes the scope of a typical exercise.

As in the case of Ground Operational Exercise No. 4, Grope No. 5 has been designed primarily for training crews in the location of targets at night. The normal navigational problems are included in the exercise, particular stress being laid on the plotting of loop bearings obtained in conjunction with the re-diffusion loop trainer. Four examples of the plotting of astronomical bearings are also included, so that those trainees who have received instruction in this form of navigation may have practice, and the normal operational identification procedure, etc., is provided.<sup>135</sup>

This instruction to GROPE No.5 makes reference to the loop trainer and indicates how by 1942, the RAF was using a range of different individual synthetic training devices before using collective trainers such as the Crew Procedures Trainer.

## **Conclusion**

Although the Link Crew Trainer saga did not reflect well on the procurement processes of the wartime RAF, it is clear that the Service had a pragmatic appreciation of the benefits of STE and integrated numerous training devices into its *ab initio* and operational flight training syllabi. In conclusion, it can be seen that STE saved fuel and wear-and-tear costs in comparison to using real aircraft. They also added another layer of air safety by aiming to increase a crew's preparedness before they undertook exercises in the air. Although the RAF always maintained that the use of STE would not reduce actual flying hours, the ability to practise on the ground

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<sup>135</sup>*ibid.*

ensured that time in the air was not wasted. In short, the adoption of such devices provided improved levels of training transfer and, in the case of multi-crew aircraft, provided an excellent collective training environment where individual crew members could work together. In addition, training devices, such as the Link trainer, offered a relatively high fidelity level of training in the period of expansion when training aircraft and airspace were at a premium. The wartime RAF was at the forefront of using STE in an integrated training environment and must be considered as the premier exponent of STE during its expansion and early war years especially when compared to the Luftwaffe's minimal use of such technologies. The RAF's STE policy and application was also the catalyst for the development of synthetic training in the US Navy as evidenced by the de Florez report.

Another observation on the use of STE by the RAF centres on the enthusiasm shown by individuals and units for its adoption. This is epitomised by organisations such as 5 Group's crew training school at RAF Finningley and 15 OTU at RAF Harwell where innovation, initiative and a desire to improve training delivery came together to provide a driver for the RAF's approach to STE, especially as far as its policy, management, procurement and application was concerned. Despite some difficulties surrounding procurement and domestic manufacture, the use of STE by Bomber Command was a major boost to the effectiveness of its operational training and its adoption and growth were significant catalysts for the delivery of improved training as the war progressed.

## CHAPTER TEN

### CONCLUSION

#### **Training in Context**

This thesis has examined how the RAF's bomber force/Bomber Command operational training evolved between 1922 and 1945 and what drove that process. It has also analysed whether that operational training evolution was an improvement on what went before and if so how? Training can be a difficult concept to engage with and so this thesis has used the 'training pipeline' model as a vehicle to visualise a number of enhancing or detracting effects. These effectors include the allocation of resources; pipeline management; training methodologies; policy; desired training outcomes; course design; and syllabi. There is also the issue of legacy that needs to be considered and, as far as the bomber force and the wider RAF was concerned, this was provided by its experiences of the First World War. The thesis concludes that there was a positive evolution in the way the bomber force/Bomber Command conducted its operational training that provided significant enhancements to Bomber Command's operational effectiveness from at least 1940 onward but there were a number of detracting factors.

Firstly, that improvement was not linear. Following the reduction of the RAF in 1919 and its fight for survival in the inter-war years during a period of financial austerity and hostility from the Royal Navy and Army, it developed its unique doctrine of 'long-range' or strategic bombing. This doctrine was designed to highlight the RAF's distinctive ability to fly over ships and land armies to deliver destructive and morale shattering effects on the enemy. This inter-war period was a time of rhetoric where the training provided was of limited operational use. Referred to by Terraine

as a 'bomber obsession,' the omnipotent bomber was seen by Trenchard and his acolytes as the RAF's *raison d'être*. To them, it offered a distinct war winning capability.<sup>1</sup> Perhaps the most surprising factor here was that the RAF adopted its bombing doctrine without considering the methods or operational training required for it to be fulfilled.

Given the importance of this core doctrine and its link to the RAF's survival in the early inter-war period of financial austerity, this thesis has considered how and to what extent that doctrine was supported from a training perspective. The vehicles for this have been the Service's wider experiences derived from the First World War, the intellectual underpinnings from its Staff College instructor and student cohorts, the organisation of the Air Ministry and Bomber Command to enable meaningful operational training to take place, training policy and, finally, aircrew operational training development and methodologies. Although these were the key areas of study, the analysis of these areas has also generated other key themes that have had major impacts on operational training: the development of aeronautical technology and the intellectual ability of senior officers to understand the role of training and its inherent and vital role in enhancing operational effect. Together, these areas of study help us define how operational training evolved in Bomber Command between 1922 and 1945 and what drove that process. Additionally, this thesis has shown that this period marked an incremental improvement in operational training over time.

Central to this thesis has been the training pipeline both in regard to how student's move through it and perhaps more importantly, how it was frequently

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<sup>1</sup> Terraine, *The Right of the Line*, p.11.

disrupted. During the late 1920s and early 1930s, the training pipeline was a simple process for the RAF to master. It started with a pilot completing an *ab initio* Flying Training School (FTS) course before moving to advanced training at the same school; the so-called 'all through' system. These courses were the same for single- and twin-engine pilots destined for fighters or bombers and total FTS training would last 12 months. The pilot would then move to a frontline squadron for operational training. As discussed in Chapter Six, this was not an ideal situation as the frontline squadron could not focus on unit operational training but instead had to concentrate on type conversion training and the introduction of skills such as 'cloud flying' (instrument flying), night flying, navigation and applied bombing and gunnery for new pilots.<sup>2</sup>

There were numerous 'training gaps' that were only coming to light as the RAF began its expansion process from late 1934 but as training was added, questions arose about its relevance. An example of this concerned night flying, a large proportion of which was 'spent flying round a flare path practising landing and take-off' and did not represent 'the type of flying which would have to be undertaken in war.'<sup>3</sup> This raises an important question, as to what was the type of flying which would have to be undertaken in war and whether the RAF had a full intellectual grasp of it. Although this doctrinal question falls outside the scope of this thesis, it has also yet to be fully addressed, even by the numerous extant academic studies of RAF doctrine. It is nonetheless vitally important; as already discussed in Chapter One, doctrine should define what training is undertaken to fulfil that doctrine and here, the RAF failed to address this significantly important issue.<sup>4</sup> For example, the

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<sup>2</sup> TNA AIR 14/53, Minute Sheet 35, SASO to AOC-in-C Bomber Command, 27 April 1938.

<sup>3</sup> TNA AIR 16/245, Minute Sheet 80, SASO to Group Captain Training, ADGB, 6 May 1936.

<sup>4</sup> See for example, Parton, 'The Evolution and Impact of Royal Air Force Doctrine, 1919 – 1939.'

RAF took away various lessons from the First World War that included the RFC/RAF's tactic of escorting reconnaissance aircraft by scouts (fighters) from mid-1916 and VIII Brigade/Independent Force bombers in 1918; that night bombing resulted in lower wastage rates than day bombing, albeit with less accuracy; and that role specific training was required after basic flying training before pilots and observers were posted to their frontline squadrons.<sup>5</sup> These operational lessons were not converted into training objectives during the inter-war years and, therefore, this created a number of training gaps that were self-evident during Bomber Command's early operations over Germany.

As this thesis has shown, this conceptual study of operational training has challenged extant historiography in a number of ways. Firstly, when training has been discussed, it has concentrated on failures in navigation and night flying. Although clearly important, little attention has been focussed on why this was the case and what created these training gaps. In addition, the adoption of focussed operational training through advanced flying units, operational conversion units and heavy conversion units had a marked improvement on operational performance and a reduction in wastage rates. The same has been argued for the development of specialist aircrew members. These improvements came at a cost, primarily the consumption of resources and, in particular, removing aircraft and aircrew instructors from the operational bombing force. This research is important as it highlights the vital importance of training and how it is intertwined with doctrine and tactics and as such, it engages with current historiography and also provides an original perspective on Bomber Command.

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<sup>5</sup> TNA AIR 1/2161/209/4/26, Memorandum Commander 2 Wing to Squadrons, 18 January 1916 and Jones, *The War in the Air*, Vol.VI, Appendix XII.

## Addressing Early Operational Training Gaps

As my research has illustrated, a period of benign inter-war peace shrouded reason as the RAF forgot those lessons from the First World War and generated operational concepts featuring the self-defending bomber formation operating in daylight. This conceptual hyperbole had no basis in reality but continued to be propagated at the RAF Staff College and within many quarters in the Air Ministry. The frailty of this concept was clearly not discovered, or if so, ignored, during fighter affiliation and long-range navigation exercises. In addition, the RAF's reliance on part-time air gunners recruited from ground tradesmen to provide this all important self-defending firepower seemed an anachronism. Even as late as 1939, AOC-in-C Bomber Command, Air Chief Marshal Ludlow-Hewitt, stated that aerial gunnery was 'the weakest point of our bomber force' and that modern fighters have 'at least four times the striking power of the old fighter...'<sup>6</sup> There was also the poor armament of Bomber Command's early bombers to consider. With .303 machine guns, manually operated turrets and reduced arcs of fire, leaving the aircraft open to beam attacks, the concept of self-defence was difficult to justify.<sup>7</sup> One other key aspect of the self-defending bomber formation was the ability to fly in close formation and this was not being taught in sufficient depth at FTS or in operational squadrons. There was clearly a lack of understanding amongst many of the RAF's senior officers of tactics and modern aeronautical technology. As Hastings wrote, 'the chronic lack of clear thinking that had dogged bombing policy since the end of the First World War

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<sup>6</sup> AHB, Ludlow-Hewitt Papers, Box 2, Letter, AOC-in-C Bomber Command to Under Secretary of State for Air, 25 May 1939.

