



Air and Space Power Review

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Reviewed by Flight Sergeant Paul Marr

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The Blitz Companion: Aerial warfare, civilians and the city since 1911
Reviewed by Mark Russell

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Foreword

by Group Captain Paul Sanger-Davies

The unique challenges which we have faced together over the last year have forced us to evolve our ways of working at pace, and we paused our *ASPR* publication until the flow of high calibre articles and reviews resumed. I am delighted to re-introduce the publication with one comprehensive edition for 2021. The *ASPR* Autumn/Winter edition includes an eclectic range of articles, defence research papers and book reviews reflecting historical, current and future insights, which I hope will appeal to our extensive readership.

We have four articles, which explore historical conceptual development, the 'Main Offensive', the realities of patents and procurement and the need for rapid reorganisation, and agility.

Dr Steven Paget's article considers the report written in 1955 by Air Commodore Henry Eeles, Commandant of Royal Air Force (RAF) College Cranwell between 1952 and 1956. The military, political and social changes occurring then have parallels with our contemporary context, including expectations about access to higher education and the introduction of new technology, leading to an era of so-called 'push button warfare'. Dr Paget highlights that Air Commodore Eeles was also cognisant of issues such as balance, time and life-long learning, which remain pertinent today. The context and content of this prescient report have ensured its enduring relevance for the RAF.

Dr Richard Worrall explores the ten-week sojourn in the 'Main Offensive' aimed against Berlin with a focus upon the Battle of Hanover. Here, he details that action's four heavy-attacks in twenty-six days and suggests why this 'bomber battle' has remained relatively unknown. He also highlights how Bomber Command's experiences over Hanover revealed its limitations at this critical stage of the war.

Dr Matthew Powell examines the challenges of historical procurement in 'Royalties, Patents and Sub-Contracting: The Curious Case of the Hawker Hart'.

Group Captain John Alexander focusses on the need for rapid reorganisation of Britain's Air Defences in June 1944 to counter the devastation caused by V-1 flying bomb raids.

Wing Commander Stuart Patton provides a valuable doctrinal and historical analysis, exploring the contribution of air-to-air refuelling to operations. Whilst the critical utility and multiplier effect of air-to-air refuelling has been demonstrated over countless operations it remains an area of marginal interest for many nations. With more recent operations exposing ever greater dependencies on this capability, the paper re-examines the value of air-to-air refuelling to modern warfighting.

This edition also includes reviews of six books, ranging from a damning account of modern-day strategic failure through to the impact of air raids during the Blitz upon everyday civilians.

Flight Risk is a fine book which might be summarised as a story of strategic failure in miniature. It will be essential reading for anyone involved in advising or assisting developing air forces. Given its focus upon the Afghan Air Arm, it is likely that this will be familiar ground to many of our readers. In *Losing Military Supremacy: The Myopia of American Strategic Planning* the author does not pull his punches in expressing his views. On the contrary, he is highly critical of many aspects of the missions covered, while claiming a greater degree of realism by Russia regarding the realities of war. Techniques first linked with Russia are explored further in *This is Not Propaganda*, which focuses upon the art of disinformation and emotional influence, exposing the balance of control present behind social media and political messaging.

Fighters in the Blood: The Story of a Spitfire Pilot - And the Son Who Followed in his Footsteps - is an entertaining and, in places, poignant book which adds a unique twist to the standard autobiographical form. *Britain's War* is a fascinating and timely addition to the historiography of World War Two combining, for the first time, the military, social, political and economic histories of the war, leaving bare to the reader virtually all aspects of the British experience. Throughout, the author tackles his subject head on yet without judgement, never shrinking from distasteful subjects and with careful insight Todman forces the reader to confront the unsavoury realities of Britain's War. The final book is described by the publisher as 'An introductory international reader for students, teachers and members of the public interested in the impact of air raids on civilians and cities since the birth of air warfare' and it does this job well. In *The Blitz Companion: Aerial warfare, civilians and the city since 1911* - the author spans more than a century, from the first Italian air raid in Libya in 1911, to Russian bombing in Syria following their involvement from 2015.

I would especially like to highlight the sterling service of my predecessor, Group Captain Andy Hetterley, and of my Editorial Team in crafting this publication.

I hope you enjoy this edition, and it inspires you to explore the opportunities offered by the Royal Air Force for further conceptual advancement.

Article

The 'Eeles Memorandum': A Timeless Study of Professional Military Education

By Dr Steven Paget

Biography: Steven Paget is the Military Programmes Director in the College of Science at the University of Lincoln. Prior to that, he was a Reader in International Security and War Studies and Director of Air and Space Power Education for the University of Portsmouth at RAF College Cranwell. He is the editor of *Allies in Air Power: A History of Multinational Air Operations* (Lexington: The University Press of Kentucky, 2021).

Abstract: Examinations of historical examples are an important element of the professional military education debate and demonstrate the enduring nature of some of the necessary considerations. Air Commodore Henry Eeles, the Commandant of Royal Air Force (RAF) College Cranwell between August 1952 and April 1956 wrote a prescient report in 1955. The military, political and social changes that were occurring have some parallels to the contemporary context, including expectations about access to higher education and the introduction of new technology, which was viewed as leading to an era of so-called 'push button warfare'. Eeles was also cognisant of issues such as balance, time and life-long learning that are just as pertinent today as in 1955. The context and content of the report has ensured that it has enduring relevance for the RAF.

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Introduction

The professional military education (PME) debate is as contentious as it is valuable. While there is general acceptance of the importance of PME, there is a multiplicity of views over its content, delivery, length and purpose, amongst other factors. Dr David Morgan-Owen has written, consequently, that PME is approaching a 'fork in the road'.¹ A view has emerged that PME requires a 'fix' of some variety, but there is little agreement on what it should constitute, not least because of the divergence of perspectives on the nature of the 'problem'.² The risk is that in seeking a fix to the perceived current and future issues in PME, the past gets ignored entirely.

Some excellent work has been conducted on the history of PME, but there is still a dearth of studies, particularly in relation to air power.³ Air Marshal Edward Stringer, noted an important paradox in reflections on the conceptual component when he stated in 2018:

There is an irony in making a case that air forces have not, traditionally, expended as much effort thinking about the conceptual component of combat power as they have on ensuring a robust replenishment of the physical component or bolstering the moral one. Because no one can accuse the early pioneers of lacking visionary zeal.⁴

That 'visionary zeal' was evident in 1920 at the foundation of RAF College Cranwell, where a diverse curriculum of arts, science and vocational subjects was taught by Cambridge and Oxford graduates as the Chief of the Air Staff, then Air Marshal Hugh Trenchard, 'sought to ensure that the RAF Cadet College should be founded on the best principles of education and instruction'.⁵

As practitioners and scholars mine the works of military thinkers in search of contemporary relevance, a widening of the aperture could promote a new understanding of historical views on military education. A particularly prescient report on education at RAF College Cranwell was written by the Commandant, Air Commodore Henry Eeles, on 6 June 1955.⁶ Air Commodore Eeles, an experienced officer who had commanded 263 Squadron during the Battle of Britain, was Commandant between August 1952 and April 1956. Eeles demonstrated during that time that, in addition to a wealth of professional experience, he had a far-reaching and progressive approach to the conceptual component.

The centenary of RAF College Cranwell (2020), provides an opportunity to shed light on the important, but often overlooked, thinking about military education that has been undertaken at the College. In considering the merits of twenty-first century practitioners reviewing the experiences of the early twentieth century, Squadron Leader Paul Baroni assessed: 'The fluidity, blistering pace of technological advancement and constant change of today echoes this period, with strategic instability, conflict, financial, political and social turbulence the characterising features between 1900 and 1945. Against such a backdrop, perhaps the only consistent factor for the military is our Conceptual edge.'⁷ Although perhaps

not as tumultuous, significant military, political and social changes were occurring when Eeles was writing in the 1950s, ranging from expectations about access to higher education to the development of precision-guided missiles. Equally, issues such as balance, time and life-long learning are just as pertinent today as they were in 1955. The context and content of Eeles' memorandum has ensured, ultimately, that it has enduring relevance for the RAF.

A Time of Great Change

That history does not 'repeat' itself, but does 'rhyme' is a well-known maxim. Parallels can be drawn between the situation facing the RAF in the 1950s and in the contemporary period. Eeles wrote at a time of increasing responsibility for the RAF, reflecting:

The recent White Papers on Defence have shown clearly the gradual change that is being brought about in the direction and balance of our defence effort, still greater emphasis being placed on the Royal Air Force. The delivery to the Service of atomic missiles has started and the power of the Royal Air Force is therefore increasing both relatively and absolutely, the Service facing a period of bewildering and unprecedented change.⁸

The introduction of atomic weapons, as well as guided missiles, was perceived as a step-change for the RAF. Although the balance of power changed in terms of the UK's nuclear deterrent, new responsibilities of great significance have continued to emerge for the RAF. Most notably, the UK's military space capabilities are 'primarily coordinated and delivered by the Royal Air Force and Joint Forces Command'.⁹ In a similar vein to Eeles' prediction about nuclear weapons, Dr Bleddyn Bowen has posited that 'resources and prestige may accrue to space power in the RAF's second century'.¹⁰ The RAF will, inevitably, also have key roles in 'defending military platforms and capabilities, but also in integrating cyber effects into operations'.¹¹ Eeles' clarion call that the RAF needed officers that 'have the mentality and who have been trained sufficiently to enable them to continue building during the next 20 years on the foundations laid at the College' to tackle the challenges presented by technological change is as true today as it was in 1955.

The pertinence of the aphorism that history 'rhymes' was further demonstrated in Eeles' views on automation and the introduction of precision-guided munitions. He cautioned: 'In 20 years time the progressive introduction of guided missiles of all kinds may have reduced the importance of the pilot, but in the era of push button warfare it will still be men who push the buttons and ability, leadership and character will be required as much then as now.'¹² This view ran contrary to the opinions expressed by some that the introduction of precision-guided munitions would reduce, or even eliminate, the human factor. Eeles' view may have seemed conservative and traditionalist, but, in hindsight, he may have even understated the continual relevance of the human factor.

The introduction of Remotely Piloted Aircraft Systems (RPAS) could be seen as the ultimate manifestation of 'push button warfare', but it has not undermined the human element.

Professor Derek Gregory has pointed out that 'characterizations of the drone missions as moments in a "video game war" that inculcates a "Playstation mentality to killing" may well be wide of the mark'.¹³ Indeed, Professor Peter Lee has argued: 'Despite the technical developments that enable the Reaper (RPAS) to be operated across continents, war and air operations remain essentially human activities.' He has noted that 'the distance-intimacy paradox of remote air warfare' raises 'emotional, psychological and moral complexities'.¹⁴ As Eeles looked to the future, he warned: 'It is not enough for a cadet to have a system of beliefs as it were imposed from outside. What is required is a deep-seated pattern of behaviour corresponding to his own beliefs and convictions. Integrity, moral courage and firmness of purpose are likely to be required in the future to a greater degree than ever before.'¹⁵ The nuances of contemporary operations, the implications of modern technology and changing societal attitudes will ensure that humans are as important, if not more so, than ever.

Balancing Training and Education

Eeles, while recognising the inherent value of training and the need to inculcate cadets in their profession, was a strong advocate of enhancing the educational component: 'The chief obstacle...in designing a syllabus is that of how best to satisfy the utilitarian requirements of the professional subjects while at the same time providing a course of study which is educational in a more liberal and far reaching sense'.¹⁶ Eeles was not unique in pushing for a more liberal education. General Dwight Eisenhower, for example, emphasised in 1946: 'No one could emerge from the experience of the last war without a most profound respect for the contribution to victory made by men trained in the liberal arts. The work of natural scientists in the development of new equipment is known to everyone. Less well-known, but of great importance have been the contributions of other arts and sciences.'¹⁷

A rigorous flying programme, which was acknowledged as 'physically stimulating', was not considered to be 'conductive to the spiritual and mental development which forms the basis of education'. Eeles proposed consequently: 'If the College is to meet this responsibility to the individual cadet then it must be ordered so that the educative process produces the maximum development of which each cadet is capable.'¹⁸ Balancing and deconflicting – in terms of creating adequate time when cadets would have sufficient energy to study effectively – was viewed as a fundamental challenge. That balance, in both formal and informal PME, remains an ongoing issue. In 2017, then Brigadier Mick Ryan, Australian Army, proposed: 'All members of a military institution must balance the vocational (or training) elements of their profession with development of their intellectual capacity. Even the most junior soldiers must continue to hone their intellectual capacity.'¹⁹ Vocational training will never lose its importance, but intellectual development is becoming ever more significant.

Eeles also recognised that the benefits of education would only be realised if sufficient time was provided for evaluation and reflection: 'Necessarily he [the cadet] is taught a large number of subjects. In addition, he learns to fly, and he is instructed in ground defence, in officer-like

qualities, customs of the Service and so on. The only place where these various influences can be integrated is in the cadet himself.’²⁰ Modern literature on PME is replete with the view that reflection time is fundamental to development. Stated simply: ‘Critical thinking is learned behaviour that must be accompanied with adequate reflection time.’²¹ Creating time for reflection and, subsequently, ensuring that it is used effectively, is an ongoing necessity in all formal PME around the world.

The Long-term Benefits of Education

Eeles’ views were shaped by his beliefs about the likely long-term demands on officers joining the RAF. In addition to the likelihood that ‘the power at his disposal and the consequences of his decisions will give him great responsibilities’, Eeles was concerned that: ‘The commanders of the future will have university trained technical advisers and it would be prudent to ensure that some Cranwell cadets who have the latent ability, should have undergone the same sort of educational experience.’²² Major General Christopher Elliot, British Army (ret), writing sixty years later, expressed a similar concern when reflecting on the British experiences in Afghanistan and Iraq: ‘all the Chiefs of Defence in the decade 2000-10 had escaped the formal intellectual training and broadening experience that a university offers – particularly a grounding in conceptual skills – yet they were dealing with their peers in Whitehall almost all of whom had been to university.’²³ Subject specialisms and educational levels will never be universal, but the possession of similar qualifications to peers helps to create a level playing field.

Eeles was also acutely aware that there was an increasing expectation of access to higher education amongst potential Cranwell recruits. There was an innate pragmatism to encouraging cadets to pursue degrees as it would serve as a driver for recruitment. A 2018 publication, *Leading Change in Military Organizations*, outlined that there is a need to ‘balance external stakeholder demands or expectations with enacting necessary change in the organization’s best interest.’²⁴ Encouraging educational development was a fortunate marriage of external expectations and the RAF’s best-interests in terms of both enhancing recruitment and improving effectiveness.

Eeles, at the same time as proposing that cadets of sufficient ability should have the opportunity to obtain degrees, was very much a believer that education was a lifelong process. Eeles reasoned that ‘a cadet must learn how to learn, where to look for information, how to write, how to think, to reason and to express himself; how to apply himself to new ideas, how to organise his time and effort’, which he viewed as ‘the principles on which to build his future career.’²⁵ The absence of adequate time to learn, research and write has long been bemoaned and Eeles’ view has been echoed in the twenty-first century. Major General Robert Scales, US Army (ret), for example, asserted: ‘War is a thinking man’s game and only those who take the time to study war are likely to fight it competently. Soldiers and Marines need time for reflection, time to learn, teach, research and write. In this new age of warfare we must do more to prepare soldiers to think as well as act.’²⁶

Eeles recognised that 'education is a continuous process and it may be argued that the cadet will develop after he leaves Cranwell, and it is certainly true that the College should not attempt to teach a cadet "all that he will need to know in the next 20 years"', but he also warned that 'the argument that a cadet will educate himself in the Service must not be pushed too far'. Eeles believed that it was Cranwell's responsibility to develop the skills necessary for officers to learn and that the building blocks for their professional development, which would take place in the wider service, should be furnished at the College.²⁷

Conclusion: Thinking about Historical Thinking

Although the specifics are different, when Air Chief Marshal Sir Andrew Pulford, the then Chief of the Air Staff, stated at the launch of 'Thinking to Win' in 2015: 'harnessing the output from "new" environments, preserving the quality of one's human capital and nurturing their creativity to promote rapid organisational adaptation, are the elements that can make the difference for air power', the concepts aligned, in broad principle, with the ideas of Eeles.²⁸ The fact that Eeles' views are not well known can be explained easily as they were contained in an internal memorandum. However, that reasoning may be too simplistic and points to a contemporary lesson. Eeles' ideas have enduring relevance and deserve a wider audience, but they also serve as a timely reminder of the benefits of a robust public debate. While accusations of air forces under-valuing the conceptual component are becoming increasingly prevalent, there needs to be more reflection on the existence of 'visionary zeal'. The challenge is to provide and support the necessary platforms to promote innovative thinking about the conceptual component of fighting power.

In a provocative *War on the Rocks* article, former RAF Wing Commander Mal Craghill recently made a strong case for enhancing thinking in the RAF and giving greater prominence to the conceptual component of fighting power.²⁹ Throughout its history, recognised air power thinkers in the RAF have been relatively scarce, and whilst many have lamented their absence, it perhaps reflects on the culture of a Service that has arguably been principally preoccupied by aeroplanes and 'kit'. While more air power visionaries would undoubtedly be beneficial, a first step in the right direction would be to contemporarily recognise and, retrospectively acknowledge, the few thought-leaders in the RAF that have advanced its conceptual component. Eeles' operational experience in the Second World War may stand out in his varied career and is, undoubtedly, worthy of great respect. Less prominent, but no less important, his forward-leaning and enduring attitude to education and, the conceptual component more generally, ensured that his time as Commandant at RAF College Cranwell was invaluable. It may be necessary to shift the paradigm when it comes to defining air power thinkers. Theorists that have addressed the delivery of air power have tended to predominate, but those that evaluate its conceptual and intellectual underpinnings are equally as deserving of recognition.

What betrays the age of Eeles' memorandum is not the substantive content about air power or the conceptual component, but the gender specific language that was representative of a time when there were only male cadets at the college. Eeles' views on a broad curriculum, adequate time, the need for reflection, access to higher education and the inherent centrality of human factors in warfare are just as relevant today. The past does not hold all of the answers for PME, but there is value in addressing historical ideas when thinking about current and future requirements.

Notes

¹ David Morgan-Owen, 'Approaching a Fork in the Road: Professional Education and Military Learning', *War on the Rocks*, 25 July 2018, <https://warontherocks.com/2018/07/approaching-a-fork-in-the-road-professional-education-and-military-learning/>, (accessed 14 October 2019).

² See, for example: Gary Schaub, Jr., 'A PME Survivor on how to Fix the War College System: Take it Back to the Future', *Foreign Policy*, 23 May 2012, <https://foreignpolicy.com/2012/05/23/a-pme-survivor-on-how-to-fix-the-war-college-system-take-it-back-to-the-future/>, (accessed 14 October); Lieutenant Colonel Jack Dempsey, 'To Fix PME, Decide Whether you are Training or Educating Officers – and do it!', *Foreign Policy*, 4 June 2012, <https://foreignpolicy.com/2012/06/04/to-fix-pme-decide-whether-you-are-training-or-educating-officers-and-do-it/>, (accessed 14 October).

³ See, for example: Gregory C. Kennedy and Keith Neilson (eds.), *Military Education: Past, Present, and Future* (Westport: Praeger Publishers, 2002); Douglas E. Delaney, Robert C. Engen and Meghan Fitzpatrick (eds.), *Military Education and the British Empire, 1815–1949* (Vancouver: UBC Press, 2018).

⁴ Air Marshal Edward Stringer, 'Lord Trenchard Memorial Lecture 2018', RUSI, 4 September 2018, <https://rusi.org/event/lord-trenchard-memorial-lecture-2018>, (accessed 14 October 2019).

⁵ E.B. Haslam, *The History of Royal Air Force Cranwell* (London: HMSO, 1982), pp. 21–24.

⁶ The National Archives of the UK (TNA), AIR 20/9083, Air Commodore H. Eeles, Commandant, Royal Air Force College, Cranwell, 'Memorandum on the R.A.F. Scholarship Syllabus', 6 June 1955 [hereafter: Eeles, 'Memorandum'].

⁷ Squadron Leader Paul Baroni, 'Foreword', *Air Power Review*, 18:1 (Spring 2015), pp. 4–5.

⁸ Eeles, 'Memorandum'.

⁹ Development, Concepts and Doctrine Centre, *Joint Doctrine Publication 0-30: UK Air and Space Power* (Shrivenham: UK Ministry of Defence, 2017), p. 71. Note: Joint Forces Command became Strategic Command (UKStratCom) on 09 December 2019.

¹⁰ Bleddyn E. Bowen, 'The RAF and Space Doctrine: A Second Century and a Second Space Age', *The RUSI Journal*, 163:3 (2018), p. 63.

¹¹ Wing Commander Paul Withers, 'Integrating Cyber with Air Power in the Second Century of the Royal Air Force', *Air & Space Power Review*, 21:3 (Autumn/Winter 2018), p. 133.

¹² Eeles, 'Memorandum'. The document refers to boys and men specifically as female entrants did not arrive at the college until 1970.

¹³ Derek Gregory, 'From a View to a Kill: Drones and Late Modern War', *Theory, Culture & Society*, 28:7-8 (2011), p. 197.

¹⁴ Peter Lee, 'The Distance Paradox: Reaper, the Human Dimension of Remote Warfare, and Future Challenges for the RAF', *Air & Space Power Review*, 21:3 (Autumn/Winter 2018), p. 125. For more on the human dimension of RPAS, see: Peter Lee, *Reaper Force: Inside Britain's Drone Wars* (London: John Blake Books, 2018).

¹⁵ Eeles, 'Memorandum'.

¹⁶ Ibid.

¹⁷ Dwight D. Eisenhower, Chester W. Nimitz and A.A. Vandegrift, 'Liberal Education in the Military Forces', *The Journal of General Education*, 1:1 (October 1946), p. 34.

¹⁸ Eeles, 'Memorandum'.

¹⁹ Mick Ryan, 'The Art of Leading Unit-based Professional Military Education', *Modern War Institute*, 29 March 2017, <https://mwi.usma.edu/art-leading-unit-based-professional-military-education/> (accessed 15 October 2019).

²⁰ Eeles, 'Memorandum'.

²¹ Lieutenant Colonel Paul Berg, 'The Importance of Teaching Followership in Professional Military Education', *Military Review* (September-October 2014), p. 68.

²² Eeles, 'Memorandum'.

²³ Christopher L. Elliott, *High Command: British Military Leadership in the Iraq and Afghanistan Wars* (Oxford: Oxford University Press, 2015), p.201.

²⁴ Tom Galvin, *Leading Change in Military Organizations: Primer for Senior Leaders* (Carlisle: US Army War College Press, 2018), p. 8.

²⁵ Eeles, 'Memorandum'.

²⁶ Quoted in Peter Foot, 'Military Education and the Transformation of the Canadian Forces', *Canadian Military Journal* (Spring 2006), p. 17.

²⁷ Eeles, 'Memorandum'.

²⁸ Air Chief Marshal Sir Andrew Pulford, 'Thinking to Win', Speech by the Chief of the Air Staff Air Chief Marshal Sir Andrew Pulford, 17 September 2015, <https://www.gov.uk/government/speeches/thinking-to-win>, (accessed 13 October 2019).

²⁹ Mal Craghill, 'Thinking About Thinking in the Royal Air Force', *War on the Rocks*, 1 March 2019, <https://warontherocks.com/2019/03/thinking-about-thinking-in-the-royal-air-force/> (accessed 13 October 2019).

Article

'Bumps along "The Berlin Road"'.¹ Bomber Command's forgotten Battle of Hanover, September- October 1943

By Dr Richard Worrall

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Abstract: The many accounts on RAF Bomber Command follow the usual chronology of the 'Main Offensive' against Germany throughout 1943/4, with a linear progression from the Battle of the Ruhr, to the Battle of Hamburg, to the Battle of Berlin. Yet adopting this approach is problematic. The Battle of Berlin was halted by Harris in mid-September only to be recommenced in mid-November, but it therefore begs the simple question: what was Bomber Command doing during the interim ten weeks? Harris' force *was* far from inactive during this time, in which the centrepiece was the 'Battle of Hanover' that comprised four heavy-attacks in twenty-six days. This article identifies what happened during this period of the 'Main Offensive', to suggest why this 'bomber battle' has remained forgotten, highlighting how Bomber Command's experiences over Hanover revealed its limitations at this critical stage of the bombing war.

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Apart from the important contribution of its engineering and rubber works to the enemy's war effort, Hannover has another, and unique, responsibility to bear. It was Hannover that gave Hitler, the Austrian, his German citizenship. Thinking to acquire merit in the eyes of a possibly powerful politician, the University of Hannover presented Hitler, *honoris causa*, with a minor professorship which automatically carried with it the German citizenship that Hitler coveted. What he was supposed to profess does not particularly matter. Whatever it was, the University and people of Hannover have certainly learnt their lesson.²

Hannover, Assessment No. 17 by Air Staff Intelligence, HQ Bomber Command, undated

Dirty little target, plenty of fighters up. Thirty-eight lost.³

Trevor Dill, diary entry for 27/28 September 1943

Introduction

In 1947, the former Commander-in-Chief of Bomber Command, Air Chief Marshal Sir Arthur Harris, published his version of the bombing campaign in a book simply named *Bomber Offensive*. Written for wider public consumption, the account presented, according to one historian, was 'straightforward if not overly reflective' that unsurprisingly defended area bombing and its effectiveness.⁴ Yet this volume has been much-quoted, and has shaped the work of successive historians on Bomber Command during the Second World War, especially in the chronology of its 'Main Offensive' against Germany in 1943/4. The other key text, influential for shaping the future historiography, was the British Official History, namely *The Strategic Air Offensive against Germany 1939-1945* (SAOG) by Charles Webster and Noble Frankland, which concluded 'the great air offensive unfolded around three major battles', starting with the Ruhr, although they did concede that 'a path of destruction, initiated by the Battle of Hamburg, was then driven into the centre and south of Germany in preparation for the climax of the campaign', namely the Battle of Berlin.⁵ In so doing, most titles have missed the 'forgotten' bomber battle of 1943, namely the one against Hanover in September and October. This occurred in the weeks between the last attack in the opening of the Battle of Berlin on 3/4 September, and its resumption on 18/19 November. Many authors have glossed over this period altogether or presented it, like Harris did, as a time marked by a number of specific (and note successful) attacks, such as the 'firestorm' raid on Kassel on 22/23 October. But this has meant the history of the British contribution to the combined bomber offensive during autumn 1943 remains incomplete, with the period before the resumption of the Battle of Berlin being largely overlooked.

Examination of documentary evidence does reveal some hints that another 'battle' took place during the autumn of 1943. In November 1943, Lord Trenchard issued a pamphlet on air power and wrote that 'this war has admittedly shown the tremendous power of the bomber . . . Surely the writing is plain for all to read, after Hamburg, [and] Hanover . . . [after taking] into

consideration the magnitude of *these great bombing battles* [author's emphasis] and the effect they are having in shortening the war'.⁶ Furthermore, in April 1947, the former Director of Bomber Operations (DBOps), Air Commodore Sydney Bufton, gave a lecture to the RAF Staff College, and spoke of an addition to the bomber battles of 1943/4, namely 'the campaign against the Central German cities'.⁷ This saw several operations against Kassel and Leipzig, but the record shows the major effort was against Hanover, which fulfilled all the criteria of being a 'bomber battle'. As defined by Martin Middlebrook, this saw Bomber Command being:

... sent again and again to the same target in the hope of destroying it completely. Alternative targets had to be raided sometimes both to keep the German's defences guessing and because of weather factors, but the Germans realized what was happening and concentrated their defences at the main target. This resulted in such fierce opposition for the bombers that the conflicts were later classed as 'Battles'.⁸

Given this meaning, which is both an accurate and succinct summary, it is clear that there was indeed a 'Battle of Hanover', which moreover became the centrepiece of the British bombing offensive during autumn 1943. It represented a concentrated effort that comprised four heavy attacks on this city in just over three weeks, and saw a ferocious fight with the German air defences causing high-losses to Bomber Command (see *Chart II*). As a result, Middlebrook stated that 'there soon took place a little-remembered 'battle' involving another large German city, Hannover'.⁹

Yet the Battle of Berlin has continued to dominate assessments of this period of the British bombing offensive. Designed to bring about Germany's capitulation, it ended up being a bitter campaign that was increasingly in danger of breaking Bomber Command itself. In his *Despatch on War Operations*, Harris opined that his Command's subsequent difficulty over the German capital was because:

... it entailed many more hours flying over heavily-defended regions, whatever the direction of approach – flying four hours at the very minimum. It was the target which above all the Luftwaffe was bound to defend, and no chances would be taken with it.¹⁰

Sustaining higher losses for arguably less-and-less gain, Harris would come under greater scrutiny and censure from the Air Ministry during winter 1943/4. But what if the outcome, as Harris had depicted, had a precedent? More pointedly, had the Battle of Hanover revealed Bomber Command's limitations, which were ignored at the time but meant the subsequent failure over Berlin had in fact a tragic inevitability? This article will consider these issues.

On 16 June 1943, Harris outlined his thinking about Bomber Command's operations during the rest of 1943. Famously, he stated that:

As the nights lengthen . . . we will then go progressively further into Germany in I hope sufficient strength to be able to leave behind us, as we progress, a state of devastation similar to that now obtaining in the Ruhr; if the Boche waits for it.¹¹

Containing no direct reference to Hanover, the intended objectives were 'the complete destruction of Hamburg' and 'a really hearty hammering of Berlin', with raids on Nuremberg and Munich because of their symbolism for the Nazi movement.¹² By summer 1943 this plan seemed on the brink of fulfilment. Hamburg had been damaged severely by fire and, pressed by Churchill, Harris turned to Berlin. Justifiably optimistic, on 12 August Harris told the Chief of the Air Staff (CAS) Sir Charles Portal that 'it is my firm belief we are on the verge of a final showdown in the bombing war and that the next few months will be vital'.¹³ The latter part of this statement was undoubtedly true, though not in the way Harris intended. Opening the campaign against Berlin eleven-days later, Harris halted it after just three attacks because his force was not yet capable of bombing this target with sufficient concentration or without incurring unmanageable losses. Moving 'further into Germany' had proven easier said than done.

Notwithstanding this setback, it remained essential for HQ Bomber Command to find another city in order to maintain the area bombing offensive, especially as the Air Staff were increasingly pressing for operations against specific industrial targets, namely Schweinfurt's ball-bearing plants and Leipzig and Brunswick's aircraft factories. To forestall having to do this, Harris cast around for an 'easier' and larger city to destroy, and settled on Hanover. Just as the area bombing of Hamburg had severely damaged both the urban area and shipbuilding industries so the same method was to be used in a bid to destroy Hanover's city centre along with the rubber and heavy-engineering factories.

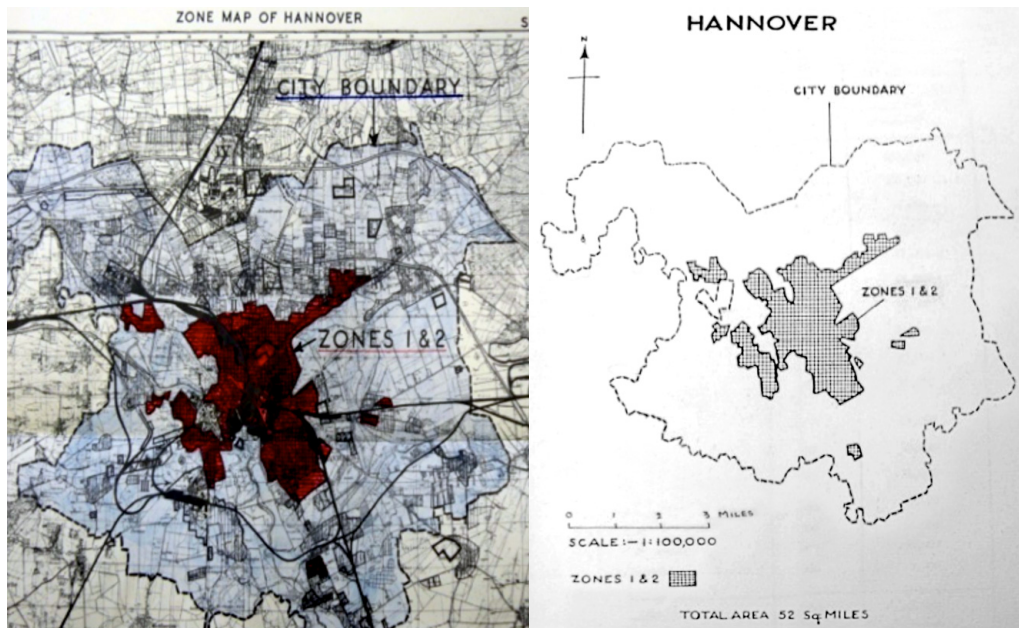
Bombing Hanover had first been considered under Operation *Abigail-Rachel* – a plan for a large-scale incendiary raid on a German city in response to the Luftwaffe's attack on Coventry in November 1940. Yet, at this time, the use of incendiaries on Hanover attracted 'a good deal of criticism' because the War Cabinet perceived the city as 'the centre of the old German aristocracy', 'strongly anti-Nazi', and having long-standing '[Royal and military] associations with this country'. Attacking this city, they feared, 'might well lead to reprisals against, say, Oxford or Winchester', and therefore for 'political reasons' it was decided on 12 December to not bomb this target.¹⁴ Yet the Luftwaffe's incendiary attack against the City of London seventeen days later saw Air Chief Marshal Sir Richard Peirse, then Commander-in-Chief Bomber Command, tell Portal that 'I hardly think the [War] Cabinet need longer feel soft-hearted towards Hanover'.¹⁵ They agreed, and on 10 January 1941 Peirse was informed of 'the inclusion of Hanover as a suitable objection for a concentration attack when a favourable opportunity occurs'.¹⁶

The day before the Ministry of Economic Warfare (MEW) had examined Hanover, and described it as 'the economic and communications centre of North Western Germany', with a population of 450,000 and many industries, which offered 'good prospect[s] of obtaining the

greatest moral and material effect' particularly as the city centre's old buildings meant 'the fire risk was great'.¹⁷ Indeed, throughout 1941 Hanover's vulnerability to area and incendiary attack underwent a considerable amount of investigation. By December, the Air Ministry's Directorate of Bomber Operations, in a report titled 'Notes on Compact Built-Up Areas that are Especially Vulnerable to Bombing', described Hanover as 'compact' comprising:

- (1) Central City Area (old town well preserved); (2) 3 Industrial Areas, 2 in the city and 1 on its SW outskirts; (3) About 2/3 of the area consists of congested 3-5 storey tenements with over 100 persons to the acre.¹⁸ (see *Maps I & II*)

Consequently, Hanover's inner area was perceived as being 'much more vulnerable' than that at Lübeck – which had itself suffered a devastating fire attack in March 1942 – and the Directorate of Bomber Operations therefore felt 'a case has been made' for undertaking an incendiary attack on Hanover.¹⁹ Moreover, Hanover's industries were an important part of Germany's war economy. Located roughly between the Ruhr and Berlin, and connected by major rail-lines and waterways, Hanover contained numerous factories. Two major sites, the *Continental Gummiwerke* and *Hanomag*, had been identified by HQ Bomber Command's intelligence staff as located 'in and around the main town [and] ... sufficiently close to be embraced in a general [area] attack ... [that] would react on the industrial output of the whole area'.²⁰ Beyond these, Nazi rearmament policy in the 1930s had led to the establishment of major armament plants in the city's northern districts to assist with the dispersal of war production from the already overcrowded Ruhr.²¹



Maps I & II: Zones 1 and 2 and city boundaries of Hanover.²²

Hanover's industrial significance lay in four areas: oil, textiles, heavy-armaments, and rubber/Buna (synthetic rubber) production. At Misburg, on the eastern outskirts, lay the *Gewerkschaft Deutsche Erdöl Raffinerie (Deurag)* oil refinery, a priority target that produced 240,000 tons of petroleum products every year, including 15,000 tons of aviation fuel. With regards to the textile industry, Hanover had one of the largest wool combers in Germany, a factory at Döhren, employing 2,500 workers. By autumn 1943, HQ Bomber Command's intelligence staff had noted that the German authorities were worried by a textile shortage because of the 'wholesale destruction' of Mönchengladbach's cloth factories on 30/31 August.²³

But Hanover's most important industrial activities in German war production were its heavy-engineering plants and rubber factories. In the former category, the most famous concern was *Hannoversche Maschinenbau A.G. (Hanomag)* – a Class 1+ target – comprising two large factories, one in the city centre (Linden) and another in Brink, north of the Mittelland Canal. Originally, both sites made locomotives but were switched to producing heavy military equipment, such as tanks, military transport, artillery tractors, gun carriages, and aircraft components. Later, the British believed *Hanomag* was producing components for Germany's V-weapons.²⁴ Beyond heavy-engineering, the city was also synonymous with the centre of Germany's rubber industry. *Continental Gummiwerke A.G.* owned a number of factories in Hanover, which, according to MEW's assessments in mid-1943, manufactured about 80% of the aircraft tyres made in Germany.²⁵ In addition, at Nordhafen, the *Continental* company had established a plant that produced synthetic-rubber (*Buna*).²⁶ On 13 April 1943, the importance of Hanover's rubber industry was brought to Harris' attention by none other than Viscount Trenchard. Yet the C-in-C Bomber Command was less keen, telling the RAF's 'founding father' that attacks on 'panaceas', such as rubber, should be rejected. In a precursor to later arguments with the Air Ministry over ball-bearings, Harris opined that 'specialising on one . . . [means] nothing else in Germany including morale, and housing, is likely to suffer. If the 'Panacea' fails all is lost.'²⁷ Harris' message was clear: Hanover as a city and its civilian population, not as a centre of specific industrial activity, mattered most at HQ Bomber Command.

Yet, by this time, those responsible for shaping the combined bombing offensive (CBO) did recognise Hanover for its particular industrial importance. On 14 May 1943, the Combined Chiefs of Staff (CCOS) decided to modify the mission and objectives of both the RAF's and United States Army Air Force's (USAAF's) strategic air forces. This showed the CCOS were in agreement with American Operational Analysts that paralysis of the German war-machine would be achieved by destroying certain target-systems, namely submarine construction yards, the aircraft industry, ball-bearings, oil production, synthetic-rubber and tyres, and military vehicles, all of which became enshrined in the unofficially titled 'Eaker Plan'. In describing the fifth category, the US analysts had noted that rubber products 'are vital to all phases of German Military strength on land and in the air . . . [and its] destruction will have a crippling effect'.²⁸ For the CCOS, American target-analysts and the British Air Staff the destruction of Hanover's rubber industry therefore fully conformed with the 'intermediate objective' of the *Pointblank* Directive of 10 June 1943, namely the destruction of German aircraft production and its

associated industries. The US Eighth Air Force was quick to begin, sending sizeable forces to bomb the rubber plants at Hülse (near Krefeld) on 22 June and targeting Hanover on 17 and 26 July. The combined attacks led to the MEW diary to assess Germany's rubber supply as being 'highly vulnerable'.²⁹ But over the next few months, Harris instead continued to attack the Ruhr, burned down Hamburg and bombed Italy out of the war. By autumn pressure from the Air Staff to attack aircraft production and ball-bearings had intensified, but in Harris' view these specific targets were best left to the Americans. Consequently, Hanover rose up his bombing priorities because it meant destroying a relevant target through area attack. In so doing, this city conformed to the Air Ministry's latest instructions, for on 3 September, Bottomley issued to Harris a reminder about fulfilling his *Pointblank* obligations. This stated that alongside the broader goal of 'the progressive destruction and dislocation of the German military, industrial and economic system' was the need to reduce German air strength as 'a prerequisite' to *Overlord*;³⁰ handily, Hanover seemed to fulfil both objectives, a sort of 'happy medium' between *Pointblank* targets and Harris' objectives of Germany's major industrial cities. Though seemingly just a basic reiteration of the overall aim, Bottomley's letter was representative of Air Staff concern about the direction and costs of the CBO; that after three raids in ten days, Berlin had seemingly become the major (and costly) focus of Bomber Command, whilst the Americans had endured heavy-losses over Schweinfurt in August and had continued to sustain significant casualties through September. Indeed, on 6 September, Coryton told Bottomley about having spoken to the Deputy-C-in-C Bomber Command, Air Vice-Marshal Robert Saundby, who had told him that 'Schweinfurt was still well up on their list of priority of targets but that Berlin had the full focus of the limelight at the present'³¹ – though Harris would pull back from the German capital within days. For these reasons, the Air Staff increasingly pressed HQ Bomber Command to make a direct contribution to *Pointblank* by attacking German Air Force (GAF) targets. Moreover, the Air Staff had examined the CBO's progress up to 31 August and drawn some negative conclusions. Bufton wrote 'no priority target, e.g. towns associated with fighter production, has been attacked', yet 'now that operations involving deeper penetration are being carried out there would seem to be every reason for adhering to the plan' by attacking cities connected to German aircraft production.³² Given this context, in Harris' mind Hanover seemed to fit the bill perfectly. It had a large urban area, an old city centre (*Altstadt*), relevant GAF targets, and other war industries – in other words a perfect target for the 'catch-all' technique of area bombing.

Moreover, it did so because MEW's experts at that precise moment had been analysing the entire Axis tyre industry. The focus was not just on *Continental* in Hanover, but also included the *Dunlop* factory at Montluçon (France), whose output constituted 'about 9%' of the tyre production available to Germany.³³ With the Axis rubber industry being championed by the Air Staff as a primary target-system, it was little surprise Harris soon targeted Hanover following an attack on the French target on 15/16 September. Hanover was a target whereby area bombing coincided with fulfilment of Air Staff wishes for attacks on GAF targets, or so it seemed to HQ Bomber Command at the time. Indeed, to secure Harris' cooperation urgently – the Air Ministry having produced estimates that German air strength stood at 780 single-engined fighters and

740 twin-engined nightfighters – Bottomley on 26 September placed less emphasis on the smaller and more specialist targets of Schweinfurt and Gotha and instead promoted attacks on the larger industrial cities concerned with aircraft production, namely Brunswick, Stuttgart, Kassel, and Hanover.³⁴ Therefore, both the Air Staff and HQ Bomber Command had, in late-summer 1943, seen the need to bomb Hanover but both had taken different paths to arrive at this conclusion.

Harris later described this period of the bombing offensive in which 'towns were now being chosen for attack because they were centres of German aircraft production'.³⁵ He did not refer to Hanover by name, for good reason as highlighted later, but the city would be an example in Harris' defence of area bombing, in which he claimed quite correctly had caused damage to Germany's war industry, including its aircraft production. The Air Staff became increasingly sceptical and, as shown below, a schism between the two sides would open up during the Battle of Hanover's duration.

On 22 September, Harris made the decision to attack *Eel* (Hanover's codename)³⁶ that night, with the aim being 'to cause maximum damage in target area'.³⁷ The Battle of Hanover thus commenced and lasted from 22/23 September to 18/19 October. The opening attack saw a sizeable force of 711 bombers sent,³⁸ and although twenty six aircraft (3.7%) were lost, in itself below the 5% threshold, this attack would prove to be the least expensive of the Hanover operations. Indeed, the subsequent attacks revealed all too clearly the dangers of returning to the same target on a regular basis. The opening attack was conducted in good weather yet most of the bombs missed the town centre and had fallen on the southern suburbs or surrounding countryside, and it was considered by HQ Bomber Command a failure. For Harris, well into the city centre 'groove', this performance was viewed with considerable alarm and, as will be shown, it also caused some soul-searching throughout the Command over what had gone wrong.

In between 23/24 and 26/27 September, Hanover was considered for attack on two occasions. The first time saw Harris, concerned by the poor performance of the Pathfinders and *H2S* the previous night, select Mannheim instead – the scene of an impressive *H2S*-led attack some 2½ weeks before. Three nights later, Hanover or Bochum was earmarked for attack, but both were cancelled late in the afternoon. Air Vice-Marshal George Brookes, AOC-in-C (RCAF) 6 Group, recorded this was because 'the weather turned dud in target area'.³⁹ This suggested HQ Bomber Command at this time maintained little faith in its blind-bombing technique – a method that became both all too familiar and all too predictable during the forthcoming campaign against Berlin. The second raid on Hanover was instead made in clear weather on 27/28 September by 687 aircraft. This attack was even more costly, with 38 aircraft missing (5.6%), and losses were especially high for the non-Lancaster operators, with ten Stirlings, seventeen Halifax Mk.II/V, and one USAAF B17 lost. The bombers missed the aiming-point in the city centre by between one to five miles, but some bombs fell on Hanover's new industrial area north of the Weser-Elbe causing considerable damage to factories, especially *Hanomag's*

modern plant.⁴⁰ Branded another failure, however, it showed all too clearly that HQ Bomber Command's yardstick of success remained damage to a city centre, not its industrial suburbs.⁴¹ Yet few could deny that the bombing accuracy, in terms of where it was *intended* to have fallen, had not been good.

| Date: | Possible targets: | Time target confirmed: |
|-----------------|---|--|
| 22/23 September | Target Area I: Hanover & spoof raid on Oldenburg Area II: Bochum | 1450: Target confirmed as Area I |
| 23/24 September | Target Area I: Mannheim & spoof raid on Darmstadt Target Area II: Hanover | 1305: Target confirmed as Area I |
| 26/27 September | Target Area I: Hanover Target Area II: Bochum | 1700: both operations cancelled |
| 27/28 September | Target Area I: Hanover & spoof raid on Brunswick Target Area II: Kiel & spoof raid on Wismar | 1320: Target confirmed as Area I |
| 29/30 September | Target Area I: Baltic Gardening & Hanover Target Area II: Bochum | n/a: weather conditions scrubbed gardeners & Hanover. Lancasters detailed to attack Bochum |
| 8/9 October | Target: Hanover & diversionary raid on Bremen | n/a |
| 18/19 October | Target Area I: Hanover Target Area II: Gelsenkirchen | 1620: Target confirmed as Area I |

Chart I: Battle of Hanover: attacks and cancelled operations.⁴²

Given the high-losses suffered, few aircrew welcomed a return to this city on 8/9 October. One bomb-aimer on 158 Squadron, Flt Lt G P Dawson, recorded 'none of us were very keen on this trip. Hanover was a costly place to visit'.⁴³ And so it proved again, as 27 aircraft (5.4%) failed to return – 13 being Halifaxes – from the 504 aircraft despatched (which included the venerable Wellington on its last German operation). The bombers had been sent in poor weather, with Brookes describing it as 'much haze and smoke all day. Smoke terrible & increased by sundown. Aerodromes yellow by 2100 [and] . . . weather looked quite dud for us, poor vis., with possibility of fog later, however, the operation stood & away they went'.⁴⁴ In truth, 6 Group should probably not have operated that night, but Harris no doubt wanted to slay the Hanover bogey at the earliest opportunity. Ultimately, it was a gamble that paid off, for the attack caused widespread devastation in central Hanover. One account by a local citizen described this as '*Der schwarze Tag*',⁴⁵ whilst a more official German record implied a 'firestorm' raged throughout the city centre:

0440 hrs. Gauleiter Hannover reports to Bormann and Goebbels: 3/4 Quadrat [sic] kilometre is on fire. The blaze is so fierce that it is in many cases almost impossible to rescue people who have been surrounded by it. Number of homeless tentatively reckoned at 150,000 to 200,000. *Katastrophen*.⁴⁶

As HQ Bomber Command noted, the fires 'spread over an elliptical area 2 miles long by a mile wide' and in total destroyed 'about 54% of the fully built-up area of the town'. Within this lay damage to the main railway station, tracks, engine sheds and rolling-stock, alongside 'exceptionally severe' destruction to the city's industries, particularly to *Continental's* old works at Hainholz (Priority 1+) and *Hanomag's* main site at Linden (Priority 1)⁴⁷ – a reminder of just how damaging area bombing could be to industrial plants and factories. Given this terribly destructive outcome, which followed the two previous unsuccessful attacks, it was little wonder Harris dispatched a personal message to aircrews stating:

The last attack on Hanover was an outstanding success for us and another major catastrophe for Germany. Good show. A few more like this and the Boche will break.⁴⁸

Elsewhere, the War Cabinet had been informed that 'damage on the Hamburg scale was inflicted at Hanover',⁴⁹ an observation that only served to add credibility to Harris' promise to Churchill, namely that Bomber Command would be able to destroy Berlin to win the war.