<sup>7</sup> Donnelly, *The Whitley Boys*, p.27. See also Table 6, Vickers Wellington – Beam Attack, p. 308.

persisted even in the face of the most convincing evidence' and this had major implications for what operational training needed to be undertaken.<sup>8</sup>

As discussed in the chapters covering pilot and other aircrew training, the RAF had to seriously re-assess its pilot training processes and the catalyst for this was Expansion Scheme A in 1934. Starting from a base of training 300 pilots each year and seconding gunners, observers and wireless operators from ground trades, the RAF's Director of Training, Air Commodore Tedder, decided to divide FTS into two phases. Elementary flying training would be conducted at civilian schools as cost reduction and capacity increasing measures while Service Flying Training Schools (SFTS) would introduce applied military flying, including rudimentary bombing and gunnery training. The bulk of operational training was still being conducted in frontline squadrons. The main contribution of Tedder's pilot training initiative resulted in the procurement of an initial tranche of 50 Link trainers and this heralded the expansion in the use of synthetic training throughout the RAF and specifically in Bomber Command. By the end of the conflict, the RAF was using over 200 different synthetic training devices, some of which were highly complex collective crew training systems. As briefly discussed in Chapter Nine, when examining Synthetic Training Equipment (STE), Bomber Command was a long way ahead of the *Luftwaffe* in its application and also provided a model for the US Navy in its adoption of STE through Commander Luis de Florez's 'Report on British Synthetic Training' that was completed in 1941. STE saved money by better preparing aircrew for airborne exercises, provided an environment for repeatable training and could be used even if inclement weather prevented flying.

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<sup>8</sup> Hastings, *Bomber Command*, p.109.



Through the establishment of Group Pool Squadrons (GPS), that were renamed Operational Training Units (OTU) in early 1940, Bomber Command addressed the need to remove the training burden from the operational squadrons and recognised the more thorough training required to operate increasingly complex twin-engine bombers. This enhancement to operational training also raised the question of resources and the allocation of aircraft to operational or training units. This exacerbated the friction between the Air Ministry and the Ministry of Aircraft Production (MAP) under Beaverbrook. Although a clear benefit to training, the establishment of OTUs did nothing to address how operational training was being managed or organised within the Air Ministry or Bomber Command. The AOC-in-C Bomber Command, Air Marshal Portal, highlighted this in May 1940: ‘...our operational squadrons cannot possibly maintain a sustained air campaign unless there exists a powerful organisation behind them for the provision of trained crews.’<sup>9</sup> Not only did Portal amplify the need for a better training structure, he also highlighted the conflict between allocating resources between training and operations that became a perennial argument within the Air Ministry in the lead-up to war. Before the establishment of the Air Member for Training (AMT) at Air Council level, training was still divided between CAS (operational training) and the Air Member for Personnel (AMP - all other flying training). The appointment of Air Vice-Marshal Garrod as AMT in July 1940 was a transformative moment and a clear turning point in the way that Bomber Command organised and conducted its operational training. The creation of the AMT post, and to a lesser extent, the creation of the RAF’s command structure in 1936, enabled Bomber Command to formulate its own ideas on training, a situation

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<sup>9</sup> TNA AIR 2/4169, Letter AOC-in-C Bomber Command to Under Secretary of State for Air, 11 May 1940.

that was further strengthened with the formation of 6 (Bomber) Group on 1 January 1939. This Group became responsible for Bomber Command's OTUs and was commanded by Air Commodore MacNeece Foster, a key figure in driving crewing policy, the development of operational training curricula and the use of STE. These developments have been largely ignored in the historiography covering Bomber Command and therefore this thesis provides a valuable insight into the importance of operational training as an enabler of operational capability.

As this thesis has already shown, another key player in the development of operational training in Bomber Command in 1939-1940 was the AOC 5 Group, Air Vice-Marshal Arthur Harris. Harris's character has often been defined by his tenure as AOC-in-C Bomber Command where he pursued a dogmatic, single-minded and obsessive path that emphasised the ability of the bomber to break German morale and destroy its cities. Nowhere is this hubris more apparent than in his minute to Churchill, four months after he became AOC-in-C, that asserted Bomber Command could '...knock Germany out of the war in a matter of months...' and that if air power is not given priority, it will '...become inextricably implicated as a subsidiary weapon in the prosecution of a vastly protracted and avoidable land and sea campaigns.'<sup>10</sup> In his early career, Harris was described as 'an innovative person who brought about changes to equipment and method,' and this refers to his inter-war work on night-time target marking and converting transport aircraft to bombers.<sup>11</sup> This innovation carried on when he was AOC 5 Group with the development of the Group Crew Training School at RAF Finningley that made use of collective STE developed at the

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<sup>10</sup> Webster and Frankland, *Strategic Air Offensive Against Germany, Vol. 1*, Minute from Harris to Churchill, 17 June 1942, p.340.

<sup>11</sup> C. Coulson, 'Bomber Harris: A Dangerous Commander?' Canadian Forces College, Advanced Military Studies Course 3, December 2000, p.16.

station.<sup>12</sup> Once forwarded to the Air Ministry the letter drew the comment from the Director of Staff Duties, Air Commodore Willock, who noted that 'A.V.M. Harris is well known for producing bright ideas' and that Willock's 'contention has always been that the more training that can be done on the ground to simulate conditions in the air, the higher the standard we shall attain.'<sup>13</sup> Harris was ahead of the Air Ministry and his initiative was considered so good that his ideas on collective STE were amalgamated into the Operational Training Unit syllabus.

In discussing key figures in the development of operational training, Air Chief Marshal Sir Edgar Ludlow-Hewitt played perhaps the largest role both as AOC-in-C Bomber Command (September 1937 – April 1940) and as RAF Inspector General (April 1940 – October 1945). Orange said of Ludlow-Hewitt that he 'shared Trenchard's mystical faith in the bomber since 1918, but reality broke in soon after he was appointed head of Bomber Command in 1937.'<sup>14</sup> Ludlow-Hewitt wrote two significant Bomber Command Annual Training Reports for 1937 and 1938 that indicated the training gaps within that organisation.<sup>15</sup> Both of these reports highlighted the lack of training in navigation, night flying and gunnery. These were followed in a letter to the Air Council in mid-1939 where he drew attention to his Command's 'shortcomings.' This clearly irked the Air Ministry so much that he was called before the Air Council in August 1939. Although removed as AOC-in-C Bomber Command in April 1940, Ludlow-Hewitt continued to provide valuable

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<sup>12</sup> TNA AIR 2/4168, Letter 5 Group to HQ Bomber Command, 18 January 1940.

<sup>13</sup> TNA AIR 2/8645, Minute Sheet Comment DSD to D of P and D of O, 5 February 1940.

<sup>14</sup> Orange, *Slessor: Bomber Champion*, p.64.

<sup>15</sup> TNA AIR 2/2058, Bomber Command Annual Training Report 1937 and AHB, Ludlow Hewitt Papers, Bomber Command Annual Training Report 1938.

assessments on RAF, and more specifically, Bomber Command's training as the RAF's Inspector General.

### **A More Complex Operational Training Pipeline Emerges**

From the simple training pipeline discussed above when Tedder was Director of Training under AMP in 1935, where he was responsible for training 300 pilots each year, by 1941 this had grown to training 19,000 pilots a year. Between 1939 and 1945, 117,000 pilots and 209,000 other aircrew were trained, which gives an idea of the growth in the overall training infrastructure.<sup>16</sup> The vast number of those aircrew undertook the majority of their non-operational training in the Dominions or the USA as part of the Empire Air Training Scheme (EATS) or US British Flying Training Schools (BFTS) programmes. Like the use made of STE by the RAF in comparison to the *Luftwaffe* that has been discussed above, overseas training also provided the advantage over the *Luftwaffe* in that such training could be undertaken with no chance of enemy interference or poor weather disrupting the flying training programme. This growth in training was highlighted in Bomber Command by the hours flown that were dedicated to training. As considered in Chapter Seven, June 1944 saw 55.8% of its total flying hours undertaken in OTUs and Heavy Conversion Units (HCU). The reasons for this growth in training time was due to the expansion of the bomber force and the arrival of four engine bombers that began to enter service in increasing numbers from late 1941. But this expansion to address improved technology came at a price. Tedder's scheme used four phases: pilot assessment, a two-week basic military skills course at RAF Uxbridge, a two-month *ab initio* flying phase at a civilian school and, finally, a nine-month service flying training phase. As

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<sup>16</sup> TNA AIR/3233, *Flying Training, Vol. I: Policy and Planning*, p.8.

shown in Table 3, by 1944 pilots undertook a minimum of 15 phases spread over a maximum of 99 weeks before they became a frontline bomber pilot.<sup>17</sup> If nothing else, this consumption of resources highlights the investment required in training to match a desired operational output.