After a pause due to the phases of the moon, Harris launched the final attack on 18/19 October. The Operations Record Book (ORB) of 83 Squadron recorded this decision 'came as a slight surprise in view of the pounding this town has received, but the devastation is not as complete as that at Hamburg, so our warriors set out to complete the write off'.⁵⁰ An all-Lancaster force of 360 aircraft was dispatched, but it proved a most unsatisfactory encore, with 5% (18 Lancasters) lost; 103 Squadron itself losing three. These losses had come at the hands of an enemy who had been hampered by the weather, but had not been fooled by the Mosquito 'spoof' raid on Berlin. Moreover, thick cloud over Hanover had led to scattered bombing, though once again HQ Bomber Command showed its particular way of defining what constituted success in its attacks, for the Command's Digest stated '[s]everal important factories, including Continental Gummi Werke (rubber and tyres) and Hanomag ... have been hit as well as railway buildings and gas works, but no further extensive housing devastation has been caused'.⁵¹

In sum, while the Battle of Hamburg had comprised four attacks to complete that city's destruction, the Battle of Hanover represented four *attempts* at destroying this city. But in his letter to Churchill on 3 November 1943, Harris chose to say Hanover, listed as being within the geographical target-system of 'The Berlin Road', had been 'Virtually Destroyed'.⁵² Based on HQ Bomber Command's own definition of this term, namely 'devastation to a degree which makes the objective a liability to the total German war effort vastly in excess of any assets remaining',⁵³ it was an over-inflated claim. At best, damage to Hanover's industrial production saw only a

temporary decline, which lasted about two months. Yet making such a case was vital for Harris given that he was ready to embark on the Berlin offensive, knowing that the Air Staff's support of the city bombing programme was wavering. In so doing, the C-in-C Bomber Command succeeded in achieving a short-term victory against the Air Ministry, for on 12 November he received from Churchill the War Cabinet's congratulations on 'the recent successes of Bomber Command, whose deeds in the first week of October mark yet another stage in the offensive against Germany'.⁵⁴ Sensing this amounted to encouragement, if not an actual 'green light', to commence the Battle of Berlin, Harris wrote back immediately:

All ranks of Bomber Command are greatly heartened by the message conveyed by you from the War Cabinet. With *your* [author's emphasis] unfailing encouragement which armed and supported us through our darkest hours . . . [means] every bomb which leaves the racks makes smoother the path [to final victory].⁵⁵

Yet for all the flowery rhetoric and grandiose promises, the issue of whether Bomber Command could do so represents the central focus of this article. For a case can be made that owing to several reasons, Bomber Command's indifferent performance against Hanover meant the prospect of success against Berlin hung in the balance even before the campaign began. Notwithstanding his statement to Churchill in early-November that this could be achieved, only weeks earlier Harris himself had complained to Portal that 'we are having far too many shows of the Hanover and Kassel variety which partially miss the boat'.⁵⁶ This comment was attributable to continued weaknesses of Bomber Command, namely its ability to mark the target and the continual inconsistencies of *H2S* when used as a bombing-aid. Added to this was a third factor, which centred on the growing ineffectiveness of British tactics and technical devices to protect against German nightfighters.

Certainly, Harris had every right to be concerned about 'missing the boat' over Hanover. For two out of the four Hanover attacks revealed the continual difficulties of target-marking, whilst a third showed all the uncertainties of the blind-bombing technique. Worryingly, the 22/23 September raid had occurred in good visibility, with little cloud over the target, and should have allowed the attack's colour-coded procedure – Red (target area colour), Yellow (aiming-point colour) and then Green (bombing colour) to have been successful. But instead the initial target indicators were dropped all over the place. This was due to a 60mph wind at altitude near Hanover that caused the 'blind-markers' to approach the city on the wrong track, and rendered inaccurate their calculations based on a dead-reckoning run from the Steinhuder Meer.⁵⁷ Consequently, the red Target Indicators (TIs) were dropped some 3-4 miles south-east of the aiming-point, with the limitations of *H2S* on this target unable to rectify the error, although the 'visual-markers' nearly saved the situation by releasing their yellows accurately on the aiming-point. But the real problem lay with the 'backers-up' who simply dropped their greens on the greatest concentration of TIs first found, which were the reds, rather than reinforcing the yellows. The ORB of one Pathfinder squadron recorded:

[this] was one of the worst PFF raids ever, and TIs were scattered, most of the bombing being south of the target. The main force did not undershoot, and we know now the attack was a decided failure. The fault lay with PFF who were not meticulous in this timed run.⁵⁸

Indeed the Main Force, aiming at the misplaced greens, dropped its 2,500 tons of bombs some 2-9 miles south-south-east of the aiming-point, missing the city centre and Hanover's main industrial area completely, and falling instead on the southern suburb of Döhren-Wülfel and in open country.⁵⁹

In an attempt to achieve greater bombing accuracy, Bomber Command used the technique of making a timed-run from a recognizable landmark on 27/28 September. But this method did not lead to improved results. 'The reason for the inaccuracy is not known', HQ Bomber Command noted later, 'but errors in the run from the Steinhuder Meer may have caused the selection of the wrong part of the straggling built-up area of Hannover and its suburbs',⁶⁰ which once again *H2S* had frustratingly done little to help correct. Consequently, central Hanover was insufficiently illuminated to enable the visual-markers to identify the aiming-point as the red TIs were dropped some 1½-4 miles north or north-east of the aiming-point. The backers-up, though achieving a good concentration in the placement of their green target-markers, would be drawn north of Hanover, and so was the main bombing.⁶¹ This showed that target-marking, on a sprawling city located inland, was a difficult prospect which *H2S* had done little to assist. One pilot from the Halifax Pathfinder squadron (35 Squadron), the Norwegian J K Christie, who later rose to Major General, described his crew's performance as 'very bad indeed (Dropped Everything)'. Initially believing they 'had done very well', the following morning it was revealed they had dropped their markers 4½ miles from the aiming-point. 'This sort of mistake is just about the worst one can do in PFF, and a very dim view was taken by all concerned',⁶² he lamented. It certainly was, and condemnation came right from the top. 'The attack on Hanover was a complete flop; Harris' message to 8 Group aircrews began, because:

... the great majority of PFF crews must have discarded their own navigational reckoning and the indications of their aids and following blindly, if not lightheartedly, on to misleading markers and incendiaries ... I cannot too strongly impress upon every Pathfinder crew their individual responsibility for making as sure as possible by their own reckoning and aids that they are on target before blindly joining in and thus making confusion worse ... What happened at Hanover is a lesson which you no doubt will take to heart in future.⁶³

Nonetheless, having made what Harris described as 'the worst failure we have had yet'⁶⁴ it was hardly an encouraging sign of the ability to accurately bomb particular areas of Berlin. The Main Force did not escape criticism either, as night photographs had shown the headings of many aircraft to have been 'all over the compass'. This, Harris complained bitterly, was because:

Not the slightest attempt appears to have been made by the majority of crews to approach Hanover on the heading laid down. Many were in fact on the reciprocal. The added collision risk is serious enough but all chances of successful concentration are also nullified by such wholesale disregard of orders by captains. It is obvious that navigation has been largely abandoned by lost crews in favour of a rough system of running a course until they see someone bombing somewhere and joining in regardless of reckonings. Unless AOCs take a firm grip now and put this deplorable state of affairs right we are faced by a prospect of wasted effort, futile casualties and consequent failures, which cannot be.⁶⁵

Such a critical assessment, incisive and to-the-point, about the Main Force's standard of navigation showed considerable improvement had to be made before the Battle of Berlin restarted within weeks.

Concerned by the criticism, Bennett responded to Harris' complaints, thus sparking a series of letters between the two about the PFF. Believing the Hanover failure had made 'it advisable for me to do a "stock-taking" of the state of the Path Finder Force', it developed into a lengthy complaint about the quality of the personnel being acquired by 8 Group. The selection policy of 'nothing but the best' was not being adhered to, Bennett complained, because a third of crews posted to the PFF were rookies, not seasoned veterans. That this was occurring was because some Groups, especially Cochrane's 5 Group, had developed a habit of retaining their best/most experienced crews, an accusation which contained some truth. The AOC 8 Group ended by suggesting a number of remedies: that the original PFF recruitment policy should stand; all second and third tour aircrew should be made available; there should be no direct intake of new crews; and on a technical note the 3-cm version of *H2S* had to be operational urgently.⁶⁶ Harris responded six days later, and dealt with Bennett's points in turn. The tone was cordial enough but the message was clear: the PFF's training and marking performance had to improve. Yet on the complaint about other Groups retaining their best crews, Harris' response was surprisingly glib, telling Bennett to 'not take too seriously the remarks of anyone in Main Force Groups who says that he can find crews which can beat the Pathfinders at their own game. This sort of thing arises from a spirit of rivalry, which, up to a point, is no bad thing'.⁶⁷

But such a view was complacent. Behind-the-scenes, the Directorate of Bomber Operations took more seriously Bennett's complaints about crews being 'not as good as they used to be and that he is unable to train them sufficiently'. 'With the advent of winter', Bufton was informed, 'this will become worse unless a solution be found'.⁶⁸ This no doubt reflected the Directorate's increasing anxiousness for Bomber Command to target specific industries, such as Schweinfurt's ball-bearing factories. Moreover, Bennett and Cochrane were becoming increasingly bitter rivals from this time, which was detrimentally affecting operational performances. One author writes that the 22/23 September attack had seen 8 Group test 5 Group's idea of time-and-distance runs – a technique that had led to poor results. The fact

this method was again tried two days after Harris' letter on 25 September, and had led to 'a worse error' being committed 'on the same town was an impossibly bitter pill for Bennett'.⁶⁹ Yet behind the personal aggravation lay the harsh fact that Bomber Command had not the technical capability to carry out the method Cochrane advocated. For without a Ground Position Indicator (GPI), timed-runs from particular landmarks were extremely difficult to do. All concerned were no doubt relieved when on 8/9 October a better performance by the PFF saw accurate ground-marking, and a better performance by the Main Force saw flight paths correctly maintained, bringing them over the well-placed TI's on time. It was little wonder Harris sent two congratulatory messages to his crews on 10 and 12 October respectively, with the latter stating 'the whole of the centre of Hanover and much else besides has been burnt out. Some of it is still burning. Well done'⁷⁰ (see *Map III*).



Map III: Extensive fire damage to Hanover's city centre on 8/9 October (shaded area)⁷¹

Yet the relief was premature, for the 'Hanover problem' soon came back to haunt the Command. The 18/19 October operation revealed another difficulty with target-marking, namely doing so in thick cloud. On this night, only 50 Lancasters from 360 despatched had bombed within three miles of the aiming-point – a statistic that showed all too clearly the problem encountered. Indeed, the performance was sufficiently bad that there was an inadequacy of night-photographs, which the Bomber Command Raid report noted 'makes it impossible to reconstruct the raid in detail'; moreover no bomb-plot chart could be issued either. The disappointing outcome had occurred because half the 'blind-markers' had dropped *both* yellow TIs and sky-marker flares, which caused mounting confusion among the aircraft following over exactly which to bomb, and the 'visual-markers' could not offer any clarification because of the cloud up to 22,000 ft, thus retaining their red TIs.⁷² In the scathing, if somewhat witty, remark of 83 Squadron's scribe 'there was a popular song called "It's getting to be a habit with me" which might well be adopted as the Squadron's theme song . . . [Y]et another shambles'.⁷³ Consequently the Main Force arrived to find no concentration of red TIs could be seen, and they simply dropped their bombs on any cluster of markers they came across or by the uncertain method of the ETA.⁷⁴ This attack highlighted the question of what precisely the Main Force should do if a concentration of sky-markers could not be seen? It was a scenario that needed addressing quickly, for it was inevitable that it would become the primary method for Berlin operations during the winter. Skymarking allowed some damage to be inflicted on German cities on nights of poor weather, which was itself something of an achievement, but unless the technique saw dramatic improvement to bring about a more concentrated attack it would not deliver the devastation Harris hoped, or required, to completely destroy Berlin's urban areas.⁷⁵

Of course, *H2S* had been perceived to assist with bombing accuracy on these longer-distance operations into Germany. Back in June 1943 Harris had claimed optimistically that 'when we begin to work outwards from the Ruhr again that *H2S* will really come into its own',⁷⁶ but therein lay the problem. Against some targets it performed well, such as over a small city having a river flowing through it (e.g. Mannheim) or on a port where the contrast between the land and sea (e.g. Hamburg) was identifiable. Less successful was its performance over Berlin during August and September, whose sheer size meant it was difficult for *H2S* to identify specific parts of the 'Big City' and the screen simply became 'fogged' by the sheer vastness of the built-up area. 'Until we got the new types of *H2S*', Harris later wrote, 'I considered it better to attack other cities which we had a much greater chance of destroying'.⁷⁷ But Hanover was hardly an easier target for *H2S* because it revealed additional limitations. First, the Raid Report for the 22/23 September operation described Hanover as 'a straggling town', and consequently crews chose the wrong *H2S* image to interpret as the town centre.⁷⁸ All this showed that, in autumn 1943, *H2S* was a temperamental instrument on which to rest the fortunes of the British bombing offensive (see *Appendix*). Indeed, on 29 October, Harris informed Street about his Command's operational experience of *H2S*; the record, the C-in-C described, was mixed, and 'in some instances it has resulted in the main concentration of the attack falling outside the built-up area'.⁷⁹ Second, the attacks on

Hanover, with its heavy air defences and particularly stiff fighter opposition, had exposed another problem of *H2S*, which was a lesson for Berlin, namely 'the difficulties of interpreting *H2S* responses under operational conditions, i.e. during evasive action'. Quite simply, this caused the ground image to become considerably distorted. Third, the most salient operation for the weather likely to be encountered (and was) over Berlin was the last Hanover operation of 18/19 October but *H2S*, Harris stated, had proven 'insufficiently accurate' to mark the aiming-point. Yet despite its shortcomings, the C-in-C maintained that 'for long range targets, *H2S* is the only suitable device available for marking or blind bombing purposes'. The key word here is 'only', as opposed to 'suitable', for although it was an inconsistent tool *H2S* could still be useful, especially if 3 cm sets could be provided 'without delay' and in substantial numbers.⁸⁰ Nonetheless, doubt remained as to how effective Bomber Command could be in the forthcoming Battle of Berlin. After all, as Webster and Frankland noted that 'area bombing was not, as is often supposed, simply a question of spilling bombs at random over large towns, though even that had been difficult enough in the past. If they were to be effective, area attacks had to be not merely heavy, but also accurate and concentrated', which, in turn, required high-standards of bomb aiming.⁸¹ Harris was not unaware of this and, a day before writing to Churchill about the forthcoming Battle of Berlin, he told Portal that from four attacks two were 'likely to be partial successes', one 'a complete failure' and the other 'an outstanding success'.⁸² This perception, applied to the Battle of Hanover, was an over-generous evaluation with the 'partial successes' being in fact 'total failures'. Harris was therefore left to place faith in 3 cm *H2S* making two out of four attacks 'highly successful',⁸³ although in reality it proved of little value in the forthcoming winter offensive.

The Battle of Berlin became synonymous with heavy losses, but the costs of attacking cities deeper inland, in the face of not having air superiority, had been all too apparent during the Battle of Hanover only weeks before. As F H Hinsley stated, 'Bomber Command's casualties began to return to the disturbing level reached during the Battle of the Ruhr', despite the lengthening hours of darkness and extensive use of counter-measures. The 'immediate explanation', wrote the author, was the continuing increase in German nightfighter strength.⁸⁴ This was true, but so too was the fact that the Luftwaffe's capabilities were increasingly strengthening during this time, all of which meant Hanover – located about 140 miles west of Berlin – proved a beastly target for Bomber Command. *Chart II* shows the campaign against this city cost 109 bombers (4.8%), which compared to the missing rate of the Battle of Hamburg – also comprising four attacks – of 87 heavy-bombers (2.85%) and the opening three raids of the Battle of Berlin in August/September 1943 that saw 125 bombers (7.4%) missing. Raids on Hanover were more costly than attacks on heavily-defended Essen, which during the Battle of the Ruhr had seen 92 aircraft missing from 2,070 sorties (4.4%) against 'the home of Krupps';⁸⁵ this clearly demonstrated the increased risk of making attacks deeper into Germany even before Bomber Command commenced its campaign against Berlin.

| Bomber battle: | Raid 1: | Raid 2: | Raid 3: | Raid 4: | Total a/c dispatched, lost & final average % lost: |
|--|---|---|---|---|---|
| Battle of Hamburg | 24/25 July | 27/28 July | 29/30 July | 2/3 August | |
| (a/c dispatched): | 791 (347 Lancasters; 246 Halifaxes; 125 Stirlings; 73 Wellingtons) | 787 (353 Lancasters; 244 Halifaxes; 116 Stirlings; 74 Wellingtons) | 777 (340 Lancasters; 244 Halifaxes; 119 Stirlings; 70 Wellingtons; 4 Mosquitoes) | 740 (329 Lancasters; 235 Halifaxes; 105 Stirlings; 66 Wellingtons; 5 Mosquitoes) | 3095 |
| (a/c lost): | 12 | 17 | 28 | 30 | 87 |
| (% lost of a/c dispatched): | 1.5% | 2.2% | 3.6% | 4.1% | 2.8% |
| Opening Phase of Battle of Berlin | 23/24 August | 31 August/ 1 September | 3/4 September | <i>n/a</i> | |
| (a/c dispatched): | 727 (335 Lancasters; 251 Halifaxes; 124 Stirlings; 17 Mosquitoes) | 622 (331 Lancasters; 176 Halifaxes; 106 Stirlings; 9 Mosquitoes) | 320 (316 Lancasters; 4 Mosquitoes) | <i>n/a</i> | 1669 |
| (a/c lost): | 56 | 47 | 22 | <i>n/a</i> | 125 |
| (% lost of a/c dispatched): | 7.7% | 7.6% | 6.9% | <i>n/a</i> | 7.5% |
| Battle of Hanover | 22/23 September | 27/28 September | 8/9 October | 18/19 October | |
| (a/c dispatched): | 716 (322 Lancasters; 226 Halifaxes; 137 Stirlings; 26 Wellingtons; 5 B-17s (US)) | 683 (312 Lancasters; 231 Halifaxes; 111 Stirlings; 24 Wellingtons; 5 B-17s (US)) | 504 (282 Lancasters; 188 Halifaxes; 26 Wellingtons; 8 Mosquitoes) | 360 (360 Lancasters) | 2263 |
| (a/c lost): | 26 | 38 | 27 | 18 | 109 |
| (% lost of a/c dispatched): | 3.6% | 5.6% | 5.4% | 5.0% | 4.8% |

Chart II: Losses incurred during Bomber Command's battles of summer and autumn 1943 ⁸⁶

As *Chart III* shows, particularly gruesome were the Halifax and Stirling losses, which mostly were above the 5% threshold, and these statistics revealed clearly the vulnerability of Harris' force by autumn 1943. It was no coincidence that, on 26 October, Harris requested that factories producing Stirlings and Halifaxes be switched over to producing Lancasters, but this was refused.⁸⁷ Nevertheless, it was clear that one month before the Battle of Berlin re-started, Bomber Command contained a considerable number of sub-standard aircraft, whilst the Lancaster force, about 360 strong, was hardly sufficient to destroy the German capital on its

| Battle of Hanover | 22/23 September | 27/28 September | 8/9 October | 18/19 October | Total of type dispatched; lost; (% dispatched) |
|--|------------------------|------------------------|------------------------------|----------------------|---|
| Number of Halifaxes dispatched: lost: (% dispatched): | 226 12 (5.3%) | 231 17 (7.6%) | 188 13 (6.9%) | N.O. | 645 42 (6.5%) |
| Number of Lancasters dispatched: lost: (% dispatched): | 322 7 (2.2%) | 312 10 (3.2%) | 282 14 (5%) | 360 18 (5%) | 1276 49 (3.85%) |
| Number of Stirlings dispatched: lost: (% dispatched): | 137 5 (3.6%) | 111 10 (9%) | 0 (operating against Bremen) | N.O. | 248 15 (6%) |
| Number of Wellingtons dispatched: lost: % dispatched): | 26 2 (7.7%) | 24 1 (4.2%) | 26 0 0 | N.O. | 76 3 (3.95%) |
| Number of Mosquitoes dispatched: lost: % dispatched): | N.O. | N.O. | 8 0 0 | N.O. | 8 0 0 |
| Number of US B.17 dispatched: lost: % dispatched): | 5 0 0 | 5 1 (20%) | N.O. | N.O. | 10 1 (10%) |

Chart III: Losses by aircraft type (Note: N.O. = not operating)

own. Harris recognised this, and authorised a search throughout the Command to find more Lancasters, whose low number was a consequence not just of operational losses but also because of sluggish production by Avro’s factories during the summer and autumn.