The main reason for this massive transformation in operational training can be summarised under the headings of technology and tactics. In terms of the driver behind the sheer growth of training throughput, to these factors can be added the expansion of the bomber force. As far as the technology is concerned, complex four-engine bombers with their crew of seven demanded bespoke training to operate and this led to cultural change in that the omnipotent pilot could not undertake all roles as was the belief in the mid-1930s. In turn, discrete crew members, such as the navigator, flight engineer, bomb aimer, specialist dorsal and tail gunners, and wireless operators who also undertook electronic warfare roles began to emerge in 1942 and these required specialist training. The other technological factor to impact operational training was the need to operate in an increasingly hostile environment.

Biddle has said that, 'in the 1920s, bombers developed more quickly than fighters'.<sup>18</sup> However, the momentum began to shift in the 1930s, as fighter development began to catch up. Moreover, the advent of 'radar changed the air defense [sic] equation significantly.' In her comment Biddle also provides a key reason for why the RAF was happy to promote its doctrine of the all-powerful bomber during the 1920s and early 1930s as the performance difference between the bi-plane bomber and bi-plane fighter was negligible. Where criticism can be levelled at

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<sup>17</sup> Table. 3, Length of Pilot Training Process – 1944, p. 306.

<sup>18</sup> T.D. Biddle, *Air Power and Warfare: A Century of Theory and History* (Strategic Studies Institute, US Army War College, Monograph, March 2019), p.21.

the RAF it is that it failed to monitor and analyse the developments in aircraft engineering during the mid-1930s, most notably, all-metal cantilever construction, increased fire power and higher performance generated by improved engines. Concerning tactics, as Chapter Three has highlighted, the RAF's Staff College paid little attention to contemporary conflict and the lessons that could be drawn from it. Notable examples include the Italo-Ethiopian (1935-1936), Sino-Japanese (1937-1939) and Spanish Civil (1936) wars.

We have already discussed how the idea of the self-defending bomber being used in daylight attacks had to change to accommodate attacking the enemy by night. Even this change in tactics did not solve the problem of hitting specific targets. The Butt report of August 1941 highlighted the gross inaccuracy of such bombing methods, which heralded the move to area bombing. These changes of emphasis, or evolution of bombing practices, are well known, of course, but they have never been considered in relation to operational training. The most significant training shortfall was highlighted in Bomber Command's lack of sufficient emphasis on long-range navigation and night flying. Despite the introduction into service of aids such as Gee, Oboe and H2S, these shortfalls remained until the gradual decline of the *Luftwaffe's* night fighter and ground based air defence structure in late 1944.<sup>19</sup> This decline was not precipitated by a lack of aircraft but more by a lack of fuel, poorly trained pilots and the destruction of radar and reporting stations in the Kammhuber Line as Allied armies advanced through Western Europe.

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<sup>19</sup> Air Ministry, ACAS(I), *The Rise and Fall of the German Air Force (1933 to 1945)*.

## **Operational Training Evolution?**

In answering how Bomber Command operational training evolved between 1922 and 1945, and what drove that process we can see that between 1922 until as late as 1935, very little evolutionary improvement took place. It was as though the RAF was engulfed in a period of stasis and, considering the financial austerity and political disarmament backdrop to the period, that is perhaps unsurprising. Lessons from the First World War, especially concerning a failure to provide specialist operational training specific to the pilot's operational role and the requirement to balance the need for quantity whilst maintaining quality were forgotten. However understandable this period of stasis was, it cannot be condoned from the perspective of the intellectual failure of both the Air Ministry and the RAF Staff College to interrogate emerging aircraft technologies and assess their impact on the Service's tactics and doctrine. The RAF's blind faith in its strategic bombing doctrine was not underpinned by any workable means of how it was to be achieved nor any organisational structure to direct and manage training implementation. Real and identifiable positive evolution to operational training started to emerge only with the restructuring of the RAF in mid-1936 that provided Bomber Command with direct input into how its aircrew should be trained. The other driver in improving operational training was the expansion schemes that started to become effective in 1935 although little operational training benefit was really seen until 1939 with the major driver being the formation of Group Pool Squadrons, later termed OTUs, and the opening of an additional navigation school.

The addition of an OTU phase provided increased pilot flying hours operating a heavier aircraft than those used in the SFTS phase (Oxford, Anson or Cessna) and the expansion of the collective crew training environment for other aircrew, albeit

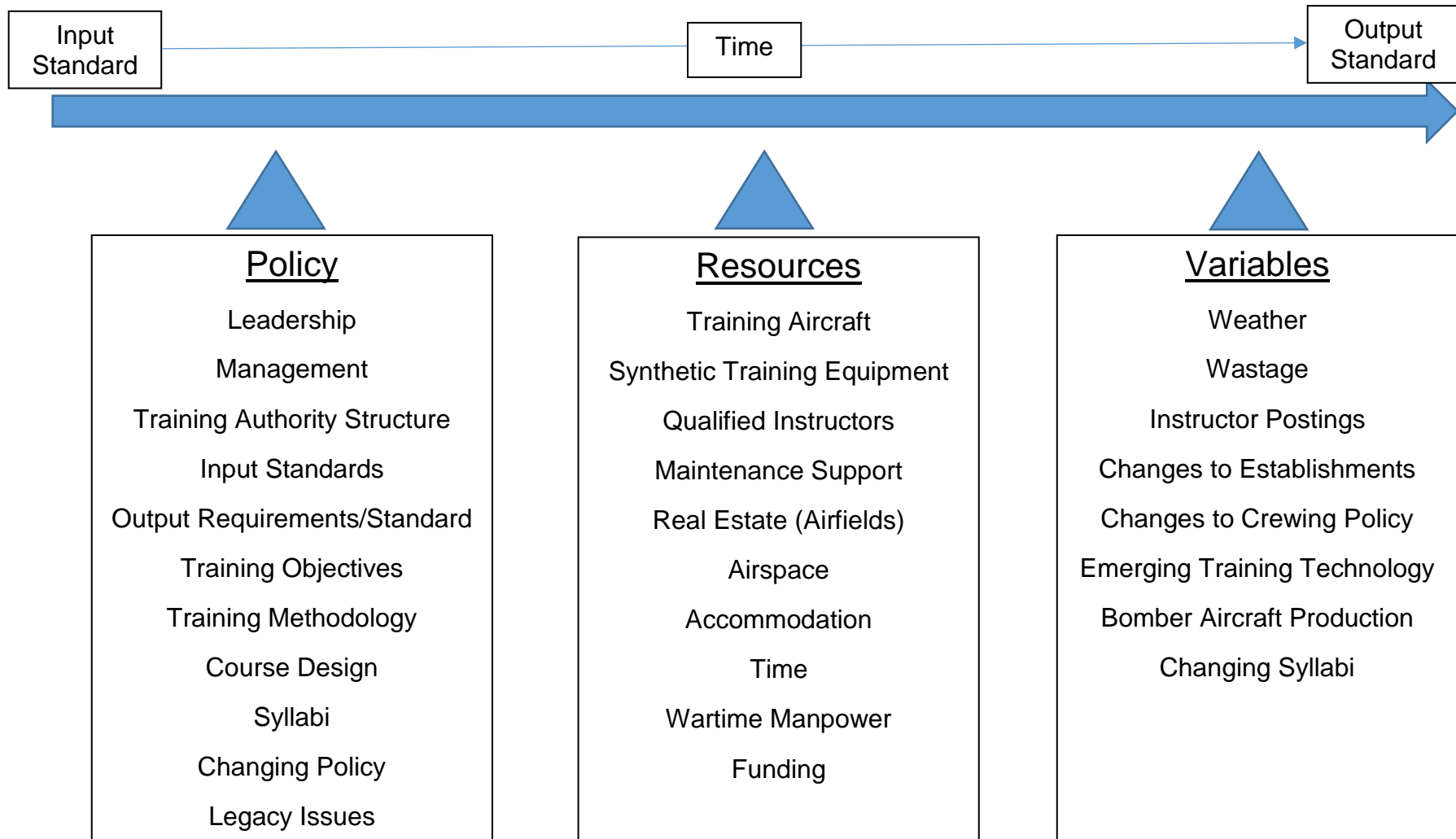
many of these were still part-time ground crew; a situation that did not change until 1941. This was a major improvement on previous training methods and resulted in the production of more able aircrew. There is little doubt that the 'phoney war' gave Britain the space and time to regenerate its poorly functioning inter-war operational training methods and with OTUs being the first step, the appointment of Garrod as AMT was certainly a key driver for further improvements as was Bomber Command's focus on 6 Group as its operational training authority with two further training groups added as the war progressed.