The immediate solution, as Harris told Air Vice-Marshal E A B Rice on 21 October, was for 1 Group to train aircrews on Stirlings and Halifaxes at HCUs before attending a Lancaster Conversion Unit for a final course on landing and take-off procedures. It was far from an ideal solution, as it involved training on one type and operations on another. But it was the best compromise available for quickly releasing the 150-odd Lancasters tied-up in training units, though it overlooked the fact that some of these aircraft would have been old, worn-out examples, already cast-off by front-line squadrons. Nonetheless, Harris was desperate to

railroad through this measure, telling Rice ‘to accept this decision as a matter of force majeure against which no arguments can be allowed to prevail’.⁸⁸ This stemmed from the C-in-C’s logic that as ‘the Stirling drops approximately 26 tons of bombs for the loss of a crew, the Halifax 30 tons and the Lancaster 130 tons’, every example of the latter type needed to be employed on operations, not training. Doing so achieved not just the ‘direct gain’ of a greater bomb tonnage on the target, but also the ‘negative gain’ of saving the vulnerable Stirling and Halifax from the further casualties that the Battle of Hanover had showed were likely to be incurred on longer-distance operations.

Yet given the future direction of operations, which involved deeper penetrations into Germany, it must be asked, why did the Battle of Hanover prove so costly? *Chart IV* shows the number of guns defending certain areas, which not surprisingly were formidable in the Ruhr, Hamburg and Berlin. Yet calculated another way, although Hanover had three times fewer guns than Berlin, it was seven times smaller than the German capital. This meant Hanover had a ratio of about 7.2 gun-batteries every square mile, whilst Berlin’s figure comes out at 2.4 gun-batteries for every one square mile. Put this way Hanover comes out as a heavily-defended target, and therefore it must be asked as to how the city’s flak defences performed?

| <i>Target</i> | <i>Heavy A.A.</i> | <i>Light A.A.</i> | <i>Searchlights</i> | <i>City Area (sq. miles)</i> | <i>Approx. Ratio of guns to sq. miles</i> |
|------------------|-------------------|-------------------|---------------------|------------------------------|---|
| Berlin | 440 | 400 | 245 | 345 | 2.4 : 1 |
| Hamburg | 260 | 320 | 130 | 89 | 6.5 : 1 |
| Hanover | 154 | 220 | 120 | 52 | 7.2 : 1 |
| Ruhr Area | 750 | 1000 | 400 | 1,000 | 1.75 : 1 |

Chart IV: Air Staff figures on German flak defences ⁸⁹

The first attack saw considerable searchlight activity alongside moderately intense heavy-flak fired in barrage form, but these ground defences lessened once the bombing began. Consequently, only five aircraft were lost to flak although a further 18 were damaged.⁹⁰ By the time of the next attack, the air defences had been strengthened by railway-mounted AA batteries quickly dispatched to the city. A greater number of guns allowed the flak to be fired in barrage form up to 19,000 ft, complemented by the many active searchlights. But notwithstanding this, no bombers were shot down although 22 bombers were damaged. Once again, the flak had decreased during the attack, and the aircraft coned during the later stages were hardly fired on. This occurred not just because the flak-gunners took cover but also due to German tactics that saw nightfighters orbiting searchlight beams.⁹¹ This trend of Hanover’s AA defences transitioning during the attack to aid the Luftwaffe’s nightfighters was again seen on 8/9 October when ‘towards the close of the attack, small cones were formed in a line across the target, presumably to help [the] fighters’.⁹² With only eleven aircraft damaged on the final operation,⁹³ clearly the Germans believed their nightfighters remained the most

effective means of downing British bombers and, as a result, Hanover's flak defences, though strong, were not responsible for Bomber Command's substantial losses in this bomber battle.

Instead, an overwhelming proportion of the 109 bombers lost were caused by nightfighters, for the Battle of Hanover showed the Luftwaffe had quickly recovered from its summer 1943 slump through tactical innovations that made Bomber Command's operations ever more costly. As Hinsley noted, autumn 1943 saw 'new methods of interception which, circumventing the counter-measures which the British had introduced against its previous methods of interception, enabled it to inflict increasing casualties on the bombers'.⁹⁴ This meant, Hinsley continued, 'the British were disappointed in their hope that the Germans would take between six months and a year to overcome *Window*', and the Battle of Hanover in fact came at the start of its lessening effectiveness. For the Luftwaffe had switched all single-engined aircraft and increasing numbers of twin-engined nightfighters on to free-lancing tactics (*Wilde Sau*). This method was first tried on the Cologne operation of 3 July 1943, but had developed over the summer to become impressively effective by the time of the Hanover operations. It had been adopted precisely because it freed the Luftwaffe's nightfighters from reliance on those elements that *Window* had affected most, namely ground-radars. Now, German aircraft gathered at radio beacons to await information broadcast on a 'running commentary' on the whereabouts of the bomber-stream and its likely destination. Moreover, the beacons allowed nightfighters from all over the Reich to be airborne, ready to swoop on the bomber-stream. Once the bombers' target was ascertained, the German nightfighters were released to attack and consequently this turned the target area into the main place for interceptions and combats. To counter this, Bomber Command adopted a new tactic on this night, designed to *confuse* the enemy air defences, namely the large decoy operation (as opposed to the usual small-scale Mosquito 'spoof' attack), which in this case saw eight Mosquitoes and 21 Lancasters sent to Oldenburg, a target just beyond the route followed by the Main Force. This counter-measure had been discovered by accident on the Mannheim operation of 5 September when the British, monitoring the Luftwaffe's radio commentary, saw that their losses had been minimised because the German controller had made the mistake of sending the nightfighters to Nuremberg.⁹⁵ Thus, HQ Bomber Command concluded *Wilde Sau* fighters could be assisted in flying in the wrong direction by diversionary attacks. So, on this night, had the Oldenburg diversion worked? The answer was not really, as the post-raid report presented the picture of what transpired:

At one point all fighters were ordered to Berlin, and this probably reduced the number of attacks reported in the target area. A total of 102 interceptions were reported, the majority being near or over the target itself. Of the 38 attacks, 22 occurred within 20 miles from the target on the return.⁹⁶

Reading between the lines the message here was concerning. For it showed the defenders possessed a tremendous ability to recover quickly and make the target area extremely active, where 'most of our losses' occurred.⁹⁷

But HQ Bomber Command did not draw this conclusion, and the next Hanover operation on 27/28 September saw the main bombing force adopt a 'straight-in' approach with a diversion on Brunswick. But as the post-raid report dryly admitted, 39 aircraft failing to return indicated Bomber Command's tactics had been somewhat short of 'partially successful', for the Germans had detected the bomber stream over the Zuider Zee, and although the Brunswick feint had succeeded in pulling away a substantial number of fighters during part of the attack, Hanover was considered as 'the possible objective very early'.⁹⁸ Therefore, as with the previous attack, it showed how speedily the nightfighters could leave the wrong area to intercept the British bombers. Moreover, in both operations, the Germans' speedy recovery was inadvertently helped by the diversionary target and main objective being too close to one another. This was shown by Wireless Intelligence that revealed the nightfighters had been ordered to Brunswick at 2154 hrs and, despite bombs dropping on Hanover at 2200 hrs, Brunswick was still believed to be the main target until 2208 when Hanover was finally identified. But the distance between the two cities was only about 35 miles – sufficiently close for the nightfighters to reach Hanover and intercept the later waves of bombers. Indeed, the British recorded 54 combats and 145 sightings of German aircraft around the target area⁹⁹ – these being of Ju.88s, Me.110s, Me.210s, Do.217s, Me.109s and Fw.190s, which clearly showed how all German nightfighter types had been switched to Wilde Sau tactics by this time.

On 8/9 October operation there was a much larger diversionary raid by 119 aircraft, mostly 3 Group Stirlings, to Bremen. The target made sense for this tactic because earlier that day the Americans had bombed the city's shipyards and Focke-Wulf factory, and Harris therefore hoped to mislead the defenders into believing the major effort was a follow-up attack. Initially, the Germans were fooled and all nightfighters were ordered to Bremen. But the problem was that Bremen lay near to the route of the main force going to Hanover (about 60 miles) – indeed the entire force had followed a similar track before splitting to head to their designated targets. Consequently the Luftwaffe ran into the bomber-stream near Hoya, roughly in between the diversionary target and main objective, and followed it to the main target. This meant the Luftwaffe possessed reliable information on the bombers' progress, and other nightfighters could be directed to intercept in the Hanover area where, the British noted, 'there were many observations of aircraft shot down'.¹⁰⁰ As a result, 27 aircraft were lost (5.4%), with tellingly the flak 'not expected to play a great part in actually destroying our aircraft' but designed 'to keep the bombers above a certain height, about which the fighters were warned'.¹⁰¹

Owing to the weather, the fourth Hanover operation would only be supported by small-scale Mosquito 'spoofs' on Duisburg and Berlin.¹⁰² Harris instead hoped that the tactic of sending an all-Lancaster force, unhindered by the 'weaker brethren' aircraft, would be effective in getting the bomber force to quickly sneak in and out of Germany. But the post-raid analysis showed how the Luftwaffe's tactics had evolved to counter this:

The running commentary picked out aircraft up in the neighbourhood of Groningen at 19.16 hours, and directed the fighters along the route in readiness to announce the

target as soon as it should be identified. At 2007 Hannover was announced after the first bombs had been dropped there. Combats and sightings of enemy aircraft were virtually confined to within 40 miles of the target area [on both journeys]. A very large, possibly a record number of fighters was active, but weather conditions subdued their efforts.¹⁰³

This suggested the Germans were transitioning to a new method, namely *Zahme Sau*. Central to this technique was early detection of the bomber-stream to nullify the British counter-measure of diversionary raids. At this time, Luftwaffe tactics were a hybrid of both methods, in which the bombers' destination was ascertained so single-engined aircraft could be utilised around the target, yet the desire to infiltrate the bomber-stream early meant the bombers' journeys through Germany could also be used for attacking purposes. The latter showed that technologically the Luftwaffe was not standing still, for its twin-engined nightfighters were now using a device called Benito and the SN-2 airborne radar to aid interception in the darkness found away from the brightly lit target area (owing to searchlights, target-markers and fires).¹⁰⁴ In essence, Bomber Command confronted an ever-more innovative enemy, one that in less than favourable weather conditions had still caused the loss of 18 bombers. Stephen Harris' observation that 'raids featuring smaller, all-Lancaster main forces and taking a short time to complete usually suffered relatively low casualties',¹⁰⁵ remains open to debate when applied to Hanover, for this target was an altogether tougher proposition compared to those places that all-Lancaster forces had been sent to in early-October, namely Hagen, Munich and Stuttgart.¹⁰⁶ On 18/19 October, the 5.0% loss rate showed Harris had got away with it – but only just. Even the impressive RV Jones overlooked the losses against Hanover and continued to over-state *Window's* effectiveness and the British ability to influence the 'running commentary' broadcast by the German controllers to the Luftwaffe's nightfighters.¹⁰⁷ Within weeks, Bomber Command was at the end of the 'Berlin Road' by concentrating its effort against the German capital, but it would encounter a Luftwaffe that had increasingly perfected its nightfighting techniques.

Overall, as *Chart I* shows, the losses on the first Hanover operation were manageable but the Germans soon got the upper-hand over the counter-measures the British could offer. This was shown by three operations, including two at Hanover, costing 5% or more, yet worryingly these high-losses had occurred on nights when, as the British themselves acknowledged, the Luftwaffe's efforts had been far from perfect. Nonetheless, it showed all too clearly the costs incurred when Bomber Command was undertaking medium-distance attacks without any kind of air supremacy, and had revealed the air war favoured the defenders, before long-distance trips to Berlin were resumed. It was hardly an optimistic outlook; indeed, it was little wonder that Harris, in that famous and oft-quoted line, warned Churchill that attacking Berlin would cost Bomber Command 400 – 500 aircraft. This figure came from the harsh operational experience of the Battle of Hanover only weeks before, with the 109 bombers lost on the four operations. Berlin, whose larger size required at least four times more operations to destroy, was clearly expected to incur about quadruple the losses.

If such attrition would, as Harris claimed, ultimately 'cost Germany the War' then the Battle of Hanover showed that attempting so might cost Harris Bomber Command.¹⁰⁸

The SAOG concluded that November 1943 was 'the time at which the chances of decisive success for the general area offensive had acquired their most promising aspect', which led Harris 'to intervene with a vigorous demand' for continuing this bombing policy to achieve final victory,¹⁰⁹ the Battle of Hanover showed the reality was, in fact, quite the reverse. Bombing using *H2S* remained an uncertain proposition, the Luftwaffe's nightfighter force was becoming stronger, and British bomber losses were mounting. Though the *Pointblank* Directive had been designed to help kickstart the American daylight bombing offensive to achieve air superiority as a prelude to *Overlord*, the costly British performance over Hanover, even before Bomber Command's considerable haemorrhaging of aircraft during the Battle of Berlin, showed that *Pointblank's* 'intermediate objective' was 'not only a general but also a Bomber Command interest'.¹¹⁰

Conclusion

The chronology of Bomber Command's campaign during 1943/4 was set of course by Harris himself in his *Despatch on War Operations* and postwar account *Bomber Offensive*, in which the 'Main Offensive' against Germany comprised a number of battles that went from the Ruhr, to Hamburg, to Berlin. But the former account was an official one designed to disabuse the doubters still existing in the Air Ministry about the efficacy of area bombing, in which successive failures like Hanover could hardly be elaborated on, if mentioned at all. Similarly, *Bomber Offensive*, published only two years after the end of the war, also saw the omission of the Battle of Hanover. Both accounts therefore left a lot unsaid. Consequently this meant Harris' chronology stuck and acted as the natural guide for many subsequent publications on the British bombing offensive.

Yet, the other key text, influential for shaping the future historiography was *The Strategic Air Offensive against Germany*. Webster and Frankland correctly, if briefly, examined the bombing offensive during autumn 1943 labelling it 'The Campaign on the Road to Berlin'. In so doing, they tantalisingly expressed some pertinent observations about Bomber Command during this time, but failed to relate them more pointedly to Hanover. Instead, they offered the general, if correct, assertion that 'anything beyond the range of *Oboe* remained for Bomber Command as a zone of relative inefficiency', which meant 'the outlook for the campaign which was now about to begin on the road to Berlin was, therefore, unpromising'.¹¹¹ Went unsaid was how this was shown all too clearly during the Battle of Hanover. Second, the SAOG's authors described the deceptive measures that Bomber Command deployed, which had been relatively successful during the Battle of the Ruhr. But, as they pointed out, 'the verdict' upon Bomber Command's tactical effectiveness lay in the subsequent phases of the campaign: Hamburg, 'the campaign on the road to Berlin', and over Berlin itself.¹¹² The reality was more specific, with the Battle of Hanover being the first clear sign of the problems of attacking targets that lay further inland, closer to the German capital. Finally, in showing how the

bomber battle examined in this article was overlooked, the official history concluded that '[not] until the Battle of Berlin opened in the middle of November [was] . . . Bomber Command again concentrated upon a single target as it had done in the Battle of Hamburg'.¹¹³ But as shown by the four attacks on Hanover over three weeks it was not for the want of trying. If not fully intended, it became a battle owing to Harris' determination to destroy this city. For the two September failures, which placed question marks against Bomber Command's capabilities – could not be allowed to go unanswered, especially as they had occurred immediately after the postponed Berlin campaign. Harris had to convince the doubters that he could indeed devastate the German capital, which in turn meant showing Hanover was not indicative of his force's limitations but simply an aberration. As a result, he placed great emphasis on the Hanover operation of 8/9 October, and also the destructive 'firestorm' raid on Kassel on 22/23 October, precisely because these attacks served an agenda in demonstrating that Bomber Command would be successful over Berlin. Yet the reality, taken from the evidence of all the Hanover operations, suggested otherwise.

Other authors on Bomber Command have not mentioned Hanover either, apart from two exceptions namely Martin Middlebrook and Max Hastings. As highlighted in the introduction, the former stated Hanover was a battle but added no further detail to strengthen this observation. Hastings meanwhile offered the valuable perception that high-losses meant 'Hanover now inspired almost as deep a fear as Berlin',¹¹⁴ but likewise provided no elaboration. Beyond these authors, Stephen Harris – in the majestic official history of the Royal Canadian Air Force – impressively analyses several of the Hanover raids and the tactical shortcomings of Bomber Command, including the problem of placing the primary and diversionary targets too close to one another. '[I]f the main force attacking Hanover on 22/23 September had not been so large and had done its business more quickly', the Canadian historian writes, 'there would have been no one left there for the fighters from Oldenburg to intercept'.¹¹⁵ In a more recent work, Richard Overy observed that 'the first 'Battle of Berlin' petered out until November in favour of less dangerous targets',¹¹⁶ which was certainly true, although Hanover was hardly a 'less dangerous' target as the statistics in *Chart II* shows.

Therefore, despite the occasional references to Hanover, this battle has remained forgotten. But Hanover resembled Hamburg, both battles involved a series of raids on the same target over a short space of time. Yet Bomber Command's mixed performance – at a critical moment in the British bombing offensive – meant it was little wonder Harris never depicted Hanover in this way. Instead, he (and many other writers) portrayed this period as being marked by a collection of successful 'one-off' attacks – Hagen (1/2 October), Hanover (8/9 October), and Kassel (22/23 October). Harris could not have done otherwise, for portraying Hanover as a battle told an altogether different story about his Command's capabilities on the eve of resuming the Berlin offensive, and might even put a serious question mark next to his judgement of having done so. Nonetheless, the Battle of Hanover is important to study; indeed it represents a valuable window into assessing Bomber Command immediately prior to the supreme test of all.

In his *Despatch*, Harris did precisely this, with an assessment of his force on two levels, namely the aircraft he had available and the effectiveness of *H2S*. On the first consideration, he wrote that by early November 1943 the Lancaster was the 'mainstay' of operations to Germany because the Wellington had become obsolete and the Halifax Mk's II/V and Stirling 'continued to be unsatisfactory'. The evidence from Hanover showed clearly just how Bomber Command's ranks remained swelled by vulnerable aircraft, which would still have to be used against Berlin. The C-in-C had little choice; to have operated only Lancasters would have meant sending a force of about 400 aircraft, which was hardly sufficient to 'wreck Berlin from end to end'.¹¹⁷ With regards to *H2S*' performance, Harris wrote it 'was incapable of really precise marking under any conditions'.¹¹⁸ It will be remembered the Berlin campaign had itself been halted to improve Bomber Command's capabilities at delivering a more accurate attack. Yet the evidence from the Battle of Hanover showed just how fickle *H2S* remained, and at least on two occasions being of little use in correcting errors made by the PFF target-markers. And that, worse still, target-marking on these occasions had been fatally undermined by an indifferent performance. Moreover, the device found it difficult to pinpoint the city centre of this sprawling city. Perhaps most critically, the device had shown itself to be of limited use for the marking-technique that ultimately would prove so critical over the German capital, namely blind-bombing. Notwithstanding all this, the AHB's narrative labelled the period from September to November 1943 as one of 'Improving Technique', but such a description can only be sustained so far.¹¹⁹

What then of Bomber Command's tactical and technical innovations for protecting the bomber-stream, which are important given that high losses had influenced the earlier decision to suspend the Battle of Berlin? Certainly, Hanover revealed all too starkly that *Window*, which had brought Bomber Command reduced losses over Hamburg, was in fact a very temporary triumph over the Reich's air defences. Consequently, autumn 1943 saw new tactics tried, such as diversionary raids and all-Lancaster operations, but losses mostly above the 5% threshold of acceptable casualties told its own story about the effects of British techniques when going further inland and encountering the Germans' increasingly effective methods of detection and interception. This period, in fact, saw the Luftwaffe not just recovering from the Hamburg setback, but also pioneering counter-measures that made mid-distance targets expensive, let alone the further one of the German capital. Initially, this came in the form of *Wilde Sau* whose impact reached its zenith during the Battle of Hanover, inflicting heavy-losses during the first three attacks. But as the fourth raid showed, the Luftwaffe's nightfighting tactics were far from stationary, as they clearly had begun using *Zahme Sau* against Bomber Command that involved detecting and intercepting the bomber-stream early owing to such devices as *Benito* and the new AI set, *SN-2*. This method would become ever more lethal during the forthcoming winter campaign. Thus, enhancing German capabilities and the corresponding high British losses inflicted during autumn 1943 fed back into British bombing strategy. As identified 'the crux was whether, as Sir Arthur Harris claimed, the Battles of the Ruhr, Hamburg and Berlin were parts of a decisive campaign which required only reinforcement and persistence or whether, as Air Marshal Bottomley now suggested, the German fighter force had interposed

itself between the heavy bombers and any decisive action'.¹²⁰ The Battle of Hanover gave a clear answer, namely the clear need to reduce the strength of the Luftwaffe; the Air Staff went into winter 1943 firmly convinced that attacking such targets was the right way ahead.

Overall, it is difficult to make the case that Bomber Command's technical and tactical capabilities improved during autumn 1943. The official historians concluded that:

'these issues were about to be put to a further and much more drastic test in the great Battle of Berlin which was now impending, but a consideration of the evidence arising from the three attacks in August and September scarcely provided the grounds for an optimistic expectation as to the outcome'.¹²¹

The 'drastic test' had been set, and failed, over Hanover. Consequently, the Battle of Hanover during autumn 1943 contained all the warning signs of the later difficulties encountered over Berlin. It was a time not of improving capabilities but instead saw the accumulation of more evidence that suggested ending the war through the progressive destruction of Berlin was in fact beyond Bomber Command's capabilities.

Harris was aware of his force's limitations; indeed, the correspondence with Bennett and other Group commanders over the bombing performance on 22/23 September, and his statement to Churchill about the losses likely to be incurred against Berlin, demonstrated this recognition. But Harris was playing for high-stakes, and showed a 'gambler's instinct' by proceeding. But others were less pleased at the prospect of sustaining a campaign against Berlin in the face of a revitalised Luftwaffe nightfighter force. Throughout the autumn, the Air Staff became increasingly unhappy with Harris' bombing programme; indeed, Portal wanted to have a conference with Harris to ascertain 'what is preventing the execution of the [Pointblank] plan, especially our B.Cd's part in it', in which the agenda would be 'specifically designed to show how far performance has fallen short'.¹²² Notwithstanding the success on 8/9 October the Hanover operations spanned a period that was increasingly less conducive to Harris' version of the bombing offensive. On 19 October, Bufton wrote that Harris must undertake an 'all out air effort in an all-out offensive against the GAF' by attacking such cities as Leipzig, Augsburg and Gotha, and 'keep[ing] them out of action'.¹²³ All this was quite a change from earlier in the year. Back in June, as Probert writes, 'Harris had been in a strong position' because the height of the Battle of the Ruhr saw him 'delivering the goods and everyone knew it'.¹²⁴ Five months later, the ground was weaker as Bomber Command had suffered two tactical defeats, namely the pullback from Berlin in mid-September and the Battle of Hanover during the following month. The latter showed the clear warning signs of likely failure of the Berlin offensive; the repercussions of ignoring these would prove both enormously frustrating and costly for Bomber Command. Webster and Frankland state that, in casualties and bombing efficiency, 'the Battle of Berlin compared unfavourably with the preceding Battles of the Ruhr and Hamburg and the campaign on the road to Berlin'.¹²⁵ But the evidence, highlighted in this paper, showed this assertion to be much less convincing when

measured against Bomber Command's performance over Hanover. In early November 1943, when Harris told Churchill that wrecking Berlin would 'cost Germany the war',¹²⁶ the failure to absorb the lessons of the Battle of Hanover saw hubris triumph over clear thinking.

Notes

¹ The National Archives [hereafter TNA], Kew, PREM3/14/1, Harris-Churchill, 3/11/43.