The decision over specialist crewing composition and single pilot operation that was made in late-1941 coincided with AMT's 'New Deal' proposal that added a number of elements to the training pipeline, the aim being to increase aircrew quality. This was discussed in detail in Chapter Seven but, in essence, this provided increased ground and flight training time and content to the flying training programme for pilots and other aircrew members that reflected experiences gained from flying operational sorties. This process was helped significantly by Bomber Command's Operational Research Section that used post-raid reports to identify trends, define lessons learned and use these to add to the training syllabi where appropriate. These developments were clearly an improvement on what went before and perhaps highlight the innovation that emerges in conflict.



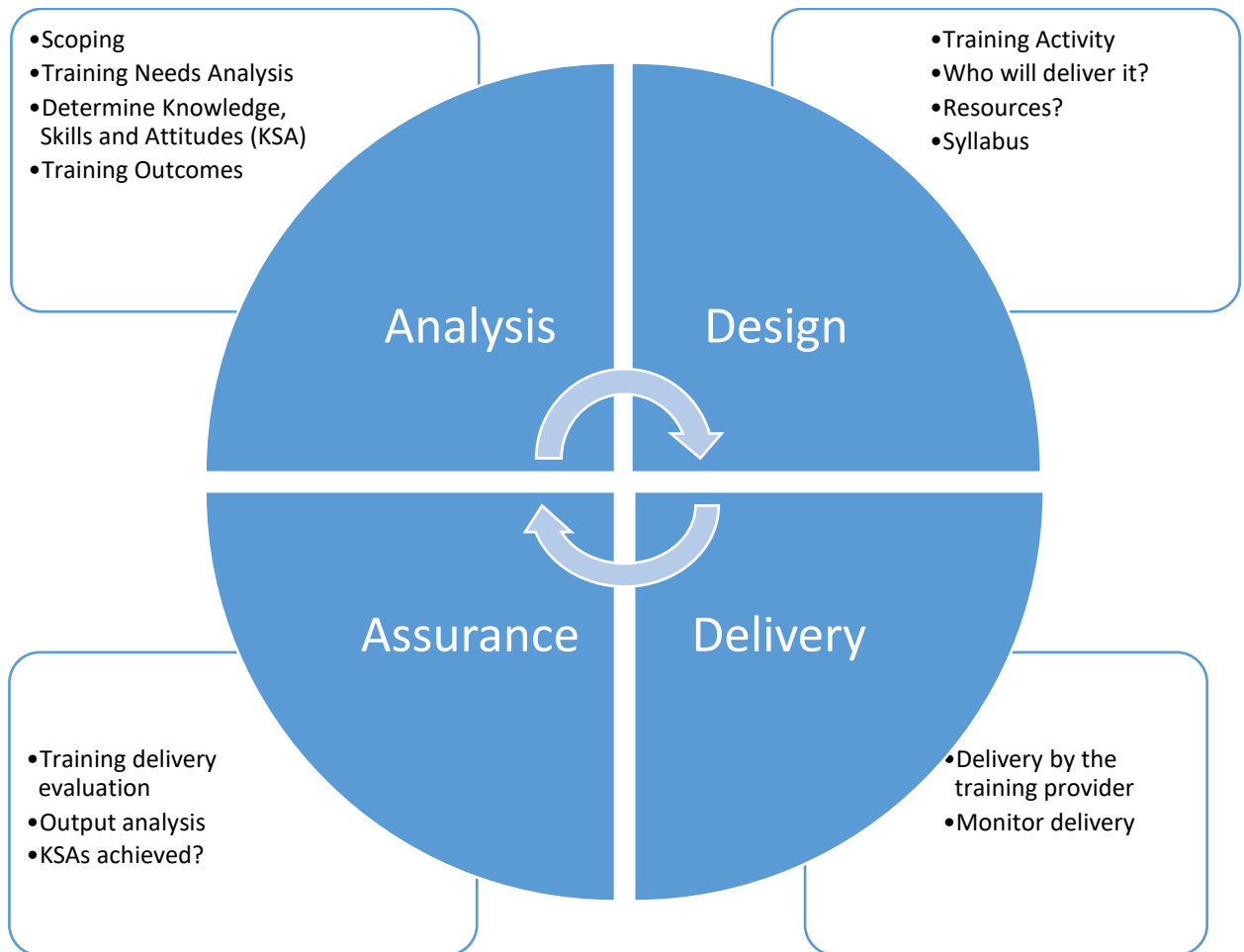
# The Training Pipeline

(Table 1)



# Systems Approach to Training (SAT)<sup>1</sup>

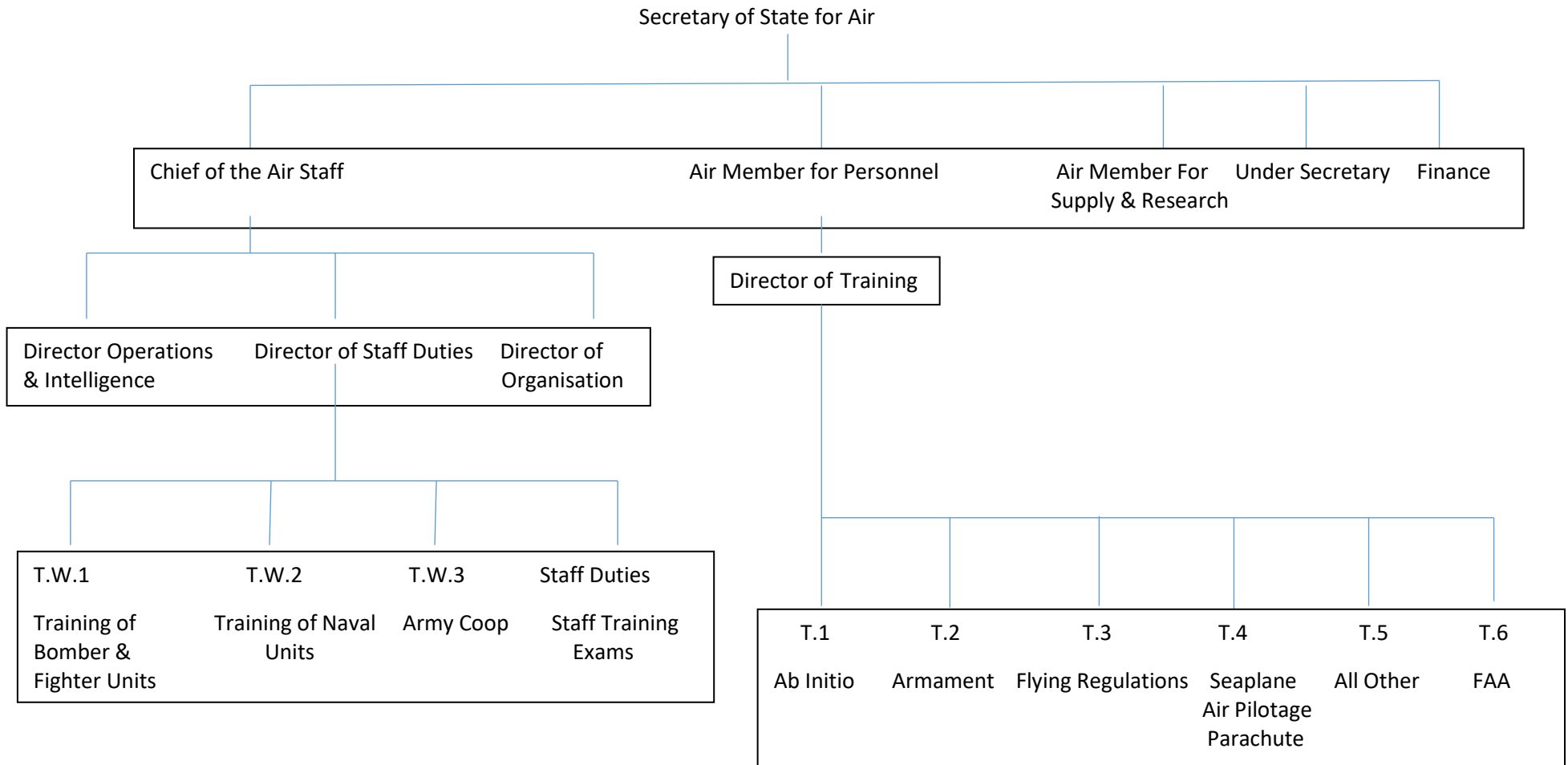
(Table 2)



<sup>1</sup> UK Ministry of Defence, JSP 822 Defence Direction and Guidance for Training and Education, Part 2: Guidance, 1 November 2021.

# Organisation of the Air Ministry – June 1934 – Showing Training Responsibilities <sup>1</sup>

(Table 3)



<sup>1</sup> RAFM AIR 69, lecture, Organisation of the Royal Air Force, 1934

# Pilot Flying Log Book Showing Types of Aircraft Flown and Time in Training<sup>1</sup>

(Table 4)

RECORD OF SERVICE			AIRCRAFT FLOWN								
UNIT	DATES		UNIT	DATES		AIRCRAFT	ENGINE	AIRCRAFT	ENGINE	AIRCRAFT	ENGINE
	FROM	TO		FROM	TO						
A.C.R.C. LONDON.	6.10.41	25.10.41	No 57 SQUADRON, EAST KIRKBY.	1.4.45	25.11.45.	D.H. 82 A.	GIPSY I.				
17 I.T.W. SCARBOROUGH.	25.10.41	27.2.42				STEARMAN B.II	LYCOMING-PRATT AND WHITNEY.				
11 E.F.T.S. PERTH.	28.2.42	21.3.42				VULTEE B.T.13.	PRATT AND WHITNEY.				
A.C.D.C. MANCHESTER.	22.3.42	24.3.42				VULTEE B.T.13A	PRATT AND WHITNEY.				
T.S. 'BANFORA'.	25.3.42	7.4.42				CESSNA A.T. 17.	(1) JACOBS R-755-9.				
31 P.D. MONCTON. N.B.	7.4.42	29.4.42				CURTIS A.T. 9.	(2) LYCOMING. R-680-9.				
RAF R.C. TURNER FIELD, GA	1.5.42	1.6.42				AIRSPERD OXFORD.	CHEETAH X.				
LAKELAND AERO SCHOOL, FLORIDA	2.6.42	5.8.42				AVRO ANSON.	(2) CHEETAH IX.				
BASIC F.S. GUNTER FIELD, ALABAMA	6.8.42	10.10.42				VICKERS WELINGTON.	(1) PEGASUS XVIII.				
ADVANCED FLYING SCHOOL.						HAWLEY PAGE HALIFAX.	(2) PEGASUS XVIII.				
TURNER FIELD, GEORGIA.	10.10.42	13.12.42.				AVRO LANCASTER Mk I to III.	(1) MERLIN RR. (2) MERLIN RR. (3) MERLIN RR. (4) MERLIN RR. (5) MERLIN RR.				
31 P.D. MONCTON. N.B.	16.12.42	4.1.43				AVRO LINCOLN Mk II	(1) MERLIN 68.				
H.M.T.S. "QUEEN ELIZABETH"	5.1.43	12.1.43									
NO 7 P.R.C. HARROGATE.	13.1.43	28.1.43.									
RAF STATION. FILEY.	28.1.43	24.2.43.									
NO 7 P.R.C. HARROGATE.	24.2.43	12.3.43.									
NO 7 E.F.T.S. DESFORD.	12.3.43	2.4.43.									
NO 7 P.R.C. HARROGATE.	2.4.43	6.4.43.									
NO 18 (P) A.F.U. CHURCH LAWFORD.	6.4.43	1.6.43.									
NO 14 O.T.U. COTTESMORE.	1.6.43	1.8.43.									
NO 14 O.T.U. MARKET HARBOURGH.	14.8.43	1.9.43.									
RAF. MORETON HALL, SWINDON.	8.9.43	14.9.43.									
NO 1654, C.V. WIGSLEY, NOTTS.	14.9.43	25.10.43.									
NO 50 SQDN, SKELLINGTHORPE	26.10.43	17.5.44									
NO 3 F.I.S. LULSGATE BOTTOM, SOM.	17.5.44	15.6.44.									
NO 5 L.F.S. SYERSTON, NOTTS	20.6.44	31.3.45.									

IBCC Digital Archive

Started training 6 October 1941, finished 26 October 1943 = 23 months.      Including the Lancaster at LFS, Beetham flew 11 training types.

<sup>1</sup> International Bomber Command Centre, Sqn. Ldr. M. J. Beetham. <https://ibccdigitalarchive.lincoln.ac.uk/omeka/collections/document/11815>. Accessed 29 May.

## Length of Pilot Training Process – 1944

(Table 5)

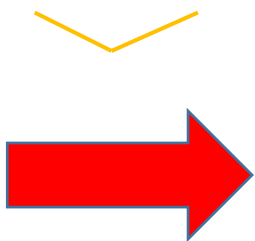
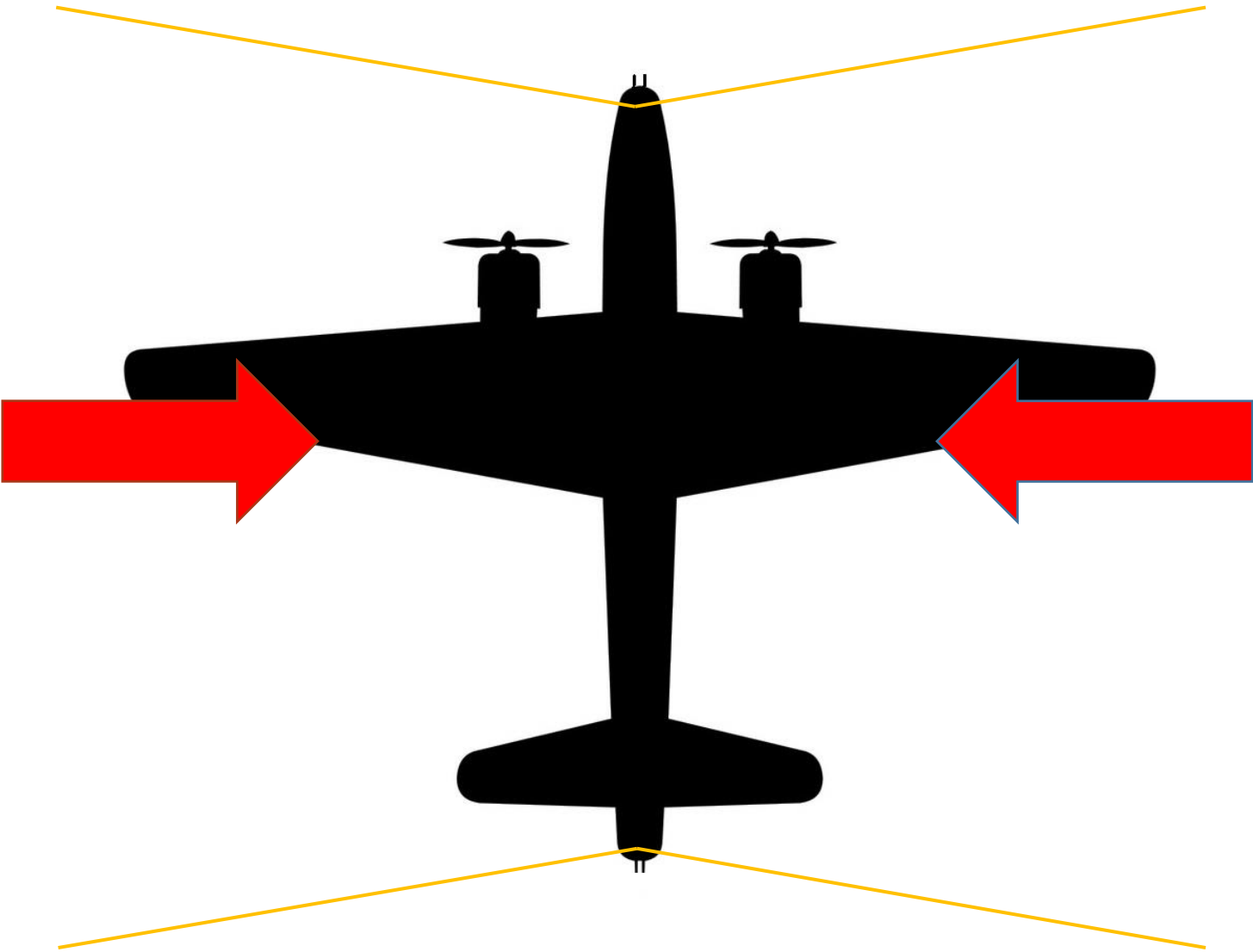
<u>Course/Process</u>	<u>No. of Weeks</u>
Air Crew Selection Board (ACSB)	0.3
Possible Preliminary Air Crew Training (PACT)	6.0
Air Crew Reception Centre (ACRC)	6.0
Grading course for Pilots in Pilot, Navigator Air Bomber (PNB) scheme.	3.0
Initial Training Wing (ITW)	8.0
Air Crew Despatch Centre (ACDC), including overseas passage	c. 4.0
Elementary Flying Training School (EFTS)	10.00
Service Flying Training School (SFTS)	20.0
Personnel Despatch Centre (PDC), including passage	c. 4.0
Personnel Reception Centre (PRC)	6.0
Air Crew SNCO or Officer courses	4.0

Pilot Advanced Flying Unit ((P) AFU) including BAT.	8.0
Operational Training Unit (OTU)	8 – 12.0
Heavy Conversion Unit (HCU)	6.0
Lancaster Finishing School (LFS)	2.0
<u>Total Weeks in Training</u>	95-99 weeks

Source: TNA AIR 20/1347, *Notes on the History of RAF Training 1939-44*, January 1945, and RAFM *Pathway to Pilot 1944*, [https://www.rafmuseum.org.uk/images/online\\_exhibitions/Pilot-Progress-1944LG.jpg](https://www.rafmuseum.org.uk/images/online_exhibitions/Pilot-Progress-1944LG.jpg). Accessed, 22 June 2022.