² TNA, AIR14/3766, HQ Bomber Command-HQ Groups, Hannover, Assessment No. 17 by Air Staff Intelligence, HQBC, undated.

³ Quoted from M. Lambert, *Night after Night: New Zealanders in Bomber Command* (Auckland, 2007), p. 335.

⁴ A.T. Harris, *Bomber Offensive* (Barnsley, 2005ed.); T. Davis-Biddle, *Rhetoric and Reality in Air Warfare: The Evolution of British and American Ideas about Strategic Bombing* (Princeton, 2002), p. 281.

⁵ C. Webster/N. Frankland, *The Strategic Air Offensive against Germany 1939-1945, vol. II: Endeavour*, (London, 1961), p. 95.

⁶ RAF Museum, Hendon, Harris Papers [hereafter HP], H50, *The Effect of the Rise of Air Power on War* by Marshal of the Royal Air Force The Viscount Trenchard.

⁷ Churchill College Archives, Bufton Papers [hereafter BP], Cambridge, BUFT 4/3, RAF Staff College (3rd Course), The History and Development of the Bomber Offensive 1939/45, 3/04/47.

⁸ M. Middlebrook, *The Nuremberg Raid 30-31 March 1944* (London, 2000ed.), p. 17;

⁹ M. Middlebrook, *The Battle of Hamburg: The Firestorm Raid* (London, 2000ed.), p. 361.

¹⁰ A.T. Harris, *Despatch on War Operations 23rd February 1942, to 8th May 1945*, with introductions by S. Cox and H. Boog (London, 1995), p. 20.

¹¹ TNA, AIR14/779, Harris-Portal, 16/06/43.

¹² Ibid.

¹³ HP, H82, Harris-Portal, 12/08/43.

¹⁴ Kings College London, Liddell Hart Centre [hereafter LHC], WM (40) 305th Conclusions, Confidential Annex, 12/12/40; TNA, AIR20/5195, Air Ministry-HQ Bomber Command, Operation Abigail, 13/12/40.

¹⁵ Christ Church Library and Archives, Oxford, Portal Papers [hereafter PP], File 9, Peirse-Portal, 30/12/40.

¹⁶ TNA, AIR8/865, Air Vice-Marshal D.F. Stevenson-Peirce, 10/01/41.

¹⁷ TNA, AIR20/5195, Hanover, Details as an Industrial Target, 09/01/41.

¹⁸ BP, 3/50, R. Dickinson-A. Morley, 15/12/41.

¹⁹ HP, H16, D.A.C. Dewdney-A.P. Morley, 07/05/42. Hanover had escaped relatively lightly hitherto. Notwithstanding the Air Ministry's Directive on 15 January 1941, which instructed Bomber Command to focus on Germany's oil, Peirse was allowed to launch one large area raid per month. He did so against Hanover on 10/11 February (sending 222 aircraft), but apart from minor operations in 1941 and a raid by 71 aircraft on 26/27 January 1942, when 71 aircraft attacked the city, there was no major attack on Hanover for the next 20 months. It was recommended by Air Vice-Marshal Donald Bennett, the AOC-in-C of the Pathfinder Force (PFF), as a target for Operation Millennium, the 1,000-bomber attacks on selected German cities, but

ultimately rejected. See HP, H57, Saundby-Harris, 08/09/42 [and Enclosure] Proposed Attack on Hannover by G/C Bennett, 06/09/42.

²⁰ TNA, AIR 14/1205, Briefing Note on Hanover, Prepared by Air Staff Intelligence, HQBC, 13/09/42.

²¹ Ibid.

²² TNA, AIR 20/1732, Zone Maps of Hanover, undated.

²³ TNA, AIR14/3766, Assessment No. 17 by Air Staff Intelligence, HQBC, undated. In a style characteristic of Harris, it was stated this 'may well send shivers down the back of the ill-clad German, particularly one who has been bombed out'.

²⁴ TNA, AIR14/3435, Coryton-Harris, 5/10/43.

²⁵ TNA, AIR41/43, AHB Historical Narrative, Ch. 14, The Autumn Offensive, pp. 114-17.

²⁶ TNA, AIR14/2662, Bombers' Baedeker Part I (A-K), Hannover.

²⁷ HP, H50, Harris-Trenchard, 14/04/43; RAF Museum, Trenchard Papers, MFC76/1/495, Trenchard-Harris, 13/04/43.

²⁸ TNA, AIR41/43, pp. 114-17.

²⁹ Ibid, pp.114-17. See also R. Freeman, *Mighty Eighth War Diary* (New York, 1981), pp. 68; 77; & 79.

³⁰ TNA, AIR14/779, Bottomley-Harris, 3/09/43. See also BP, 3/64, Report of Committee of Operational Analysts, 5/04/43.

³¹ TNA, AIR20/3239, Coryton-Bottomley, 6/09/43.

³² TNA, AIR20/4832, Bufton-Coryton, 16/09/43.

³³ TNA, AIR 20/8142, Collier-Bufton, 09/09/43.

³⁴ B. Greenhous/S.J. Harris/W. C. Johnston/W.G.P. Rawling, *The Crucible of War: The Official History of the Royal Canadian Air Force Volume III* (Ottawa, 1994), pp. 706-713.

³⁵ Harris, *Bomber Offensive*, p. 185.

³⁶ TNA, AIR40/1517. Fish Code-Names, undated. Bomber Command gave fish-based codenames to all German cities, e.g. Berlin (WHITEBAIT), Essen (BULLHEAD), Hamburg (DACE), etc.

³⁷ TNA, AIR27/815, 103Sq ORB, 1943.

³⁸ This included five B17s from the US Eighth under the command of 3 Group. Though experimental, the fact the Americans were doing so gives an insight into the thinking that pervaded the Eighth Air Force headquarters by autumn 1943, namely the rising cost of daylight attacks meant the night-time alternative at least had to be explored. General Ira Eaker would send small number of bombers twice to Hanover (and Munich and Frankfurt) but these experiments did not convince the Americans to disregard their daylight method.

³⁹ George Metcalf Collection [hereafter GMC], Canadian War Museum, Ottawa, Brookes Diary, Sunday 26 September 1943.

⁴⁰ TNA, AIR14/3411, Bomber Command Report on Night Operations, 27/28rd September 1943, HANNOVER: Brunswick, 17/11/43.

⁴¹ PP, File 13, Bomber Command Digest No. 76, 26/09/43.

⁴² TNA, AIR25/152, No. 8 Group ORB, 1 August 1942-31 December 1943; AIR25/1, No. 1 Group ORB, 1 May 1936-31 December 1943.

⁴³ IWM, 08/140/1, Private Papers of Flt Lt G.P. Dawson.

⁴⁴ GMC, Brookes Diary, Friday 8th October 1943. The following day he recorded 'thick fog at 0400 . . . & we only got about 60% of them back again due to weather conditions & 34 are still away'.

⁴⁵ IWM, 11540 01/28/1 (German civilian Ilse Lange).

⁴⁶ TNA, HW16/58, Decrypts of German Police Communications during Second World War, 1 Nov. 1942-30 Nov. 1943, Appendix A, Log of Police Decodes concerning the raid on Hannover, 9 Oct. 43.

⁴⁷ TNA, AIR14/3411, Bomber Command Report on Night Operations, 8th/9th October 1943, HANNOVER: BREMEN, 13/11/43.

⁴⁸ HP, H49, Harris-AOCs Groups, 10/10/43.

⁴⁹ LHC, WM (43) 143rd Conclusions, 11/10/43.

⁵⁰ TNA, AIR27/687, 83 Squadron ORB, 1943.

⁵¹ PP, File 13, Bomber Command Digest No.80, 24/10/43.

⁵² TNA, PREM3/14/1, Harris-Churchill, 3/11/43.

⁵³ Ibid.

⁵⁴ HP, H65, Churchill-Harris, 12/11/43.

⁵⁵ HP, H65, Harris-Churchill, 12/11/43.

⁵⁶ PP, File 10, Harris-Portal, 04/10/43.

⁵⁷ TNA, AIR14/3411, Bomber Command Report on Night Operations, 22/23rd September 1943, HANNOVER: Oldenburg, 16/11/43.

⁵⁸ TNA, AIR27/687, 83 Squadron ORB, 1943.

⁵⁹ TNA, AIR14/3411, Bomber Command Report on Night Operations, 22/23rd September 1943; TNA, AIR41/43, pp. 110-16.

⁶⁰ TNA, AIR14/3411, Bomber Command Report on Night Operations, 27/28th September 1943.

⁶¹ Ibid.

⁶² RAF Museum, MF10016/5, Diary of Maj. J. K. Christie. For another account on the Pathfinder's performance see W.R. Thompson, *Lancaster to Berlin* (Manchester, 1997 ed.), pp. 161-2.

⁶³ HP, H57, Harris-Bennett, 23/09/43.

⁶⁴ Ibid.

⁶⁵ HP, H49, Harris-AOCs Bomber Groups, 24/09/43.

⁶⁶ HP, H57, Bennett-Harris, 25/09/43.

⁶⁷ HP, H57, Harris-Bennett, 01/10/43.

⁶⁸ TNA, AIR20/6232, BOps2(a)-DBOps., 2/10/43.

⁶⁹ J. Maynard, *Bennett and the Pathfinders* (London, 1996), pp. 133-4. Maynard concludes 'it was said that the name Hanover was never again willingly mentioned in his presence'.

⁷⁰ HP, H49, Harris-AOCs Bomber Groups, 12/10/43.

⁷¹ TNA, AIR14/3766, map to Assessment No. 17 by Air Staff Intelligence, HQBC, undated.

⁷² TNA, AIR14/3411, Bomber Command Report on Night Operations, 18/19th October 1943, HANNOVER, 13/12/43.

⁷³ TNA, AIR27/687, 83 Sq ORB, 1943.

⁷⁴ TNA, AIR25/152, No. 8 Group ORB, 1943.

⁷⁵ The PFF would adopt the rather desperate *ad hoc* measure of the 'Berlin Method' that involved 'flooding' the target with every kind of marker.

⁷⁶ TNA, AIR14/779, Harris-Portal, 16/06/43.

⁷⁷ Harris, *Bomber Offensive*, pp. 185-6.

⁷⁸ TNA, AIR14/3411, Bomber Command Report on Night Operations, 22/23rd September 1943.

⁷⁹ TNA, AIR20/5803, Harris-Under Secretary of State for Air, 29/10/43.

⁸⁰ Ibid.

⁸¹ Webster/Frankland, *SAOG, vol. II*, p. 96.

⁸² HP, H82, Harris-Portal, 2/11/43.

⁸³ Ibid.

⁸⁴ F.H. Hinsley, *British Intelligence in the Second World War*, Vol. 3, (London, 1984), p. 294.

⁸⁵ Webster/Frankland, *SAOG, vol. II*, p. 129.

⁸⁶ Quoted from R. Worrall, *Battle of Berlin: Bomber Harris' gamble to end the war* (Oxford, 2019), p. 90; M. Middlebrook, *The Bomber Command War Diaries: An Operational Reference Book 1939-1945* (Leicester, 1996 ed.) pp. 411-439.

⁸⁷ HP, H82, Harris-Portal, 26/10/43.

⁸⁸ TNA, AIR 14/3542, Harris-Rice, 21/10/43

⁸⁹ Worrall, *Battle of Berlin*, p. 32.

⁹⁰ TNA, AIR14/3411, Bomber Command Report on Night Operations, 22/23rd September 1943; AIR24/259, Interceptions/Tactics No. 197/43, Night 22/23 Sept. 43.

⁹¹ TNA, AIR14/3411, Bomber Command Report on Night Operations, 27/28rd September 1943; AIR24/259, Interceptions/Tactics No. 202/43, Night 27/28 Sept. 43.

⁹² TNA, AIR14/3411, Bomber Command Report on Night Operations, 8th/9th October 1943; AIR24/260, Interceptions/Tactics No. 210/43, Night 8/9 Oct. 43.

⁹³ TNA, AIR14/3411, Bomber Command Report on Night Operations, 18/19th October 1943; AIR24/260, Interceptions/Tactics No. 215/43, Night 18/19 Oct. 43.

⁹⁴ Hinsley, *British Intelligence*, Vol. 3, pp. 308-11.

⁹⁵ Ibid, pp. 308-11.

⁹⁶ TNA, AIR14/3411, Bomber Command Report on Night Operations, 22/23rd September 1943.

⁹⁷ TNA, AIR24/259, Interceptions/Tactics No. 197/43, Night 22/23 Sept. 43.

⁹⁸ TNA, AIR14/3411, Bomber Command Report on Night Operations, 27/28rd September 1943.

⁹⁹ TNA, AIR24/259, Interceptions/Tactics No. 202/43, Night 27/28 Sept. 43.

¹⁰⁰ TNA, AIR14/3411, Bomber Command Report on Night Operations, 8th/9th October 1943.

¹⁰¹ TNA, AIR24/260, Interceptions/Tactics No. 210/43, Night 8/9 Oct. 43.

¹⁰² TNA, AIR24/260, Interceptions/Tactics No. 215/43, Night 18/19 Oct. 43.

¹⁰³ TNA, AIR14/3411, Bomber Command Report on Night Operations, 18/19th October 1943.

¹⁰⁴ Hinsley, *British Intelligence*, pp. 313-4. The former device would be carried by an aircraft that was then inserted into the bomber-stream and 'enabled the [German] controller to direct other fighters to the stream, either by emitting a DF note for other fighters to home on to or by announcing that it in contact so that the controller, knowing its position from *Benito*, could inform the waiting fighters by R/T'.

¹⁰⁵ Greenhous et al, *Crucible of War*, p. 719.

¹⁰⁶ Ibid, p. 719.

¹⁰⁷ R.V. Jones, *Most Secret War: British Scientific Intelligence 1939-1945* (London, 2009 ed.), pp. 387-88.

¹⁰⁸ TNA, PREM3/14/1, Harris-Churchill, 3/11/43.

¹⁰⁹ Webster/Frankland, *SAOG*, vol. II, p. 47

¹¹⁰ Ibid, p. 139.

¹¹¹ Ibid, pp. 135-7.

¹¹² Ibid, p. 146.

¹¹³ Ibid, p. 158.

¹¹⁴ M. Hastings, *Bomber Command* (London, 1999 ed.), p. 210.

¹¹⁵ Greenhous et al, *Crucible of War*, p. 719.

¹¹⁶ R. Overy, *The Bombing War: Europe 1939-1945* (London, 2013), p. 342.

¹¹⁷ TNA, PREM3/14/1, Harris-Churchill, 3/11/43.

¹¹⁸ Harris, *Despatch on War Operations*, p. 20.

¹¹⁹ AIR41/43, pp. 114-17.

¹²⁰ Webster/Frankland, *SAOG*, vol. II, p. 36.

¹²¹ Ibid, p. 165.

¹²² TNA, AIR20/780, Portal-Bottomley, 27/09/43. This was held on 12 October.

¹²³ TNA, AIR20/780, Bufton-Coryton, 19/10/43.

¹²⁴ H. Probert, *Bomber Harris: His Life and Times* (London, 2006 ed.), p. 257.

¹²⁵ Webster/Frankland, *SAOG*, vol. II, p. 194.

¹²⁶ PREM3/14/1, Harris-Churchill, 3/11/43.

Article

Royalties, Patents and Sub-Contracting: The Curious Case of the Hawker Hart

By Dr Matthew Powell

Biography: Matthew Powell is a Teaching Fellow in Air Power and Strategic Studies at the RAF College, Cranwell. His first book, *The Development of British Tactical Air Power, 1940-1943: A History of Army Co-operation Command* was published by Palgrave Macmillan in 2016. His current research focuses on the relationship between the Air Ministry and the aircraft industry in the inter-war period.

Abstract: Aircraft procurement by the Air Ministry in the inter-war period was beset by various problems, with numerous solutions proposed in an attempt to resolve them. One such potential solution was the proposal to sub-contract the production to other aircraft manufacturers within the Air Ministry's ring of firms who were allocated firm orders. This action by the Air Ministry, it was believed, would spread the technical knowledge of aircraft production to a wider base that could be built upon in a time of national emergency or war. This approach was also a way of 'artificially' keeping firms alive where they had been unsuccessful in being awarded contracts. Such a scheme would, from the industry's perspective, however, lead to less orders for firms successful in aircraft design and allow the potential sharing of industry secrets amongst direct competitors.

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Introduction

The Air Ministry found itself under increasing pressure from several sides regarding its expenditure on new aircraft in the early 1930s. The aircraft industry felt that the sparsity of orders threatened their individual existence as going concerns, politicians were starting to murmur at the outlay of public money and many believed that the Royal Air Force (RAF) was not receiving value for money when it placed orders.¹ There were also rumours spreading that aircraft firms were inflating the prices charged in order to maximise profits. Politicians felt that they were in fact exploiting the relationship between the Air Ministry and the private firms in order to make excessive profits as the RAF was reliant on these firms for all aircraft as well as for implementing the new technologies that were emerging in the field of aircraft design. Whilst no Parliamentary debate on the issue had yet been forthcoming, those at the Air Ministry who worked under the Air Member for Supply and Research (AMSR) (Air Marshal Sir Hugh Dowding) believed that such an action was imminent, and that evidence had to be provided to demonstrate that steps were being taken to reduce the cost of new aircraft and ensure greater value for money.² The Air Ministry has been portrayed as a conservative organisation that did not look to implement major changes, save for the development of doctrine surrounding strategic bombing.³ The reality is somewhat more nuanced than this.

This article will use the case study of the Hawker Hart aircraft to demonstrate how the Air Ministry looked to implement this new ordering system as this was the aircraft designated for the first experiment of the procedure. It will argue that facing huge pressure from bodies such as the Public Accounts Committee and the Treasury, the Air Ministry faced little option in altering the ordering system for new aircraft but had to tread a very fine line when doing so to retain the support of the Society of British Aircraft Constructors (SBAC) and the aircraft industry who believed their very existence was threatened by the proposed changes.⁴ It will further demonstrate that the Air Ministry was a forward-looking organisation that sought to introduce a system of procurement, even by limited experimental means, which would be widely implemented if a major war was to break out. This system was that of sub-contracting orders for airframes away from the aircraft firm that had designed it and to other manufacturers who had demonstrated themselves to be more efficient at production or could offer to construct the aircraft as a whole for a cheaper price.⁵ The ordering system employed by the Air Ministry had been in place since 1920 and was based around the concept that, provided the quoted price of a successful aircraft design was deemed fair and reasonable within the wider market, the designing firm would receive the full production contract.⁶

These discussions over how best to interact with the suppliers of aircraft echo what is happening today. Military spending is generally unpopular with the wider public who prioritise other areas of public outlay such as health and education. The quest for value for money is seemingly unending. This article can provide guidance to policy makers today as to how private industry may try to ensure that they have the advantage those involved in

procurement, both militarily and in general, by resisting attempts to change procurement processes and efficiency drives. With a better understanding of how these interactions worked in the past, decision makers can forge better arguments and ensure changes occur. This has the potential to ensure public money is spent better and delays and overspends are reduced to the minimum necessary.

Whilst the Air Ministry and RAF were naturally relatively conservative in outlook, their reliance on developing technologies and technical expertise meant that they had to also be forward-looking and anticipate major changes in both aircraft design and procurement techniques. With the increasing pace of technological development in airframe design and construction the Air Ministry had to be cautious in what was adopted as failure may lead to aircraft incapable of competing in the event of war. A force of aircraft not technologically capable also had the potential to harm British foreign policy and diplomatic efforts as policy could not be backed up by the theoretical or actual threat of force. The SBAC also looked to allow its members to take control of the sub-contracting process, attempting to establish the principle that it should be down to the original designing firm to decide whether the whole aircraft or certain component parts should be subcontracted.⁷ To place these ideas within their modern context, many 'tier one' manufacturing firms 'subcontract' out the manufacture of components to 'tier two' suppliers with very few manufactured by the tier one firm.⁸ For the SBAC, the sub-contracting out of entire aircraft would mean unnecessary duplication of jigs, tools and gauges.⁹ This demonstrates that the SBAC and Air Ministry had differing perspectives. The duplication of jigs, tools and gauges, as well as an aircraft industry that was capable of producing aircraft from engineering drawings, was seen by the Air Ministry to be a necessary precaution, which would be vital in any future war. For their purposes, they required an aircraft industry that was as flexible as possible. Through the SBAC's eyes, whilst they were not, in principle at least, against an aircraft industry that was capable of reacting to an unpredictable and increasingly unstable global situation, their interest was principally concerned with the survival of their members as going concerns and so would defend the status quo.¹⁰ The system that had to be navigated by aircraft firms was far from ideal, but better than some of the ideas that were being proposed. The ordering system, combined with the creation of the ring of approved Air Ministry suppliers in 1924, provided firms with some degree of stability and allowed them to make small profits on the relatively small number of aircraft that the Air Ministry could order given the constrictions in budgets.¹¹

Sub-contracting had been employed during the First World War where firms were under greater government control in terms of production requirements. Successful designs in this period were often produced *en masse* by other firms as it was the quantity of aircraft that was crucial to supporting the British Expeditionary Force on the Western Front as well as other subsidiary theatres.¹² Naturally enough, given their different perspectives, the Air Ministry and the SBAC failed to see eye-to-eye on this issue. The 1931 Report into the aircraft industry, conducted by the Air Ministry, as well as the discussions that followed its publication,

will be used to demonstrate the precarious position the Air Ministry found itself in with the industry as well as how they sought to modify their ordering procedures without causing the collapse of the entire industry.¹³

In order to facilitate any necessary change to Air Ministry ordering procedures, a report was commissioned to look at the state of the aircraft industry in 1930. This report not only investigated the aircraft industry, but the Commission also looked to provide advice and new ideas that had the potential to transform how aircraft were purchased for military means. Some of the more radical changes suggested would, if implemented wholesale, have had a profound effect on the individual firms of the aircraft industry. What was suggested was the implementation of relatively wider-scale sub-contracting of successful aircraft designs, utilising open tendering to gain better pricing of aircraft and send a wider message to industry as a whole that the time of high aircraft prices was at an end.¹⁴

The Hawker Hart was not the first instance of compulsory sub-contracting directed by the Air Ministry within the aircraft industry. It had been introduced as a temporary expedient in 1924 and was considered again in 1927-28.¹⁵ Sub-contracting was considered for the Hawker Hart as it was a versatile aircraft that was produced in many variants.¹⁶ In an attempt to wrest some control of the process with regards to compulsory sub-contracting, the SBAC suggested that the majority of decisions with regards to what aspects of production and construction should be sub-contracted should be left to individual firms.¹⁷ On the one hand, such a move would make the lives of individual construction firms easier as they would be able to adjust the sub-contracting system to best suit themselves on an individual basis. On the other hand, however, this would lead to potential chaos within the Air Ministry, as there would not be standard procedures for ensuring consistency of sub-contracting and losing a general overview of what was sub-contracted out at any time. The only way for sub-contracting to function effectively when required was for the Air Ministry to retain overall control of the process and procedures as well as what was sub-contracted out by individual firms and when. This would naturally put them at odds with the SBAC and individual firms who would want complete control in order to shape the system to their economic and production benefit and not that of the Air Ministry which would ultimately have to take responsibility for any failings in aircraft production and procurement. The SBAC continued to argue for the widespread adoption of sub-contracting as a basis on which to control prices, as costs could only be lowered 'by the continued manufacture of a standard article'.¹⁸