Vickers Wellington  
Field-of-Fire, Front and Rear Turrets

(Table 6)



1. Turret Field-of-Fire, 80°left and right of centre line.
2. Susceptibility to beam attack.

## BIBLIOGRAPHY

### Primary Source Documents

- National Aerospace Library (NAL) - Farnborough
- Report on the work of O.R.S. Representative at No: 4 Group Headquarters July, 1943 to June, 1945.
- Smith-Barry and the Gosport School of Special Flying, 1917/1918. Lecture by Cyril Napean-Bishop, 26 November 1962.
- Ministry of Aircraft Production Statistical Review, 1939-1945 dated January 1946. (J.V. Connolly Collection)
- Air Historical Branch (AHB) - RAF Northolt
- Ludlow-Hewitt Papers.
- Air Council Minutes 1918 – 1935.
- Expansion Progress Meetings 1938 – 1940.
- Fleet Air Arm Museum (FAAM) - RNAS Yeovilton
- Naval Air Service Training Manual 1915* (London: HMSO, November 1914).
- Training Manual, Royal Flying Corps, Part I, 1914.* W.O. 2054.
- Training Manual, Royal Flying Corps, Part II (Military Wing), 1914.* W.O.1893.
- Sub. Lt. T. V. Lister *Flying Log Book.*
- Sub. Lt. H.L. Gaskell *Flying Log Book.*
- Royal Air Force Museum (RAFM) - Hendon
- C.D.22, *Operations Manual, Royal Air Force*, July 1922.
- AP 956, *A Selection of Lectures and Essays from the Work of Officers Attending the First Course at the Royal Air Force Staff College, 1922-23.* December 1923.
- AP 1308, *A Selection of Lectures and Essays from the Work of Officers Attending the Fifth Course at*



*the Royal Air Force Staff College, 1926-27. April 1928.*

*AP 1352, Report on the Qualifying Examination for the RAF Staff College held on 27<sup>th</sup>, 28<sup>th</sup> and 29<sup>th</sup> March 1928 with Copies of Examination Papers and Remarks Thereon, March 1928.*

*AP 1399, The Air Ministry and Its Organisation, December 1930.*

AIR 69, Staff College Notes and Papers.

International Bomber Command Centre - Lincoln

Various aircrew log books.

The National Archives (TNA) - Kew, London

AIR 1, Operational Records.

AIR 2, Additional Records AM.

AIR 6, Armed Forces (Gen Admin) RAF.

AIR 8, CAS.

AIR 10, Air Publications.

AIR 14, Bomber Command.

AIR 20, AHB Unregistered Papers.

AIR 41, AHB Narratives.

CAB 23, Cabinet Papers.

Joint Services Command and Staff College (JSCSC) Shrivenham

Archive A/Z379, 'Winter Training in the RFC in France'. Letter from GHQ to British Armies in France, 6 December 1917.

General Publications, *The RAF Quarterly* and *The Hawk*.

## UK Government and Official Publications

AIR 41/39, AHB Narrative – The RAF in the Bomber Offensive Against Germany – *Vol. I, Pre-War Evolution of Bomber Command 1917-1939.*

AIR 41/40 AHB Narrative – The RAF in the Bomber Offensive Against Germany – *Vol. II, Restricted Bombing September 1939 – May 1941.*

AIR 41/41 AHB Narrative – The RAF in the Bombing Offensive Against Germany – *Vol. III, Area Bombing and the Makeshift Force June 1941 – February 1942.*

AIR 41/42 AHB Narrative – The RAF in the Bombing Offensive Against Germany – *Vol. IV, A Period of Expansion and Experiment March 1942 – January 1943.*

AIR 41/43 AHB Narrative – The RAF in the Bombing Offensive Against Germany – *Vol. V, The Full Offensive February 1943 – February 1944.*

AIR 41/56 AHB Narrative – The RAF in the Bombing Offensive Against Germany – *Vol. VI, The Final Phase March 1944 – May 1945.*

AIR 41/4, AHB Narrative – *Aircrew Training 1934 – 1942.*

AIR 20/1347. *Notes on the History of RAF Training 1939-1944.*

Air Ministry, AMT Pamphlet, January 1945.

*The Origins and Development of Operational Research in the Royal Air Force* (London: HMSO, 1963)

Raleigh, Walter & Jones, Henry, *The War in the Air*, Vols. I and II (Oxford: Clarendon Press, 1922)

Jones, Henry, *The War in the Air*, Vol. III (Oxford: Clarendon Press, 1931)

Jones, Henry, *The War in the Air*, Vol. V (Oxford: Clarendon Press, 1935)

Jones, Henry, *The War in the Air*, Vol. VI and Appendices (Oxford: Clarendon Press, 1937)

Richards, Denis, *Royal Air Force 1939-1945 Vol. 1* (London: HMSO, 1953)

Richards, Denis, *Royal Air Force 1939-1945 Vol. 2* (London: HMSO, 1953)

Saunders, Hilary, *Royal Air Force 1939-1945 Vol. 3* (London: HMSO, 1954)

Webster, Charles & Frankland, Noble, *The Strategic Air Offensive Against Germany 1939 – 1945, Volume I* (London: HMSO, 1961)

Webster & Frankland, *The Strategic Air Offensive Against Germany 1939 – 1945, Volume II* (London: HMSO, 1961)

Webster & Frankland, *The Strategic Air Offensive Against Germany 1939 – 1945, Volume III* (London: HMSO, 1961)

Webster & Frankland, *The Strategic Air Offensive Against Germany 1939 – 1945, Volume IV* (London: HMSO, 1961)

HMSO, JSP 822, Part 2. *Training and Education Glossary* (2021)

## **US Government Reports**

Kreipe, Walter & Koester, Rudolph *Pilot and Aircrew Training in the Luftwaffe 1921-1945*. Commissioned by the USAAF.

## **Book**

Roskill, Stephen (ed.) *Documents Relating to the Naval Air Service, Vol.1, 1908-1918* (London: Naval Records Society, 1969)

## **Theses and Dissertations**

Cording, Rex *The Other Bomber Battle: An Examination of the Problems that Arose between the Air Staff and the AOC Bomber Command between 1942 and 1945 and their Effects of the Strategic Bomber Offensive – PhD Thesis* (University of Canterbury, NZ, 2006)

Gray, Peter *The Strategic Leadership and Direction of the Royal Air Force Strategic Air Offensive Against*

- Germany from Inception to 1945* – PhD Thesis (University of Birmingham, October 2009)
- Mahoney, Ross *The Forgotten Career of Air Chief Marshal Sir Trafford Leigh-Mallory, 1892-1937: A Social and Cultural History of Leadership Development in the Inter-War Royal Air Force* – PhD Thesis (University of Birmingham, March 2014)
- Monahan, Fin *The Origins of the Organisational Culture of the Royal Air Force* – PhD Thesis (University of Birmingham, January 2018)
- Morley, Robert *Earning Their Wings: British Pilot Training, 1912-1918* – MA Thesis (University of Saskatchewan, December 2006)
- Parton, Neville *The Evolution and Impact of Royal Air Force Doctrine: 1919-1939* – PhD Thesis (Selwyn College, Cambridge, October 2009)
- Pugh, James *The Conceptual Origins of the Control of the Air: British Military and Naval Aviation, 1911-1918* – PhD Thesis (University of Birmingham, September 2012)
- Sinnott, Colin *RAF Operational Requirements 1923-1939* – PhD Thesis (King's College London, June 1998)
- Stone, Trevor *Royal Air Force Logistics During the Second World War: Transformation, Sustainment and Flexibility* – PhD Thesis (University of Exeter, February 2016)
- Walker, David *Supreme Air Command – The Development of Royal Air Force Command Practice in the Second World War* – PhD Thesis (University of Birmingham, January 2017)
- Withington, Thomas *Bomber Command's Electronic Warfare Policy and Suppression of Enemy Air Defence Posture During the Second World War* – PhD Thesis (University of Birmingham, September 2017)

## **Books**

- Anon. *The Royal Air Force in the Great War* (London: IWM, 1996). This book was first published by the AHB in 1936 as AP125, 'A Short History of the Royal Air Force'

- Ash, Eric *Sir Frederick Sykes and the Air Revolution 1912-1918* (London: Frank Cass, 1999)
- Ashworth, Chris *RAF Coastal Command 1936-1939* (Sparkford: Patrick Stephens, 1992)
- Baldwin, John *et al* (ed.) *Redefining Culture – Perspectives Across Disciplines* (Mahwah, NJ: Lawrence Erlbaum Associates, 2006)
- Baring, Maurice *Flying Corps Headquarters 1914-1918* (London: Buchan & Enright, 1985)
- Barker, Ralph *The Royal Flying Corps in World War 1* (London: Robinson, 2002)
- Barker, Ralph *The Royal Flying Corps in France – From Bloody April 1917 to Final Victory* (London: Constable, 1996)
- Barker, Ralph *The Thousand Plan* (London, Pan Books, 1967)
- Bennett, Ralph *Behind the Battle – Intelligence in the War with Germany, 1939-1945* (London: Pimlico, 1999)
- Biddle, Tami *Rhetoric and Reality in Air Warfare* (Princeton: Princeton University Press, 2004)
- Bishop, Patrick *Bomber Boys* (London: Harper Perennial, 2007)
- Black, Jeremy *Air Power – A Global History* (London: Rowman & Littlefield, 2016)
- Black, Jeremy *Rethinking Military History* (London: Routledge, 2004)
- Boog, Horst (ed) *The Conduct of the Air War in the Second World War – An International Comparison* (Providence/Oxford: Berg, 1992)
- Bowyer, Chaz *The Men of Coastal Command 1939-1945* (London: William Kimber, 1985)
- Bowyer, Chaz *Pathfinders at War* (Shepperton: Ian Allan, 1977)
- Boyle, Andrew *Trenchard – Man of Vision* (London: Collins, 1962)
- Chamier, J.A. *The Birth of the Royal Air Force* (London: Pitman, 1943)
- Charlwood, Don *No Moon Tonight* (London: Goodall Publications, 1984)
- Chorley, William, R. *Royal Air Force Bomber Command Losses, Vol. 7 – Operational Training Units, 1940 - 1947*, (Hinckley: Midland Publishing, 2002)

- Chorley, William, R. *Royal Air Force Bomber Command Losses, Vol. 8 – Heavy Conversion Units and Miscellaneous Units, 1939 – 1947*, (Hinckley: Midland Publishing, 2003)
- Clark, Alan *Aces High* (London: Fontana, 1974)
- Cox, Sebastian & Gray, Peter *Air Power History – Turning Points from Kitty Hawk to Kosovo* (Abingdon: Cass, 2002)
- Cruttwell, Charles *A History of the Great War 1914-1918* (Oxford: Clarendon Press, 1934)
- Dandev, A. & Todman, D. (eds.) *War Diaries 1939-1945 – FM Lord Alanbrooke* (London: Phoenix, 2002)
- Dean, Maurice *The Royal Air Force and Two World Wars* (London: Cassell, 1979)
- Delve, Ken *Bomber Command 1936-1968* (Barnsley: Pen & Sword, 2005)
- Delve, Ken *Fighter Command 1936-1968* (Barnsley: Pen & Sword, 2007)
- Docherty, Tom *Training for Triumph* (Bognor Regis: Woodfield Publishing, 2001)
- Donnelly, G.L. *The Whitley Boys* (Walton on Thames: Air Research Publications, 1991)
- Douglas, Sholto *Years of Command* (London: Collins, 1966)
- Dunmore, Spencer *Wings for Victory* (Toronto: McClelland & Stewart, 1994)
- Dyndal, Gjert *Trenchard and Slessor: On the Supremacy of Air Power over Sea Power* (Trondheim: Tapir Academic Press, 2007)
- Edgerton, David *England and the Aeroplane* (London: Penguin, 2013)
- Ehlers, R.S. *Targeting the Third Reich* (Kansas: University Press of Kansas, 2009)
- English, Allan *The Cream of the Crop* (Montreal: McGill-Queen's University Press, 1996)
- Fox, Michael *To Rule the Winds* (Solihull: Helion & Co., 2014)
- Francis, Martin *The Flyer* (Oxford: Oxford University Press, 2013)
- Gibbs-Smith, Charles *Aviation: An Historical Survey from its Origins to the End of World War II* (London: HMSO, 1970)

- Golley, John *Aircrew Unlimited* (Yeovil: PSL, 1993)
- Grattan, Robert *The Origins of Air War* (London: IB Tauris, 2009)
- Gray, Peter *Air Warfare – History, Theory and Practice* (London: Bloomsbury, 2016)
- Grey, C.G. *A History of the Air Ministry* (London: Allen & Unwin, 1940)
- Grey, Jeffrey (ed.) *The Last Word?: Essays on Official History in the United States and British Commonwealth* (Westport: Praeger, 2003)
- Guinn, Gilbert, S. *The Arnold Scheme* (Charleston: The History Press, 2007)
- Hammerton, John Sir *ABC of the RAF* (London: The Amalgamated Press, 1942?)
- Harris, Arthur *Bomber Offensive* (London: Greenhill Books, 1998)
- Harrison Place, Timothy *Military Training in the British Army, 1940-1944* (London: Routledge, 2000)
- Hart, Peter & Steel, Nigel *Tumult in the Clouds* (London: Hodder & Stoughton, 1997)
- Harvey, Maurice *The Allied Bombing War 1939-45* (Tunbridge Wells: Spellmount, 1992)
- Hastings, Max *Bomber Command* (London: Pan Books, 1999)
- Henry, Mike *Air Gunner* (London: GT Foulis, 1964)
- Higham, Robin *The Military Intellectuals in Britain 1919-1939* (Westport: Greenwood Press, 1966)
- Higham, Robin *Bases of Air Strategy: Building Airfields for the RAF, 1914-1945* (Shrewsbury: Airlife, 1998)
- Hittle, James *The Military Staff its History and Development* (Harrisburg: Military Service Publishing, 1944)
- Hobbs, T. & Grene, D. (eds.) *Thucydides, History of the Peloponnesian War* (Cambridge: Harvard University Press, 1919)
- Hunt, Leslie *Twenty-One Squadrons – The History of the Royal Auxiliary Air Force, 1925-1957* (London: Garnstone Press, 1972)
- Hyde, Montgomery, H. *British Air Policy Between the Wars: 1918-1939* (London: Heinemann, 1976)
- James, John *The Paladins* (London: Macdonald, 1990)

- Jefford, C.G. *Observers and Navigators and other non-Pilot Aircrew in the RFC, RNAS and RAF* (Shrewsbury: Airlife, 2014)
- Jones, Neville *The Beginnings of Strategic Air Power – A History of the British Bombing Force 1923-1939* (London: Frank Cass, 2002)
- Jones, Reginald V. *Most Secret War* (London: Coronet Books, 1978)
- Kelly, Lloyd L. *The Pilot Maker* (New York: Grosset & Dunlap, 1970)
- Kennett, Lee *The First Air War, 1914-1918* (New York: The Free Press, 1991)
- Kiernan, R.H. *The First War in the Air* (London: Peter Davies, 1934)
- Killebrew, Tom *The Royal Air Force in Texas* (Denton: University of North Texas Press, 2003)
- Kingston-McCloughry, E.J. *Winged Warfare* (London: Jonathan Cape, 1937)
- Layman, R. D. *Naval Aviation in the First World War* (London: Caxton, 1998)
- Lee, Lloyd & Higham, Robin *World War II in Europe, Africa, and the Americas, with General Sources* (Westport: Greenwood Press, 1997)
- Longmate, Norman *The Bombers*, (London: Hutchinson, 1983)
- Longmore, Arthur *From Sea to Sky – 1910-1945* (London: Geoffrey Bles, 1946)
- Macleod, Norman *Training Design in Aviation*, (Aldershot: Ashgate Publishing, 2001)
- Mason, F. *Major Archive – Avro Lancaster B. Mk I-III* (Thame: Container Publications, 1976)
- Mason, Tony *Air Power – A Centennial Appraisal* (London: Brassey's, 1994)
- Middlebrook, Martin & Everitt, Chris *The Bomber Command War Diaries* (Harmondsworth: Viking, 1985)
- Montgomery Hyde, H. *British Air Policy Between the Wars, 1919-1939* (London: Heinemann, 1976)
- Morillo, Stephen *What is Military History?* (Cambridge: Polity, 2010)



- Morrow, John *The Great War in the Air* (Washington: Smithsonian Institution Press, 1993)
- Murray, A. and Millett A.R. (eds.) *British Military Effectiveness in the Second World War, Vol. III* (Boston: Allen & Unwin, 1988)
- Nash, Trevor & Ebbutt, Giles *Jane's Simulation & Training Systems* (Coulsdon: Jane's, 2018)
- Neillands, Robin *The Bomber War* (London: John Murray, 2001)
- Orange, Vincent *Slessor: Bomber Champion* (London: Grub Street, 2006)
- Orange, Vincent *Dowding of Fighter Command* (London: Grub Street, 2011)
- Orange, Vincent *Churchill and His Airmen* (London: Grub Street, 2013)
- Overy, Richard *Bomber Command 1939–45* (London: Harper Collins, 1997)
- Overy, Richard *The Air War 1939-1945* (Dulles: Potomac Books, 2005)
- Overy, Richard *The Bombing War* (London: Allen Lane, 2013)
- Owen, Roderic *Tedder* (London: Collins, 1952)
- Phillpot, Ian *The Royal Air Force – An Encyclopaedia of the Interwar Years: Volume 1, The Trenchard Years 1918 to 1929* (Barnsley: Pen and Sword, 2005)
- Phillpot, Ian *The Royal Air Force – An Encyclopaedia of the Interwar Years: Volume 1I, Re-Armament 1930 to 1939* (Barnsley: Pen and Sword, 2008)
- Pitchfork, Graham *The Sowreys* (London: Grub Street, 2012)
- Probert, Henry *Bomber Harris – His Life and Times* (London: Greenhill Books, 2006)
- Probert, Henry *High Commanders of the Royal Air Force* (London: HMSO, 1991)
- Pugh, James *The Royal Flying Corps, the Western Front and the Control of the Air, 1914-1918* (Abingdon: Routledge, 1917)
- Rawlings, John *Pictorial History of the Fleet Air Arm* (London: MBS, 1973)
- Rivaz, R.C. *Tail Gunner* (Stroud: Sutton Publishing, 2003).