Open tendering would mean that a firm that was successful in designing an aircraft that met or exceeded Air Ministry requirements were not guaranteed to be awarded the full production contract, if it was deemed that their prices were over-excessive and better value with similar quality could be obtained elsewhere.¹⁹ Such an idea was an anathema to the SBAC who foresaw the potential collapse of many sound manufacturers and expressed this opinion vigorously and with great menace.²⁰

The aircraft industry in Britain suffered from two major issues that prevented it from being as efficient as it could have been in the 1920s and 1930s. The first major issue was the relative lack of orders. Due to the restrictions in defence spending in the wake of the end of the First World War, aircraft firms faced financial hardship, surviving on limited orders from the Air Ministry.²¹ This in turn led to decreased profits, a situation not helped by the imposition of an Excess Profits Tax levied to assuage public concerns that arms manufacturers had taken advantage of the death and suffering during the war to make money.²² This almost put several firms out of business, and it was only through the extensions and continuation of overdrafts that many of the firms who became household names during the Second World War survived the so-called lean years.²³ Whilst the declinist view of the likes of Corelli Barnett has been largely dismissed by more modern scholarship in this area, the situation was not quite as rosy as has been painted by David Edgerton.²⁴ The industry was not as underfunded as has been claimed, but this did not mean that it was in a healthy position when rearmament commenced in 1936. The industry had survived, but it was not in a position where mass production could begin on any scale, as the sparsity of orders had left little incentive to change production methods. The second issue, largely related to the first, was that with the limited number of orders available to firms, they were unable to invest in new manufacturing technologies such as machine tools, jigs and presses to increase their output.²⁵ They were also unable to find the necessary capital to invest in increased factory floor space that would increase their output capacity. This inability to invest would mean that when demand for aircraft increased the industry would find it difficult to increase their overall production capacity in the event of a diplomatic crisis or international emergency.²⁶

The Air Ministry had looked intensively at the current and potential future capacity of the aircraft industry through the work of Air Commodore L E O Charlton. Charlton sought to work with the industry both on the level of individual firms and the SBAC to increase the potential for expansion. Through his work and negotiations with the industry, Charlton highlighted several areas where the capacity of the industry could be expanded without increasing any public funding or the amount of orders that individual firms received. These changes would require a massive overhaul of the system of procurement from the Air Ministry, the spreading of orders amongst the firms, and a change in the general attitude of the firms and SBAC to the increased spreading of orders amongst the industry. The most contentious of Charlton's ideas was to increase the extended use of sub-contracting for aircraft orders.²⁷ Through the sub-contracting of orders to construction firms which were not the original designers of the aircraft, the Air Ministry sought to achieve two distinct aims.²⁸ The first was to increase the capabilities of individual aircraft firms so that they would be up-to-date with latest production techniques and able to construct a variety of different aircraft if a diplomatic emergency or sudden outbreak of war required a quick and unexpected upturn in production levels.²⁹ This demonstrates that the Air Ministry was seeking to develop within the industry a strategic capacity that could be utilised when required. With the rapid development of new aircraft materials, it was also vital that every firm within the Air Ministry's network of constructors was able to produce the variety of aircraft that were being ordered. Sub-contracting would allow

them to spread the orders amongst the various firms to give them the necessary experience of working in metal as opposed to wood. This had already been employed when sub-contracting had been resorted to previously. The Air Ministry's second ambition for sub-contracting was to drive the price of aircraft down by assigning contracts to the firm which could produce them for the lowest price. This was potentially a radical overhaul of the purchasing system in Britain, and such a dramatic shift in procurement policy was sure to be met with resistance by the SBAC. Traditionally, the Air Ministry's procurement policy had been based around a full development and production contract award. The contractor was expected to design the aircraft and execute extensive trials, against competitor's aircraft, to meet the minimum requirements specification. The firm who designed and produced the aircraft, which met the specifications and delivered the best value for money, were awarded the contract.³⁰ This system, it was believed by certain members of the Air Ministry, but also, and potentially more importantly, Members of Parliament, allowed firms to overcharge for aircraft and so recoup losses made on other aircraft designed and built to Air Ministry specifications and entered, unsuccessfully, into previous design competitions.³¹ There is little evidence to suggest that firms were doing this to a large and widespread degree, but, given the precarious financial position of the majority of aircraft firms, it is not beyond the realms of possibility that firms were overcharging to a certain degree to bolster their bank balance and to see them through any future lean period. It must be borne in mind that without a successful aircraft design to produce for the Air Ministry, individual firms had to bear most of the cost of successful aircraft whilst they were in the design, prototype and initial production phases. If an aircraft did not meet specification or did not succeed in proving itself against other designs, there was no recompense for the firm and any costs had to be absorbed either by past profits or through overdrafts with the bank.

By moving to a procurement system closer to that employed by both France and the United States (US), it was hoped that the cost of aircraft could be driven down, the quality of aircraft design maintained and driven upwards and improvements in the construction capability of the industry as a whole enhanced.³² There were, however, several issues that presented themselves in this aim. A position prevailed in Britain where those firms with the best design teams were often also poor in planning production meaning delays in delivery programmes. These firms were often at the forefront of technological developments in design and capability and so provided a qualitative edge over potential opponents. In order to maintain these design teams, production orders were required but at the cost of efficient delivery.

Decisions had to be made as to whether these design teams had to be artificially supported, despite the weakness of their construction skills, through the assigning of full production orders despite potential delays in delivery dates previously agreed. The firms with the best design teams generally had greater costs associated with manufacture, increasing the price of each individual aircraft. Without sufficient orders for new aircraft or the reconditioning of aircraft already in service, these firms would simply collapse and there was no guarantee that the design teams would be employed with other firms. The system of procurement did,

however, in the opinion of the aircraft firms and the SBAC, increase the standard of design through competition within the industry, as achieving the best design would likely lead to orders and a continuation of the business; failure would lead to financial problems.³³ The SBAC was able to provide convincing evidence to the Air Ministry about the effects of widespread open tendering and sub-contracting. The aircraft industries of both the US and France had adopted such a system of procurement and found that their design capabilities had diminished at an alarming rate as firms competed against each other on price instead of the capability of the aircraft.³⁴

Increasing the capabilities of the industry as a whole had been attempted with the sub-contracting out of the Siskin all-metal aircraft to give greater experience to manufacturers of working in the new material and the associated techniques and processes.³⁵ This demonstrates that the Air Ministry was seeking to develop within the industry a strategic capacity that could be utilised when required. With the rapid development of new aircraft materials, it was also vital that every firm within the Air Ministry's family of constructors was able to produce the variety of aircraft that were being ordered. Sub-contracting would allow them to spread the orders amongst the various firms to give them the necessary experience of working in metal as opposed to wood.

The second ambition for sub-contracting from the Air Ministry's point of view was that sub-contracting could be used as a tool to drive the price of aircraft lower by assigning contracts to the firm which could produce them for the lowest price. This was potentially a radical overhaul of the purchasing system in Britain, and such a dramatic shift in procurement policy was sure to be met with resistance by the SBAC.

Whilst discussions were taking place over the reintroduction of sub-contracting in 1927, the SBAC fought as hard as possible to prevent it, as it had the potential to cause serious financial hardship to several of its members which, whilst extremely capable aircraft designers, were not the most efficient production firms. The SBAC argued that, due to the disruption of having to learn how to produce a new and unfamiliar aircraft, the sub-contracting firms' costs would escalate, and their production processes and flow would be hindered.³⁶

The Hawker Hart presented several unique problems in terms of sub-contracting. One of the biggest issues that presented itself concerned the use of patents. The Hawker Engineering Company, in their design and development of the Hart, had developed certain new rivets and the tools required to manufacture them had been developed to produce the aircraft. Through sub-contracting the manufacture of the Hart away from Hawker, the Air Ministry was actively encouraging the breaking of patent law and so ways and means of indemnifying the firms who were given sub-contracted orders had to be found in order to allow them to fulfil the orders according to the engineering drawings.³⁷ The Air Ministry's position in negotiations with Hawker was made all the more difficult as Hawker had spare production capacity, and the Air Ministry had decided that in order to improve the capability of the wider

industry, it was the Hart that should be sub-contracted out.³⁸ A further reason for the Air Ministry to sub-contract out a large proportion of the Hart procurement was the sheer cost. Sub-contracting within the aircraft industry had been previously considered as a way of controlling prices within the industry. The Hart was chosen partly as a result of the ease of manufacture that the design presented, and this was demonstrated by the fact that it was possible to sub-contract out at a very early stage of its development life.³⁹ Hawker also raised the important question of safety and inspection of individual aircraft and who would be held responsible for a failure of an aircraft on trials or in the field. The question was not settled as to whether Hawker would have to provide its own staff to inspect the work of other firms and ensure that it was in line with the drawings. With a variety of tooling and gauges made available for various firms there could be no guarantee that tooling and gauges were as accurate as they were required to be.⁴⁰

In order to ensure that Hawker was suitably rewarded for its success in the open competition utilised by the Air Ministry to find the best designs for each aircraft type and encourage both risk taking and ensure that aircraft designed remained cutting edge, a system was negotiated for the payment of royalties. These negotiations demonstrated an almost entirely predictable difference of opinion between Hawker and the Air Ministry over the maximum that should be paid by the Ministry to Hawker in royalties for each aircraft produced by a sub-contractor. To Hawker, the Hart represented the culmination of twenty-one years of trial, error and development, and the drawings that resulted were in the possession of nine different aircraft firms. This also meant that trade secrets known only to Hawker were now available to a large proportion of the industry and, in any future competition, Hawker would face a more level playing field. In order to compensate for this and the fact that Hawker would not receive the full income from producing the Hart, the Air Ministry offered to pay royalties to Hawker up to a maximum of £40,000. This was deemed inadequate, as Hawker's directors felt that the Hart design was worth £100,000 and that the Air Ministry's offer would not even cover the firm's expenses. The Air Ministry felt that their offer had been fair and reasonable and in line with the guidelines set down by the Royal Commission on Awards to Inventors.⁴¹ Hawker believed that not only were the royalties being offered unsatisfactory, they were lower than in other cases where sub-contracting had been resorted to.⁴²

In an attempt to placate Hawker and to ensure their good will in terms of mentoring and training the other aircraft constructors selected to manufacture the Hart, the Air Ministry proposed to pay 7.5% royalties to Hawker of the first £250,000 of sales, 6.5% on the next £250,000 and 5.5% on the remainder of sales.⁴³ These payments would be in addition to those made to firms constructing the aircraft and so represented an additional burden on public expenditure that the Air Ministry was keen to reduce as much as possible. An agreement was reached with Hawker on the basis described above for royalty payments in November 1931 but was conditional on Hawker providing the agreed tuition and support to other aircraft firms and an agreement not to proceed against firms utilising patents registered by Hawker as the firms had been indemnified by the Air Ministry to utilise them.⁴⁴

The Air Ministry's experience with sub-contracting out the Hart made them wary of repeating the process. Whilst it was a useful tool in an attempt to influence the prices charged by aircraft firms which to a certain degree, did look to exploit the closed nature of the market that they were working within.⁴⁵ With the Air Ministry having an almost complete monopoly as the only major customer for the inter-war period and had great influence over the industry, it was also reliant on a small number of firms to provide them with the aircraft to enable the RAF to provide the military and political support required by the United Kingdom. This allowed them to artificially raise prices to a certain degree, safe in the knowledge that the Air Ministry had to pay those prices provided they could be justified as fair and reasonable.

The Hart was one of the few aircraft to be sub-contracted out during the inter-war period, and certainly one of the few where price was an overriding factor in the decision.⁴⁶ The Air Ministry was fully aware that any widespread attempt to introduce sub-contracting as a means of controlling prices would see a reduction in the design abilities of certain firms.⁴⁷ It would simply not be cost-effective to maintain expensive design teams and drawing shops if orders were then placed with other firms and small revenues ultimately made. The Air Ministry was fully aware that whilst production capacity would be important in the next war, the ability to design aircraft that were at the cutting edge of technology was more important and this had to be fostered.⁴⁸ By adopting this policy of keeping firms employed by providing them with work despite their production difficulties, to maintain design teams the Air Ministry had to relinquish to some degree their ability to influence the price of aircraft purchased.

Another major problem that presented itself was the capability of each individual aircraft firm and was an issue that was tackled by industry together through representations by the SBAC to the Air Ministry. Each firm had differing production capabilities and looked to gain technical production advantages over rival firms and were loath to allow other firms to become aware of their individual production methods that gave them a potential competitive advantage. Any attempts to bring widespread sub-contracting would require firms to divulge these trade secrets to rivals, thereby negating any competitive advantage they may have.⁴⁹ This would level the playing field and increase the amount of competition within the industry as a whole. Those firms whose production techniques were not as up to date as others could potentially have their fortunes transformed through the awarding of a subcontract that utilised new secret production methods. The successful firm would have to be supervised by the designing firm and so must divulge their secrets. Whilst this may have been acceptable in publicly owned armaments works such as the Royal Ordnance Factories, it could never work in the completely private aircraft industry. The Air Ministry did not have the same powers of mandated compliance and direction over the aircraft firms, as they were private entities. A different relationship was required as compared to that which existed between the factories in public ownership that could be directed to a much greater degree.

Firms were simply unwilling to give up any advantage they had over their competitors as it could mean the end of them as going concerns. Throughout the entirety of the inter-war

period, the Air Ministry and the aircraft industry had to find a way to bridge the exceptionally large gap in perceptions that existed between the two and the way they saw the world and their place in it. The Air Ministry looked to the long-term strategic security of the country through the creation of an aircraft industry that could respond to the vagaries and complexities of the post-1918 world. The aircraft industry, on the other hand, looked to survive until the end of the next financial year. These were perceptions that were almost impossible to marry up, as they viewed the world in two different and almost polar opposite contexts.⁵⁰

There was also entrenched disagreement with regards to the level of responsibility that the successful design firms should take for aircraft produced by another firm. This was not a new problem, as it had first been encountered during the First World War.⁵¹ Firms were, quite understandably, not keen on having to take responsibility for the products manufactured by a different firm over which they had no control in terms of quality control and production standards. The division of responsibility was a difficult concept to overcome as the firm chosen to undertake the sub-contracting would not be overly willing to take the responsibility for aircraft that they had not designed themselves. They would not be fully versed in the intricacies of production gained through the design, development and production of prototypes and the experience of how to overcome difficulties in production specific to that aircraft.⁵² There would also be the question of responsibility if an aircraft failed, and any attempt to attribute liability would be fraught with difficulty.

The SBAC fought hard against the introduction of sub-contracting in general, and if the Air Ministry was to develop this new form of procurement, it would have to provide incentives to successful designing (but inefficient manufacturing) firms to abrogate and reduce the risks they perceived through the loss of orders and the revelation of industrial secrets. In an attempt to bring individual firms on board and also to split the support within the SBAC, the Air Ministry offered a series of incentives if aircraft were to be sub-contracted out. The designing firm were to be offered a royalty of at least 5% of the agreed purchase price for each individual aircraft not produced by themselves.⁵³ This cost was an additional charge for the Air Ministry on top of that for each aircraft. This was, in the opinion of the Air Ministry, a cost worth bearing if it helped reduce the overall amount spent on new aircraft as well as increasing the strategic capability of the industry as a whole. In order to ensure that firms did not reduce or remove their design departments and simply focus on upscaling and upgrading their production facilities, (and this was a very real risk), the Air Ministry was willing, for a fair price, to give a reasonable percentage of the manufacture of aircraft to be ordered to the designing firm.⁵⁴

One way in which the Air Ministry could influence and adopt sub-contracting on a wider basis was to utilise the existing capacity of the aircraft industry. Each firm had a limited construction capacity and if it was successful in developing a new type would face the possibility of not being able to meet Air Ministry requirements for previous models of aircraft, as well as the new type. A decision would have to be made between the firm and the Air Ministry over whether the old type was still required for Service purposes and how both could be produced

if necessary. It was possible for negotiations to take place between the firm and the Air Ministry over which of the two aircraft the firm would be willing to produce, and the other would then be sub-contracted out with the firm receiving compensation in the form of royalty payments on each sub-contracted aircraft ordered from a different firm.⁵⁵ It was expected that, given the developments of technology and manufacturing processes, the firm would be more interested in producing their latest type due to the greater profits to be made. This would allow the Air Ministry to adopt a greater degree of sub-contracting in the aircraft industry whilst keeping the firms and the SBAC on side, as such an approach would be more in their interests. It would keep firms employed on producing aircraft providing the income and potential profits to keep their design teams in being. It would also increase the overall construction capacity and capability by giving various firms the experience of constructing aircraft that they had not designed.

The Air Ministry had to tread a careful and difficult line when trying to modify the nature of how they ordered aircraft from a completely privately owned aircraft industry that was able to act in unison to protect its collective interest in a far more effective manner than the Air Ministry was able to exploit its position as almost sole customer for the entire industry. The Air Ministry had to have concern not only for the functioning of the aircraft industry at that moment, but also how it would function and work to the best of its collective ability in the event of a diplomatic crisis or a sudden declaration of war. Sub-contracting orders was one way of achieving radical change within the aircraft industry but fell down on the fact that the economic and strategic position Britain found itself in after the First World War meant that there were not sufficient orders within the system at any one time to allow firms to survive whilst other firms took up the slack. Whilst the principle of sub-contracting was a sound one, the practicalities and implementation were not possible within the wider position the Air Ministry was in during much of the inter-war period. It was only with the development of the shadow factory system and the pressing need for an increase in the production capacity of the aircraft industry that large-scale sub-contracting was required.

This was not, however, the same sub-contracting system that the Air Ministry had sought to introduce with the Hawker Hart. This form of sub-contracting involved the introduction of new engineering firms into the aircraft industry working under the supervision of the aircraft firms in shadow factories.

Notes

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Article

The Worsted Manufacturer, Roderick Hill and 'the most courageous decision of the War': The Decision to Reorganise Britain's Air Defence to Counter the V-1 Flying Bomb

By Group Captain John Alexander

Biography: Group Captain John Alexander specialised in air/land integration, in the Falklands in 1982 and various Middle Eastern campaigns, before spending six years in Afghanistan and Pakistan. A polemologist and two-time CAS Fellow at Cambridge and Oxford Universities, and now an Auxiliary, he has published in *Air and Space Power Review*, the *RUSI Journal* and *Asian Affairs*.

Abstract: The first four V-1 flying bombs crossed the Channel in the early hours of 13 June 1944, exactly one week after D-Day; none were engaged and one reached Bethnal Green killing four people. When overnight 15/16 June the German Air Force launched 244 V-1s against London, the long-planned British counter V-1 defences, consisting of fighter, gun and balloon belts, brought down only thirty-three V-1s, including eleven shot-down by anti-aircraft (AA) guns, and seventy landed on London. This paper explores the decision to reorganise Britain's Air Defence during this crucial stage of the War.

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Introduction

The first four V-1 flying bombs crossed the Channel in the early hours of 13 June 1944, exactly one week after D-Day; none were engaged and one reached Bethnal Green killing four people.¹ When overnight 15/16 June the German Air Force launched 244 V-1s against London, the long-planned British counter V-1 defences, consisting of fighter, gun and balloon belts, brought down only thirty-three V-1s, including eleven shot-down by anti-aircraft (AA) guns, and seventy landed on London. Over three thousand V-1s followed in the next five weeks, some with terrible lethality like the bomb which killed 121 people in the Guards' Chapel at Wellington Barracks on Sunday, 18 June. Yet only the most modern fighters were fast enough to engage the V-1s and the 1,000 AA guns deployed destroyed less than ten per cent of the bombs they engaged.

On 13 July 1944 Air Marshal Roderick Hill, the Air Marshal Commanding, Air Defence of Great Britain (ADGB), ordered, seemingly without reference to his superiors, the complete reorganisation of the air defence scheme: redeploying almost 1,000 AA guns and 23,000 men and women from the Kent Downs to a gun belt on the Kent and Sussex coast. The redeployment reordered and separated fighter and gun engagement zones, allowing the guns to exploit new US gun-laying radars and proximity fuzes, increasing the guns' lethality four-fold.

The decision, which Hill's daughter and biographer, Prudence, called the 'most courageous of the war',² warrants analysis for a number of reasons. First, it was controversial at the time as it prioritised AA guns over fighters, when Britain's previous air defence schemes since 1917 had prioritised fighters over guns, and thus far fighters had destroyed more V-1s than guns. Second, as the official histories note, the Air Staff suspected Prime Minister Winston Churchill's son-in-law Duncan Sandys, an MP and controversial Territorial Army AA senior officer until appointed a junior minister in 1941,³ and chairman of the government's Operation Crossbow committee, had pressured Hill into the decision. Third, the decision remains contested in the historiography, with Colin Dobinson's recent and comprehensive history of AA Command in Operation Diver highlighting AA Command's and Sandys's accounts both differ from the official history, which credits an Royal Air Force (RAF) reserve officer with the idea.⁴

Additionally, much of the flying bomb historiography focuses on both the human cost and the Anglo-American Crossbow bombing operations to destroy the launch sites, rather than defence against the V-1s. The V-1s were to kill 6,184 people in the UK, out of the 51,509 killed by German bombing throughout the war, including 2,754 by V-2 rockets and 148 by cross-channel guns.⁵ Another 8,696 V-1s and 1,610 V-2s were fired at Antwerp killing 3,440 Belgian civilians and 682 Allied servicemen, and a further 314 V-1s at Brussels.⁶ The greatest human cost though was to the tens of thousands of slave labourers from occupied Europe forced to make the vengeance weapons in brutal conditions. The 81,000 tons of bombs dropped by the RAF and United States Army Air Force (USAAF) on Crossbow targets between early June 1944 and the end of August represented three per cent of all the bombs dropped by the British and Americans in all theatres during the war.⁷ Yet, Hill's decision was made in the

context of enemy deep attack by uncrewed aerial systems requiring the integration of home defence and expeditionary operations in the same time and space, across multiple domains and service boundaries, and necessitating the rapid adaptation of new technology into an established integrated air defence system is still relevant today. Moreover, political imperative appears to have compressed the strategic and operational levels of command. This article uses unpublished archival sources to examine Hill's decision.