- Robertson, Scot *The Development of RAF Strategic Bombing Doctrine 1919-1939* (Westport: Praeger, 1995)
- Roberts, Andrew *Masters and Commanders* (London: Harper Perennial, 2010)
- Rolfe, J.M. & Staples, K.J. *Flight Simulation* (Cambridge: Cambridge University Press, 1997)
- Saward, Denis *Victory Denied* (London: Buchan & Enright, 1985)
- Slessor, John, C. *Air Power and Armies* (Tuscaloosa: University of Alabama Press, 2009)
- Steel, Nigel and Hart, Peter *Tumult in the Clouds* (London: Hodder & Stoughton, 1997)
- Sturtivant, Ray (et al) *Royal Air Force Flying Training and Support Units Since 1912* (Tunbridge Wells: Air Britain, 1997)
- Sykes, Frederick *Aviation in Peace and War* (London: Edward Arnold & Co, 1922)
- Taylor, John W.R. *CFS Birthplace of Air Power* (London: Putnam, 1958)
- Tedder, Lord *With Prejudice* (London: Cassell, 1966)
- Terraine, John *The Right of the Line* (Ware: Cumberland, 1997)
- Thetford, Owen *Aircraft of the Royal Air Force Since 1918* (London: Putnam, 1976)
- Tredrey, Frank *Pioneer Pilot – The Great Smith Barry who Taught the World How to Fly* (London: Peter Davies, 1976)
- Tredrey, Frank *Pilot's Summer – A Central Flying School Diary* (London: Tiger & Tyger, 2000)
- Tripp, Miles *The Eighth Passenger* (London: Corgi, 1971)
- Verrier, Anthony *The Bomber Offensive* (London: Batsford, 1968)
- Wakelam, Randall *The Science of Bombing* (Toronto: University of Toronto Press, 2009)
- Walker, Nigel *Strike to Defend* (London: Spearman, 1963)
- Wells, Mark *Courage and Air Warfare* (London: Cass, 2005)
- Williams, George *Biplanes and Bombsights: British Bombing in World War I* (Pickle Partners Publishing, 2014)
- Williams, James *The Plan – Memories of the BCATP* (Stittsville: Canada Wings, 1984)

Wilson, Kevin *Men of Air – The Doomed Youth of Bomber Command* (London: Weidenfeld & Nicholson, 2008)

### **Chapters in Books**

Biddle, Tammi 'Learning in Real Time: The Development and Implementation of Air Power in the First World War' in Cox, Sebastian and Gray, Peter (eds.) *Air Power History – Turning Points from Kitty Hawk to Kosovo* (London: Frank Cass, 2005), pp.3-20

Biddle, Tami 'Winston Churchill and Sir Charles Portal: Their Wartime Relationship, 1940-1945' in Cox, Sebastian and Gray, Peter (eds.) *Air Power Leadership Theory and Practice* (London: HMSO, 2002), pp.178-198

Cox, Sebastian 'Setting the Historical Agenda: Webster and Frankland and the Debate over the Strategic Bombing Offensive Against Germany, 1939-1945' in Grey, Jeffrey (ed.) *The Last Word?: Essays on Official History in the United States and British Commonwealth*, (Westport: Praeger, 2003), pp.147-174

Cox, Sebastian 'Harris and the Air Ministry' in Cox, Sebastian and Gray, Peter (eds.) *Air Power Leadership Theory and Practice* (London: HMSO, 2002), pp.210-226

Faber, P. 'The Anglo-American Bombing Campaign in Europe' in Lloyd E. Lee (ed.), *World War II in Europe, Africa, and the Americas, with General Sources – A Handbook of Literature and Research* (Westport: Greenwood Press, 1997, pp.218-233

Goulter, Christine 'British Official Histories of the Air War', in Grey, Jeffrey (ed.), *The Last Word?: Essays on Official History in the United States and British Commonwealth*, (Westport: Praeger, 2003), pp.133-146

### **Journal Articles**

Andrews, J.O. 'The Strategic Role of Air Forces', *JRUSI*, 1 February 1931, pp.740-743

- Anon. 'Air Notes,' *Royal United Services Institution Journal*, Vol.72, December 1926, pp.454-464
- Anon. 'Leadership and Morale', *The Hawk*, Vol.2, No.2, December 1929.
- Anon. 'The Royal Air Force Staff College', *Flight*, 13 April 1922
- Anon. 'The Case for Standardisation of Service Aircraft', *The Hawk*, Vol.5, No.5, December 1932
- Anon. 'The University Air Squadrons', *The Hawk*, Vol.1, No.1, December 1928
- Anon. 'Aircraft Industry in the Netherlands', *The Hawk*, Vol.2, No.2, December 1929
- Anon. 'A Visit to Poland', *The Hawk*, Vol.4, No.4, December 1931
- Anon. 'Macte Nova Virtute Puer', *The Hawk*, Vol.8, No.8, December 1935
- Anon. 'Review of the Year', *The Hawk*, Vol.9, No.9, December 1936
- Baarspul, Max 'A Review of Flight Simulator Techniques', *Progress in Aerospace Sciences*, Vol.27, Iss.1, 1990, pp.1-120
- Brown, Mortimer 'On a Definition of Culture', *Psychological Review*, Vol.60, No.3, 1953, p.215
- Byford, Al & Shields, Ian 'Viewpoint – W(h)ither Air Power Education', *Air Power Review*, Vol.13, No.2, Summer 2010, pp.95-100
- Caro, Paul 'Aircraft Simulators and Pilot Training', *Human Factors*, Vol.15, No.6, 1973
- Edmonds, C. 'Air Strategy', *JRUSI*, Vol.69, No.474, May 1924, pp.191-210
- English, Allan 'The Staff College and the Evolution of British Strategic Bombing Policy, 1922-1929', *Journal of Strategic Studies*, Vol.16, No.3, September 1993, pp.408-431
- Fleming, N.C. 'Cabinet Government, British Imperial Security, and the World Disarmament Conference, 1932-1934', *War in History*, Vol.18, Iss.1, pp.62-84

- Hobson, Chris 'Flashback – Visions of Royal Air Force History – No.1', *Air Clues*, October 1994, pp.400-402
- Jeon, Chihyung 'The Virtual Flyer: The Link Trainer, Flight Simulation, and Pilot Identity', *Technology and Culture*, Vol.56, No.1, January 2015, pp.28-53
- Kiszely, J. 'Modern Challenges for Post-Modern Warriors', *The Shrivenham Papers*, No.5, December 2007
- Kline, J. 'Education and Training: Some Differences', *Air University Review*, January-February 1985, pp.94-95
- MacKenzie, S.P. 'Per Ardua: Achievements, Issues and Opportunities in Writing the History of the Royal Air Force', *War & Society*, 39:4, 2020
- MacLean, L.L. 'The Royal Air Force Training Year at Home', *JRUSI*, Vol.80, 1935
- Meilinger, Phillip 'Trenchard and Morale Bombing: The Evolution of Royal Air Force Doctrine Before World War II', *The Journal of Military History*, Vol.60, No.2, April 1996, pp.243-270
- Newall, Cyril 'The Expansion of the Royal Air Force', *JRUSI*, Vol.81, Feb/Nov 1936, pp.347-59
- Paris, Michael 'The Rise of the Airmen: The Origins of Air Force Elitism, c.1890-1918', *Journal of Contemporary History*, Vol.28, 1993, pp.123-141
- Paris, Michael 'Air Power and Imperial Defence 1880-1919', *Journal of Contemporary History*, Vol.24, No.2, 1989, pp.209-25
- Parton, Neville 'The Development of Early RAF Doctrine', *The Journal of Military History*, Vol.72, No.4, October 2008, pp.1155-1178
- Pugh, James 'The Royal Air Force, Bomber Command and the use of Benzedrine Sulphate: An Examination of Policy and Practice During the Second World War', *Journal of Contemporary History*, Vol.53 (4), 2018
- Searle, Aleric 'Inter-service Debate and the Origins of Strategic Culture: The Principles of War in the British Armed Forces, 1919-1939', *War in History*, Vol.21, No.4, 2014, pp.4-32

- Slessor, John 'The Development of the Royal Air Force', *JRUSI*, Vol.76, February 1931, pp.324-334
- Sturtivent, Ray 'British Flying Training in World War One', *Cross & Cockade*, Vol.25, No.1, 1994, pp.18-45
- Sykes, Frederick 'Military Aviation', *The Aeronautical Journal*, Vol. XVII, No.67, July 1913, pp.127-139
- Sykes, Frederick 'Further Developments of Military Aviation', *The Aeronautical Journal*, Vol. XVIII, No.70, April 1914, pp.86-101
- Trenchard, Hugh 'Aspects of Service Aviation', *Army Quarterly*, Vol.2, No.1, 1921, pp.273-282
- Vallance, Andrew 'The Role and Evolution of Air Power Doctrine Within the Royal Air Force', *Cambridge Review of International Affairs*, September 2013, pp.46-54
- Wavell, A.P. 'The Training of the Army for War', *JRUSI*, 1 February 1933
- Werrell, K.P. 'Flying Training: The American Advantage in the Battle for Air Supremacy Against the Luftwaffe', *Air Power History*, Vol.61, No.1 (Spring 2014)
- Zuckerman, Lord 'Strategic Bombing and the Defeat of Germany', *JRUSI*, 130 No.2, (1985), pp.67-70

### **Unpublished Material**

- Mason, Tony *The Royal Air Force Staff College, 1922-72.*  
Unpublished manuscript held at the JSCSC library, Shrivenham