Operations Crossbow and Diver

The Allied counter V-1 operations took place in a complex operational area. The Allied invasion of North West Europe, codenamed Overlord, was executed in the same time and space as supporting and concurrent operations, with necessarily complex command and control arrangements. These included the Fortitude deception plan, maritime and air anti-submarine and anti-surface operations, and the diversion of RAF Bomber Command and US Eighth Air Force from the Combined Bomber Offensive to support Overlord's transportation plan, under the control of General Dwight D Eisenhower, Supreme Commander Allied Expeditionary Force, as well as the amphibious and air assault itself. Moreover, UK air defence operations continued with the defeat of the German mini-blitz in early 1944, the need to protect the Overlord invasion force from German air reconnaissance and attack, and the anticipated German V-1 and V-2 vengeance weapons designed to indiscriminately kill British civilians.⁸

Operation Crossbow

Crossbow was the codename for Anglo-American operations against the German V-1 (codenamed Diver) and V-2 weapons (codenamed Big Ben). In April 1943 the British Chiefs of Staff (COS) had recommended to Churchill that his son-in-law Sandys should head the Crossbow committee of scientific and intelligence advisors to establish the flying bomb and rocket threat, and devise counter-measures.⁹ The Crossbow committee's co-ordination, combining Ultra intelligence and the RAF's Central Interpretation Unit's (CIU) analysis at RAF Medmenham resulted in the attack by 471 Bomber Command heavy bombers on the V-weapon research facilities at Peenemünde on 17 August 1943. In December, Air Marshal Bottomley, the Deputy Chief of the Air Staff who represented the Air Ministry on the Crossbow committee, reported to the COS that the CIU had detected 'ski-sites' in Northern France designed to launch the 'pilotless aircraft' at England.¹⁰ By 2 April 1944, the medium bombers of Second Tactical Air Force (2TAF) and Ninth US Air Force, and the heavies of US Eighth Air Force and Bomber Command, now under Eisenhower's control for Overlord, had dropped 15,936 tonnes of bombs on ninety-six ski-site targets, and a further 3,806 tonnes on 'large sites', a euphemism for V-2 sites.¹¹ By May 1944 ten per cent of all Anglo-American bombing effort was directed at Crossbow targets.¹²

The Diver Air Defence Plan

Meanwhile ADGB produced contingency plans for both the protection of the Overlord concentration areas and the anticipated V-1 offensive. Hill's ADGB had been responsible for Britain's air defence since November 1943 when Fighter Command was split between it and

2TAF. Hill reported through Air Chief Marshal Sir Trafford Leigh Mallory, Commander-in-Chief, Allied Expeditionary Air Force (AEAF), to the British Air Ministry, rather than to Eisenhower. Hill, a new three star in the US parlance of the time, had operational control of all elements of the integrated air defence system including the 250,000 men and women of the British Army's AA Command, under General Sir Tim Pile, General Officer Commanding-in-Chief AA Command, a four star since 1941.¹³

Hill's assessment was that the V-1 was another aircraft, only pilotless, and therefore the air defence scheme needed to be adjusted, but not radically changed, when the V-1 attacks started.¹⁴ Britain's air defence had been a composite of increasingly integrated detection and warning, fighters, guns, balloons and searchlights since the first Zeppelin raids on Britain in 1915. It was first unified under a single commander, Major General E B Ashmore, as a result of Lieutenant General Jan Smuts' first War Cabinet report following the deadly German Gotha bomber raids of mid-1917.¹⁵ Ashmore's first integrated air defence plan for the London Air Defence Area had layers of AA guns, to break up German bomber formations, with aircraft patrol lines behind.¹⁶ The inter-war Steele-Bartholomew, Romer and 1934 Reorientation Schemes had inner and outer artillery zones, but by 1939, with the introduction of faster monoplane bombers and fighters the outer artillery zone was dispensed with, and London and other cities and ports had inner artillery zones only, called Gun Defended Areas, therefore providing fighters with the freedom to engage outside of these.¹⁷

Pile's AA Command is often overlooked. AA artillery claimed around one quarter of German aircraft shot down in the Battle of Britain and was the sole means of defence against night attack until the radar guided night fighter was developed. AA Command was a relatively static organisation manned by territorials or men unsuitable for the Field Army, and an increasing number of women of the Auxiliary Territorial Service were employed in all roles except firing the guns, including the prime minister's daughter Mary Churchill.¹⁸ Pile claimed the technical aspects of air defence had forced his Command to become the most scientific arm of the Army.

It seems likely the Diver air defence plan was the result of combined ADGB and AA Command planning, with AA Command providing the AA gun expertise, notwithstanding AA Command's subsequent criticism of the plan. According to Pile's post-war despatch:

The decision to deploy [the guns] well inland was taken in order to reduce enemy jamming of radar equipment; to allow fighter aircraft the maximum area of manoeuvre and to leave the coast defences free to engage attacks by pilotless aircraft. It was not intended to use either static guns or mixed units [with men and women] in these places.¹⁹

It is clear from the maps produced at the time that the guns were sited in the Kent Downs in a belt designed to be as short as possible to cover the arcs between the probable launch zones in France and London. Scientific intelligence predicted the V-1s would approach London at heights of up to 6,000 feet, and therefore siting the AA guns in the Downs would enable them

to engage the V-1s while protecting their new gun laying radars (the GL Mk III) from expected German jamming.²⁰



Figure 1. The Operation Diver Defence Plan, April 1944.²¹ With Permission of The National Archives.

The redeployment of AA Command for the Diver air defence plan was executed on 16 June after the sustained V-1 attacks started. In three days, 376 Heavy AA guns (HAA), mainly 3.7-inch with some US Army operated 90 mm guns, and 592 light AA guns (LAA), mainly 40 mm Bofors, were deployed from London and other Gun Defended Areas to the gun belt on the Kentish Downs. That the redeployment was achieved in just three days was a remarkable performance given Pile's estimate that it would take eighteen days to redeploy.

Furthermore 560 RAF Regiment LAA guns (192 40 mm Bofors and 368 20 mm Hispano guns) were redeployed from ADGB airfields to the south coast, coming under AA Command.²² On 18 June Eisenhower directed AEF that air attacks on V-1 sites had priority over all other targets except a battlefield emergency, following the War Cabinet's request.²³

Initial Results

From 12 June to 15 July, of the 4,361 V-1s launched, 2,943 were observed by the defences and 1,241 destroyed, with 1,270 reaching London (see Table 1). Fighters destroyed 824, AA guns 261 and another 55 hit balloons. The V-1s' speed limited the warning given to fighters and only the fastest fighters such as the Tempest could catch the flying bombs. The hazard of shooting down a flying bomb led to the fighter tactic of tipping the V-1 over with the wing, probably the iconic image of the V-1 defences, as shown in Figure 2.

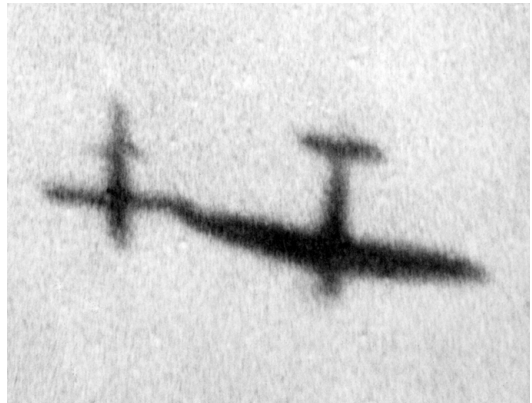


Figure 2. A Spitfire tipping over a V-1. 9 August 1944.
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It was the AA guns' performance that was most disappointing. Given a target that took no evasive action, the guns were destroying less than ten per cent of the V-1s they engaged. One factor was the V-1's approach at between 2,000 and 3,000 feet was unexpectedly low; above the effective height of LAA and too low for the mobile 3.7-inch guns to be manually laid onto the target. Electronically-powered, and therefore faster laying, static 3.7-inch guns were redeployed from the Gun Defended Areas to the Diver gun belt but it took time to build emplacements for them, although Piles' Royal Electrical and Mechanical Engineers devised an improvised platform from railway sleepers. Furthermore, AA Command's guns, sighted for protection from German jamming, had their observation and field of fire blocked by foliage or built-up areas. Many if not all the RAF Regiment LAA guns on the coast were prevented from firing at V-1s during this phase because they were in the fighter belt. Furthermore, AA Command believed the method of weapon control which enabled fighters to enter the Diver gun belt in hot pursuit of the V-1s or in good weather (defined as being able to see the ground) was further restricting gun engagements.

The Redeployment Decision

Roderick Hill was perhaps an unusual choice to command ADGB. Apart from a brief stint immediately beforehand commanding Fighter Command's 12 Group, his background was in test flying and development, with little operational command. A fine arts graduate from University College, London, in the First World War he had proved himself as an exceptional pilot, being one of the few who could master No 60 Squadron's Morane-Saulnier Type N

monoplane fighter, before commanding experimental units from 1917. He must have shown potential, as he attended the third RAF staff course, commanded No 45 Squadron in Iraq after Arthur Harris and in 1936 preceded Harris as AOC Palestine and Transjordan during the Arab Revolt, where he was responsible for introducing a strikingly modern method of close air support.²⁴ In 1942 Sir Wilfred Freeman told Portal that Hill was second rate, with 'poor judgement of men'.²⁵ Nevertheless, Hill was Leigh Mallory's choice first as AOC 12 Group and then to command ADGB.²⁶

The Worsted Manufacturer

The decision to reconfigure the air defence scheme followed a meeting between Hill and Pile's staff at HQ ADGB at RAF Bentley Priory on 10 July to deconflict fighters and guns. Pile suggested moving all the guns from the coast to the gun belt and keeping the fighters out of the belt to ensure total deconfliction, which Hill agreed to.²⁷ According to the Air Historical Branch (AHB) narrative, the official history, Hill's post-war classified report and his 1947 Despatch, before issuing the executive order Hill tasked his Deputy Senior Air Staff Officer (SASO), Air Commodore Geoffrey Ambler, to draft a note for Hill to explain to his fighter pilots why they would be excluded from the gun belt.²⁸

Ambler had an unusual background for an air officer as he was an Auxiliary, an RAF part-time reserve, called up for the war. His civilian profession was running the family's textile mill in Bradford. Furthermore, he had read engineering and economics at Clare College, Cambridge, and after the war he invented the Amber Superdraft which increased tenfold the speed at which wool was spun and transformed the worsted spinning industry.²⁹ He had started flying in 1928 and was commissioned into the Auxiliary Air Force in February 1931, commanding first No 608 (North Riding) Squadron from 1934 to 1938, and then No 609 (West Riding) Squadron, both bomber squadrons. From 1939 to 1942 Ambler was a sector commander in Fighter Command, then in 1942 Commandant of the Royal Observer Corps, before becoming Deputy SASO at Fighter Command in 1943.³⁰

Ambler wondered whether the proposed redeployment from the coast to the Kent gun belt went far enough and so he produced a formal appreciation (it would now be called an estimate) in accordance with the *RAF War Manual* overnight 12/13 July and seemingly not filed. He realised the best solution was deconfliction achieved by moving the AA guns to the coast, with fighters in front and behind.³¹ On 13 July Ambler discussed the matter with Sir Robert Watson-Watt, the radar scientist also based at Bentley Priory, and member of the Crossbow committee. Watson-Watt agreed with Ambler, and together they quickly convinced Air Vice-Marshal W B Calloway, ADGB's SASO, and all three then convinced Hill. Watson-Watt conferred with Pile, and Hill called a conference to discuss the proposal for 1730 that afternoon, attended by Hill, Pile, Watson-Watt, Calloway and Ambler, and other ADGB and AA Command staff.³²

Hill opened the conference by stating that following a comprehensive appreciation by Headquarters ADGB he had concluded the guns should be redeployed to the coast.

Pile agreed immediately. The decision is captured in the minutes, drafted as usual by Lieutenant Colonel C D Aarvold, an AA officer on Hill's staff, and these minutes were not subsequently challenged.³³ HQ ADGB's revised Operation Order, issued on 15 July, ordered a new Diver gun belt of 10,000 yards out to sea and 5,000 yards inland, and restricted fighters to above 5,000 feet when over it, and all other aircraft to above 10,000 feet. Guns outside of the gun belt could engage enemy aircraft but not V-1s. The seaward boundary of the gun belt was to be marked by marker buoys.³⁴ Furthermore, Hill notified Leigh-Mallory, who suggested starting with a trial scheme, which Hill said time did not allow. Hill informed the Air Ministry in a memo sent on 15 July, copied widely, which stressed the new plan 'was a tactical redeployment of the resources under my control' and forwarded a note from Ambler outlining the rationale for the redeployment.

Ambler's note, almost certainly based on his appreciation of just two days prior, outlined the advantages of the new plan for the 'co-ordination of Fighters and AA Guns', starting with fighters. As most fighter V-1 engagements had been overland, the new plan expanded the fighter zone overland, and allowed night-fighters the use of searchlights. Whereas deploying guns on the coast would, 'in the opinion' of experts, allow the best use of radar, the 'extensive use of VT [proximity] fuzes', and projectiles will fall into the sea, avoiding damage to property or civilian casualties. Furthermore, the new plan required only one 'rule of engagement' and both guns and fighters had absolute freedom within their zones.³⁵

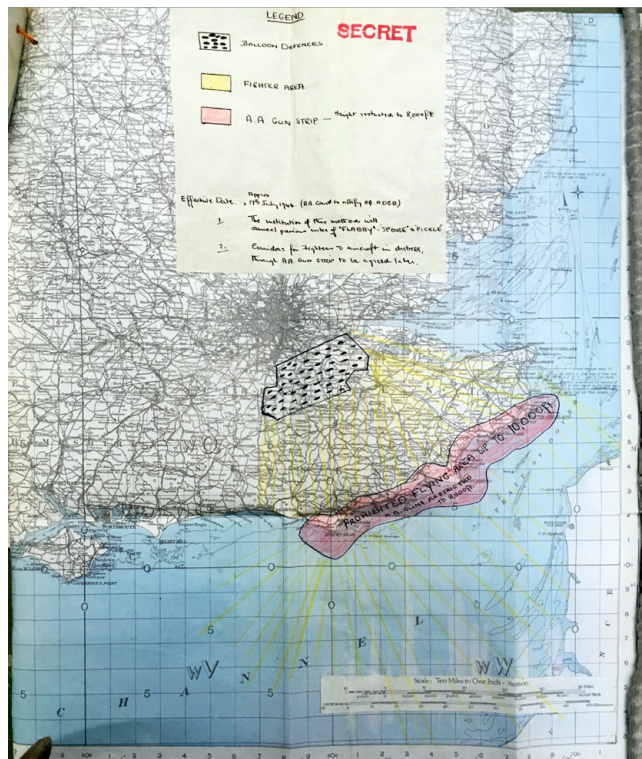


Figure 3. The Revised Operation Diver Plan, after 13 July 1944.³⁶ With permission of The National Archives.

Results of the Redeployment

The new scheme had an immediate impact, broadly quadrupling the guns' lethality. As Ambler predicted, the scheme combined the increasing replacement of mobile manually laid 3.7 inch guns with the more effective electrically powered static guns (shown in Figure 4), the use of the new US SCR 584 gun-laying radars, and the new proximity fuzes (known as variable time

(VT) fuzes) in the 3.7-inch and US 90 mm HAA guns. The improved results are shown in Table 1 for the two time periods of the main offensive, both before and after the 15 July redeployment. Phases 2 and 3, the air launched attacks and the limited long-range attacks from the Netherlands, when Hill increasingly relied on guns to bring down launched V-1s and used his fighters for counter-force attack, are beyond the scope of this article.



Figure 4. Static 3.7-inch anti-aircraft guns emplaced on the promenade of a South Coast resort, 6 August 1944. IWM H39807 non-commercial licence.

The move to the coast allowed the efficient use of the VT fuse, which alone was estimated to be seven times more lethal to V-1s than the existing No 208 fuze, which had to be set to the anticipated range.³⁷ The proportion of V-1s engaged by guns that were destroyed rose from ten per cent before the reorganisation of the defence to 17, 24, 27, 40, 55, 60 and 74 per cent respectively in the weeks following. Furthermore, an improved barrage of 2,000 balloons, now set to the correct height for the V-1s, brought down fifteen per cent of the V-1s that entered it. Although many of the fifty-six RAF Regiment LAA squadrons were now in the gun belt,

with their engagements misleadingly recorded as AA Command in the Fighter Command Operational Record Book.³⁸ Furthermore, the RAF Regiment's 815 20 mm Hispano canons, whose estimated 412,000 rounds fired accounted for only seven V-1s, were increasingly withdrawn from the operations, though its 40 mm Bofors LAA guns remained.³⁹ As the RAF Regiment squadrons on the coast were often deployed forward of the Army's HAA guns, their tents were sometimes shredded by malfunctioning 3.7-inch VT fuzes. The RAF Regiment's contribution to Diver, just one paragraph in the authorised history, is a subject ripe for further research.⁴⁰

| Number of Bombs | Main Offensive | | Phase 2 | Phase 3 | Whole Campaign |
|-----------------------|--------------------|-------------------|--------------------|-------------------|--------------------|
| | 12/6/44 15/7/44 | 15/7/44 5/9/44 | 16/9/44 14/1/45 | 3/3/45 29/3/45 | 12/6/44 29/3/45 |
| From Ramps | 4,271 | 4,346 | - | 275 | 8,892 |
| From Aircraft | 90 | 310 | 1,200 | - | 1,600 |
| Total Launched | 4,361 | 4,656 | 1,200 | 275 | 19,492 |
| Observed by Defences | 2,934 | 3,791 | 638 | 125 | 7,488 |
| Destroyed by Fighters | 924 | 847 | 71 | 4 | 1,846 |
| Destroyed by Guns | 261 | 1,198 | 331 | 87 | 1,878 |
| Destroyed by Balloons | 55 | 176 | - | 0 | 231 |
| By All Arms | 1,241 | 2,222 | 403 | 91 | 3,957 |
| Eluding Defences | 1,693 | 1,569 | 235 | 34 | 3,531 |
| Reaching London | 1,270 | 1,070 | 66 | 13 | 2,419 |

Table 1. The Flying Bomb Offensive.⁴¹

Duncan Sandys

The reason for the Air Staff's suspicion of Hill's decision was that Duncan Sandys had given Marshal of the Royal Air Force Sir Charles Portal, the Chief of the Air Staff (CAS), the impression he was making military decisions as chairman of the Crossbow Committee. Sandys, Joint Parliamentary Under Secretary at the Ministry of Supply, was from April 1943 chairman of the Crossbow Committee and reported personally to the War Cabinet. He co-ordinated V-weapon intelligence, counter-force and defensive operations, but he had no operational control. Hill and Pile attended the defensive operations element of the Crossbow Committee only, although Bottomley as DCAS attended throughout. When Sandys reported to the War Cabinet on 15 July, he was reporting Hill's decision of 13 July:

In the light of the operational experience gained to date the layout of the defences have been reviewed. As a result, it has been decided to make a number of important changes in our deployment plan for guns and fighters.

Sandys listed AA guns before fighters, though at this date fighters had destroyed four times as many V-1s as the guns, and his use of 'it has been decided' may have implied to Portal it was Sandy's decision, as Sandys was later to imply.⁴² Sandys sent a more detailed report on the V-1 defences to the War Cabinet on 17 July and again used 'it has been decided'. Sandys was either implying his responsibility or, if not, circumventing Hill's chain of command by reporting directly to the War Cabinet, rather than through AEAf, the Air Ministry and the COS' Committee.

As a result, several acrimonious exchanges between Portal and Sandys followed. When Portal reminded Sandys at the COS' Committee on 18 July of the constitutional responsibilities of the Air Ministry for air defence, Sandys admitted the new plan was 'settled' by Hill in consultation with Pile. The COS chairman, Field Marshal Sir Alan Brooke, evidently decided the military responsibilities needed clarification; hence the minutes stated the COS:

... agreed that the constitutional responsibility of the Air Ministry for the ADGB, and the responsibility of the COS Committee for advising the Government on the military aspects of defence measures, remained unchanged by any of the special machinery set up to deal with Crossbow.

This presumably is the 'first class row' and a 'tremendous beating of the drums' that Pile referred to in his later book *Ack-Ack*. In Pile's reading Hill was in trouble because he had sided with Sandys (and Pile) and hence Portal's statement that the responsibility must rest with Hill.⁴³ Another reading is that Portal is reminding Sandys (and Pile if he had a back channel to his former AA comrade Sandys) not to circumvent the military chain of command. Hill was the operational commander and had told the Air Ministry he was responsible for the decision in his 15 July memo.

Notwithstanding Portal's intervention on 18 July, Sandys on 25 July sent another report to the War Cabinet recommending a military decision, this time the desirability of increasing the number of fighter squadrons.⁴⁴ At the COS' Committee on the same day Portal, it seems, saw this as another attempt by Sandys to circumvent the chain of command. Portal reminded Sandys it was the Air Marshal Commanding ADGB's responsibility to judge whether he had sufficient fighters, for C-in-C AEAf to allocate resources as appropriate, and in any case, Hill had stated he had enough fighters. Sandys responded saying he thought more fighters were necessary, to which Portal responded by telling Sandys if Leigh-Mallory needed direction he should seek it from the COS. Sandys was subsequently forced to change the wording of his report.⁴⁵

Sandys held a lengthy press conference on 7 September after the first, most serious, phase of the V-1 offensive ended, when Allied forces overran the launch sites in France,

after which he was credited in the press for leading the successful counter-V-1 operations.⁴⁶ The photograph of the press conference at Figure 5 is illuminating, with Sandys standing, with Pile prominent to his right, Air Vice-Marshal William Gell, AOC Balloon Command, giving the impression by cleaning his glasses of someone who would rather be somewhere else, and Hill almost invisible in the background, far right, on Brendon Bracken, the Minister of Information's left.

Sandys' surviving transcript of the press conference focuses on the role of the guns, quoting the statistics that before the redeployment guns destroyed ten per cent of V-1s observed, and in the weeks after had increased to 17, 24, 27, 40, 55, 60 and 74 per cent, which got a cheer from the press. Sandys' credited both Hill and Pile for the 'bold step' of the redeployment to the coast.⁴⁷



Figure 5. Duncan Sandys, Press Conference Ministry of Information, 7 September 1944 © IWM CH 13827 non-commercial licence.

In the questions and answers after Sandys' address, Hill reminded the conference that fighters had to date destroyed more V-1s than the AA guns, giving the overall figures up to 5 September of 1,900 V-1s destroyed by fighters, 1,560 by guns and 249 by balloons, and that the Tempest Wing alone had shot down 578 V-1s. The press was interested in the names of the fighter aces, such as Squadron Leader Berry who alone had destroyed 58 V-1s in a Tempest, and the role of the women on the guns, and whether they had leave. Pile gave a figure of 392 LAA guns for the RAF Regiment, which was the number of Royal Artillery LAA guns, whereas the RAF Regiment had provided up to 600 guns.

Post War Accounts

Pile: 'Fighter Command evidently thinking along the same lines'

After the war Pile countered the RAF version of the decision when he claimed in his 1947 Despatch that the redeployment of the gun belt in July 1944 was AA Command's idea:

Lt Col H J R Radcliffe MBS, at that time my Technical Staff Officer, suggested that we should re-examine the plan of locating the guns on the coast. This plan had always seemed to us to have great advantages from the gun point of view.⁴⁸

In this Despatch Pile goes on to state 'Fighter Command [sic] were evidently thinking on the same lines' as Hill announced his decision on 13 July.

Pile's account is surprising given that he appears to have been highly regarded by Fighter Command. He joined the Royal Horse Artillery after getting into the Royal Military Academy at Woolwich (where Royal Artillery and Royal Engineer officers trained) at the second attempt, had a good First World War, after which the radical military strategist Colonel J F C Fuller convinced him to join the Tank Corps. Pile took part in the mechanised experiments, served at the RAF's School of Army Co-operation at Old Sarum. When the Government through the Inskip Review of 1937 decided to massively increase Britain's AA defences, and when Sandys joined, Pile was appointed to command the force, taking over from the future Chief of the Imperial General Staff, Brooke. Pile's success meant he was the only Commander-in-Chief to remain in appointment throughout the war. Lord Dowding and Hill, who both had operational control of AA Command, complimented Pile in their Despatches.⁴⁹

Radcliffe, as the AA Command Technical Staff Officer, would have understood the advantages of redeploying the guns to the coast as he knew the potential of the forthcoming US SCR 584 radar and VT fuzes through representing AA Command on Watson-Watt's Crossbow scientific sub-committees. The benefit of using VT fuzes on the coast had been raised at the Inter-departmental Radio Location Committee on 20 June and on 28 June Radcliffe had undertaken to consider how AA Command would make best use of the SCR 584 and VT fuzes.⁵⁰ Radcliffe may have therefore raised the advantage of redeployment with Pile but there is no record of an AA Command request to Hill.

Pile's account in his 1949 book *Ack-Ack* is subtly different to his official Despatch: skimming over the decision and instead focusing on the Air Ministry's reaction, and that he believed Hill had sided with Sandys and himself to prioritise AA Command's guns over the RAF's fighters.⁵¹

Ambler and Hill: 'certain persons have decided to compete in order to gain credit'

The RAF historian T C G James seemed aware that Pile might make contradictory claims when in late 1945 he wrote to Hill, Ambler and Watson-Watt to verify their accounts while drafting the AHB narrative. James asked Ambler for 'a significant minute or paper' to address 'the constitutional issues it raised with the Air Staff' and 'the wrong-headed notions the public have of who was responsible'. In his reply Ambler told James:

It is important to note here that this was the first approach to [ADGB] Command on this matter and at no time (to my certain knowledge) previously had any suggestion come from AA Command that the guns should be moved to the Coast. There is no doubt whatever that the proposal to move the guns to the South Coast came from Fighter Command [sic] and not from AA Command. [...] I have always felt that the decision to redeploy the guns in the heat of the battle and with politicians standing on hind legs and yelling was a most courageous and gallant act.⁵²

Furthermore, Hill supported Ambler's account of the decision when he replied to James and noted that AA Command was always keen to be seen as separate. Although neither Hill nor Pile mention it, Air Marshal Hill was a recently promoted three-star in operational control of the four-star General Pile's command. Hill, forever the test pilot, also sent James his log book entries for the 62 counter V-1 sorties he flew during Diver in his personal Tempest V.

The James-Ambler correspondence continued into early 1947 when in Ambler's final note he wrote 'certain persons have decided to compete in order to gain credit', and again states that AA Command had never previously raised the suggested move, the 13 July meeting was organised by Hill to direct his decision, and though Pile and Radcliffe may have discussed it 'what a man states he had in his mind at a particular time is not accepted as evidence in any court.' He concluded that Pile's account was part of a single service ploy to ensure Army AA was not placed under RAF control in the future.⁵³ It is worth noting that Ambler had by now been demobilised and was once again a worsted manufacturer, and possibly therefore less tainted than others by service politics.

Sandys: 'the facts are the exact opposite'

Meanwhile Sandys had convinced his father-in-law of his leading role in countering the V-1 and the decision to reorganise the defence. According to the historian David Reynolds' account of the writing of Churchill's *History of the Second World War*, Sandys drafted the 'Pilotless Bombardment' section of volume 6, first published in 1953.⁵⁴ Churchill's history credits Pile and Sandys for pressing for the move, and Hill and Pile for deciding on the move, with Sandys' approval.⁵⁵ Sandys' view was clear when he had earlier chastised Sir Archibald Sinclair, the Secretary of State for Air, for praising the role of the fighters: 'You have no grounds to claim that the RAF frustrated attacks by the V weapons. The RAF took their part but, in my opinion, their effort ranges definitely below that of the AA artillery.'⁵⁶ Yet, during the main V-1 offensive fighters destroyed 1,771 and guns 1,459, and overall guns destroyed just 32 more V-1s than fighters in all phases, as Table 1 shows, including March 1945 when Hill's fighters were attacking the launch sites and not flying defensive patrols.

When in 1956 Basil Collier drafted the V-1 chapter of the Cabinet Office official history, *The Defence of the UK*, he followed James' 1947 AHB narrative, Hill's classified report and despatch, and James' correspondence with Hill, Ambler and Watson-Watt.⁵⁷ When Collier sent his draft to Sandys for comment, adding that 'General Pile has since told us that a similar plan had been discussed at AA Command but thought unlikely to get Hill's approval', it provoked an extraordinary response. Sandys said he could not understand Collier's 'extraordinary insistence on proving exactly who was responsible for what'. Nevertheless, Sandys questioned the 'impression' that Hill was the person who initiated and inspired the plan for the reorganisation of the defences and that Pile merely 'assented to it'. Sandys wrote he was 'in a position to exercise quite considerable influence upon the policies of the commanders concerned' and furthermore:

To the best of my knowledge, the facts are the exact opposite. Pile, with my knowledge and support, had been badgering Hill for quite a while to make this change. [...] I get the impression that he was resisting this change, not on operational grounds, but because he was afraid of offending the feelings of his pilots. I was so dissatisfied with the position that I went to the Secretary of State for Air [Sir Archibald Sinclair] and asked him to consider the removal of Hill from his command. (I mention this last point as background information only. I have no wish for it to be made public).⁵⁸

Yet there is no mention of any proposal to move the guns to the coast in the minutes of the Crossbow Committee or Hill's ADGB conferences, other than on 10 July when Pile asks for the reverse, that is for all the guns to be moved to the Kent gun belt, and on 13 July when Hill directs the move to the coast.⁵⁹ Furthermore, there is no record of Sandys seeing Sinclair to get him to remove Hill from command of ADGB. That does not mean he did not, but if he had it would have been an interesting meeting, with Sandys, Churchill's son-in-law and junior minister, asking Sinclair, a Secretary of State, leader of the Liberal Party, and Churchill's devoted friend since before the First World War. Furthermore, Sinclair had an excellent relationship with his CAS, the longest serving of the chiefs of staff, and the only one who was, like Sinclair and Sandys, a member of Churchill's 'other [dining] club'.⁶⁰ In these circumstances it would have been a brave call to remove an air marshal from command because Army guns had been poorly sited, and presumably it would have fallen to Churchill to decide between Sandys, and Sinclair and Portal. Furthermore, Sandys may have been 'being economical with the truth', as his father-in-law might have said, either when telling Portal at the COS meetings in 1944 that he had not sought to influence Hill or when telling Collier in 1956 that he had. Collier, who in 1944 was an RAF intelligence officer working V-1s in HQ ADGB, noted in pencil on Sandys' response that Hill's account was 'certified by everyone but Mr Sandys as correct; where is the evidence to back his claim?'.⁶¹

Conclusions

Portal soon realised Hill had made the right decision. Bottomley reminded him of his scepticism of Hill's decision on 1 September 1944 and Portal replied in a hand-written note 'I think we had better send him an Air Council letter when we are confident that the FB [flying-bomb] is a thing of the past for London'.⁶² The Air Council then sent thanks to ADGB, AA and Balloon commands. In late 1944 Portal asked Hill to chair the technical branches committee while still commanding ADGB. Hill, agreed on the condition Ambler replaced Calloway as his SASO.⁶³ After the war, Hill was appointed Air Member for Technical Services where he established the RAF engineering branch, before retiring to become Rector of Imperial College and then Vice Chancellor of the University of London. Sandys is perhaps best known now as the Secretary of State for Defence whose 1957 Defence Review decided the RAF's fighters should be replaced by surface-to-air missiles.⁶⁴

Hill's decision was courageous not just because it occurred at a critical time in the V-1 offensive but also because of the political pressure implied by Pile and Sandys' subsequent accounts.

Fighters were to remain critical to V-1 defence after Hill's 13 July 1944 decision to reorganise the air defence scheme. Nevertheless, the effectiveness of the AA guns markedly improved when redeployed to the coast, as it allowed not just deconfliction, which had been Pile's concern, but also the use of the US SCR 584 radars and VT fuzes as they became increasingly available. By August the guns were shooting down more V-1s than the fighters, the static 3.7s averaged just 100-150 rounds per kill, down from 600 with the older fuzes and radars. Hill thus achieved the best integrated air defence available against the threat, integrating across service and operational domain boundaries and sensitivities, using the advice of Ambler, Watson-Watt, Pile and the gunnery experts like Radcliffe. The archival evidence supports Hill and Ambler's accounts of the decision, while Pile's despatch and book are factually accurate though somewhat misleading. Sandys' account is not supported by the archival evidence.

Notes

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³ J. P. Harris, 'The Sandys Storm': The Politics of British Air Defence in 1938, *Historical Research* 62 (1989): 318–36.

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⁶ Churchill, *The Second World War, Vol 6*, 49.

⁷ Phillips Payson O'Brien, *How the War Was Won Air-Sea Power and Allied Victory in World War II* (Cambridge, United Kingdom: Cambridge University Press, 2015), 484.

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Defence Research Paper

An Analysis of the Value of Air-to-Air Refuelling to Modern Air Operations

(Defence Research Paper - Advanced Command & Staff Course No 21 2018-2019)

By Wing Commander Stuart Patton

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Abstract: Although the potential of air-to-air refuelling has been repeatedly demonstrated, it has nevertheless evolved to be an area of marginal interest for many Western nations. With recent operations exposing critical shortfalls in this capability, this paper seeks to re-examine the value of air-to-air refuelling to modern warfighting. In order to do so, it first explores current doctrine, before analysing the historical development of air-to-air refuelling and its recent contribution to operations. Subsequently, the likely future challenges facing the capability are considered. This paper concludes that air-to-air refuelling is a highly versatile and valuable capability within modern operations, and notes that underappreciation and underinvestment in this area may be sufficient to limit Western war fighting capacity in future conflict.

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Introduction

The more I see of war, the more I realise how it all depends on administration and transportation... It takes little skill or imagination to see where you would like your forces to be and when; it takes much more knowledge and hard work to know where you can place your forces and whether you can maintain them there.¹

- Field Marshal Earl Wavell

The perspective of World War II General Field Marshal Earl Wavell speaks to an inconvenient truth: too often in post-operation analyses, and particularly in victory, the underpinning hand of logistics is an assumed more than an acknowledged contribution. Lamentably, developments following World War II, notably the increasing role for airborne logistics and aerial refuelling within it, do not appear to have altogether shaken this trend. It is certainly not without a degree of justification that air-to-air refuelling (AAR) crews of the United States Air Force (USAF) at times regard themselves as 'invisible men in invisible airplanes'.²

Perhaps a focus on combat elements beyond that applied to supporting enablers is unsurprising: after all, what use is a force multiplier absent the force itself? However, even if accepted, it must be recognised that such logic will shape the concepts and capabilities of a given actor. Unfortunately, these forces are all too evident in the evolution of aerial refuelling. Early post-World War II assessments within Britain's Air Ministry that 'flight refuelling on future types of aircraft [would not represent] a paying proposition' epitomise a wider trend that has seen AAR struggle to gain adequate recognition and investment in many nations.³ Thus, despite positive salients in history, it is a capability that has been dominated by the US within Western air orders of battle.

Again, it is not necessarily remarkable that the US would possess a preponderance of power amongst Western actors in a given capability area. What is increasingly notable, however, is the unsustainability of this position in a climate of prolonged expeditionary commitments, profound resource constraints and a growing threat from rising and resurgent powers. Recent coalition performance has only served to emphasise that, beyond the US, Western AAR capabilities are ill-matched to the full spectrum demands of contemporary conflict. In consequence, there is merit in re-examining the value of this capability to modern air operations.

In order to achieve this, this paper will first explore current air power doctrine, seeking to define key terms and to identify common themes amongst leading nations. With limited published material available outwith Western powers, both this and the ensuing analysis will centre on the concepts and capabilities pertinent to these actors. From here, the origins of AAR will be considered, highlighting the early factors that shaped subsequent US dominance in this area. The role of the Vietnam War in the assimilation of AAR into wider US operational concepts will then be assessed. Subsequently, the parallel evolution of British AAR capabilities,

and the impact of differing operational and political imperatives upon capability development, will be analysed. The preparedness and performance of British AAR during the 1982 Falklands War will then be used to demonstrate both the value of the capability and the potential operational impact of underinvestment in AAR.

Having investigated the evolution of aerial refuelling, its value in more recent operations will then be explored. Initially, the impact of this capability upon high-intensity warfighting in the 1990-91 Gulf War will be considered, alongside the contribution of coalition partners. The role of AAR in Western-led operations in the following decades will then be briefly examined, highlighting the mounting centrality of AAR within operational concepts, and increasing US reluctance to mitigate the shortcomings of partner nations. Finally, the future challenges to AAR will be investigated. Here, the UK will be used as a case study to demonstrate the difficulties faced by non-US actors in maintaining an affordable and relevant AAR-enabled force. The issues facing the wider AAR community will then be evaluated, centring on the complexities and importance of coalition operations in light of a mooted return to high-intensity warfighting. Overall, it will be argued that AAR is a highly versatile and valuable capability that is demonstrably and increasingly central to modern operations. However, in so doing, it will be recognised that beyond the US, underappreciation and underinvestment in this area may be sufficient to limit Western war fighting capacity in future conflict.

Concepts

At the outset, it is useful to examine how AAR is framed within modern doctrine, utilising both North Atlantic Treaty Organisation (NATO) publications and national concepts from four members of the five-eyes community: Australia, Canada, the United States (US) and the United Kingdom (UK). Here, strong standardisation is evident at the highest level, with all national concepts placing AAR as a sub-component of air mobility. Within this, national terminology is closely aligned, with all definitions for air mobility coherent with that of NATO, which establishes it as '[those capabilities enabling] the deployment, sustainment and recovery of military and civilian personnel and material by air'.⁴ Such similarity is also evident for definitions of AAR, which is broadly presented by all as 'the in-flight transfer of fuel between tanker and suitable receiver aircraft [in order to increase] the range, endurance, payload and flexibility of... capable receiver aircraft'.⁵

Beyond standardisation at this basic level, however, divergence in the doctrinal treatment of this capability is increasingly apparent. Reduced attention and focus is particularly evident in non-US doctrine, with neither the UK nor Australian exploration of AAR exceeding 100 words within documents of 122 and 253 pages respectively; similarly short treatment in the Canadian capstone doctrine is somewhat offset by more detailed treatment within its subordinate *Move* keystone doctrine.⁶ In light of this, the USAF digital framework offers valuable conceptual consideration of what would otherwise appear to be an area of peripheral doctrinal emphasis.⁷

Despite such limitations, sufficient detail exists to identify recognised mechanisms through which AAR can contribute to joint operations, notably including the ability of AAR to enhance the key air power strengths of *speed* and *reach*. Through this approach, receiving aircraft may be flown greatly beyond their normal range, reducing the impact of Access, Basing and Overflight frictions, and minimising time lost to en-route maintenance and weather vulnerabilities. AAR can therefore be seen to enable the projection of air power capabilities both further and faster than would be feasible without this capability. Identified with Canadian and USAF doctrine as a *force enabling* contribution, this has evident utility for the projection of fast-jet air power.⁸ However, the potential to reach globally from a domestic base also carries significant consequences for stand-off strategic strike, including nuclear munitions in the case of the US, and rapid deployment, particularly in the case of Special Forces.⁹

In addition to enhancing air power strengths, AAR is also offered in partial alleviation to the inherent weaknesses of air power, specifically *limited payload*, *impermanence*, and the *basing* sub-element of *fragility*.¹⁰ In this sense, AAR may reduce the requirement to trade between mission payload and mission fuel, offering the airborne replenishment of fuel in cases where runway or aircraft design constraints would otherwise preclude or limit mission feasibility. Beyond payload, AAR may also enable receiving aircraft to remain on-station far in excess of their routine endurance, potentially allowing the same degree of operational coverage to be achieved with fewer aircraft. Both this latter point, and the ability to reduce the weighting of geographic necessity in basing selection, are presented as *force multiplying* benefits of AAR within the consulted doctrine.¹¹

Origins

With much potential for AAR implied within doctrine, it is useful to now consider the inception of this capability, with particular emphasis on how early perceptions and attitudes shaped its development and distribution among nations. In this regard, the earliest concepts emerged amongst aviators in the First World War, with the first, albeit crude, AAR attempts completed in the US in 1921. Within two years, the US Army Air Service was conducting more significant trials, such that by 1924, this service had demonstrated the ability to triple the range of a receiving aircraft during a flight from the Canadian border to Tijuana, Mexico.¹²

Despite this early success, it was not until 1927 that further development activity began in earnest, with the Army Air Service successfully completing a continuous flight in excess of 150 hours. The pace of development then accelerated quickly, with further record flight lengths achieved within months, culminating in a near month-long flight of 647 hours. However, notwithstanding the Mexican demonstration flight, many such attempts had been conducted while remaining in the vicinity of the aviators' bases, and had therefore offered only limited insight into how this might be used to extend the range of an aircraft. Ultimately, the military potential of this capability failed to gain traction with the US prior to World War II, amidst apparent concern that the reduction in payload required to accommodate refuelling equipment would negate any benefit of extended range strike.¹³

Nevertheless, successes in the US did serve to reinvigorate parallel efforts in Europe, with early Royal Air Force (RAF) interest principally centred on the potential to extend the range of aircraft that had taken off at light weight. Such logic was based variously on reducing fatigue in sea plane hulls, limiting damage to grass strips and as a means of circumventing weight restrictions being considered by the League of Nations for bomber aircraft. However, as in the US, early interest did not translate into operational capability, resigning the leading legacy of AAR prior to World War II to an experimental mail service between Southampton and New York.¹⁴

Developments in AAR during World War II fared little better. US interest re-emerged in 1942 within concepts to strike Japan, but became marginalised by lengthy lead-in times for both equipment and training. Similar British ambitions in 1944 underpinned interest in an AAR capability for its Tiger Force, with AAR intended to offset a lack of Allied basing in the region. However, extended development timelines again undermined its necessity following the capture of airfields closer to Japan.¹⁵ Lacking a clear operational driver, British commitment to the concept therefore remained markedly hesitant in the early the post-World War II period; rising Cold War urgency to have Moscow within range of US bombers would ultimately provide the catalyst to develop the AAR concept militarily. In consequence, the first employment of AAR in support of combat operations was completed by a limited pool of nine US KB-29 aircraft during the 1950-53 Korean War.¹⁶

The Vietnam War

I don't believe many foresaw that air refueling would become a basic part of the scheme of employment of fighter forces over North Vietnam. Yet, early operations indicated that it would be most difficult to sustain any significant [tactical] air effort unless air refueling were used...with any substantial armament load, there was no way an F-105 or F-4 could fly [against Hanoi] without air refueling.¹⁷

- General William W. Momyer
US Commander Seventh Air Force (1966-68)

Following the limited operational employment of AAR in support of the Korean War, the Vietnam War would see the US utilise AAR at an unprecedented scale in support of combat activity. The intensity of the war, and its supporting AAR requirements, were such that many of the operational advantages and concepts identified in modern refuelling doctrine would be exposed and developed during the course of the conflict. Such an evolution is firmly evident in General Momyer's above assertion and in consequence, the contribution of AAR to the Vietnam War will now be used as a case study to explore this development.

In focussing on this conflict, it is important to recognise that as war in Vietnam approached, AAR concepts remained closely coupled to strategic bombing and nuclear deterrence within US attitudes. In consequence, the first aircraft capable of refuelling fighters close to their intended operating speeds and altitudes, the KC-135, was allocated to US Strategic

Air Command (SAC), limiting the development of tactical concepts. The employment of AAR aircraft in support of fighters pre-war was therefore largely confined to the facilitation of extended-range deployments; the first exercise activity in which such aircraft supported fighters in the *strike* phase did not take place until 1964, less than six months prior to the deployment of KC-135s to South East Asia.¹⁸

Given such limited pre-war exposure, the role of AAR in shaping the employment and operational capabilities of fast-jet aircraft in Vietnam will first be considered. In this regard, AAR enabled fighter aircraft to operate against North Vietnam from the relative security of Thailand, reducing the ground threat to both aircraft and their support crews. It also allowed these aircraft to operate with reduced compromise to their payload, while the ability to dynamically re-schedule AAR brought enhanced in-mission flexibility, enabling combat aircraft to be re-tasked as necessary.¹⁹ Beyond basic force multiplying, AAR was also able to yield more nuanced contributions to the fast-jet force. Here, limitations on airfield handling capacity, particularly arming, threatened to limit the amount of combat aircraft that could be generated in support of a single mission. Thus, by refuelling the earliest aircraft to launch, AAR was able to increase the force concentration available to combat planners, with attendant consequences for high-intensity operations against North Vietnam.²⁰

Fast-jet AAR in Vietnam would also expose the concept of 'saves': the practise of refuelling an aircraft that had otherwise insufficient fuel to complete its flight to base. Inherently connected to the advent of AAR in combat operations, this is a prominent term in US literature on the topic, with 53 'saves' officially recognised in 1966 alone.²¹ Given the striking risk of such operations, one may question whether AAR in fact encouraged operationally-focussed risk-taking beyond levels that would have been considered without it. Nevertheless, records reflect that this mechanism enabled a number of aircraft to provide extended support to critical operations, and also facilitated the recovery of aircraft with battle damaged fuel systems. Thus, while not an uncontroversial concept, the ability of AAR to enable the recovery of aircraft and airmen that would otherwise have failed to return is a capability that is not readily dismissed.²²

Beyond supporting fast-jet aircraft, the contribution of AAR remained significant, with force enabling contributions coming to the fore. AAR directly facilitated B-52 operations from the US base at Guam, offering the immediate benefit of reducing the strain on airfields closer to Vietnam, while also providing secure basing for a strategic asset. As a result, B-52s from Guam were heavily involved in the Arc Light raids against North Vietnam, in addition to the politically-significant Linebacker raids of 1972. More broadly, both carrier-based AAR and the airborne refuelling of helicopters were first fielded in major combat operations in this theatre, while AAR aircraft had also been adapted to meet the novel fuel requirements of the SR-71 reconnaissance aircraft. Such indirect support to reconnaissance efforts was further augmented by installing collection and communications rebroadcasting equipment onto AAR aircraft themselves, thereby maximising returns on their significant loiter times.²³

With significant benefits of AAR identified in this campaign, a number of shortfalls were also exposed. AAR aircraft were swiftly recognised as both highly vulnerable and highly valuable, restricting their ability to meet refuelling requirements in the contested airspace of North Vietnam. Moreover, the increasing centrality of AAR to operations in Vietnam rendered demand such that by 1972, 30 per cent of SAC's total refuelling fleet were committed to the theatre, testing even the significant resources of the US.²⁴ Limits to the ability of AAR to alleviate wider pressures would also be recognised, with the use of AAR to create large strike packages offering North Vietnam substantial warning of impending strikes. Separately, the enormous logistic demands of aerial refuelling had exposed the dependency of AAR basing on upstream logistic capacity.²⁵

Viewed holistically, Vietnam can readily be seen as an important point in the development of AAR both conceptually, and as an operational capability. Notwithstanding fuel provided by carrier-based naval assets during the war, AAR aircraft of the USAF ultimately offloaded almost nine billion pounds of fuel in the course of nearly 200,000 operational sorties.²⁶ Such statistics suggest that by the end of the war, AAR had become an integral component of US expeditionary war fighting capacity; the parallel evolution of British concepts between World War II and the 1982 Falklands Conflict will now be considered.

British AAR and the Falklands Experience

Pre-War Evolution

The evolution of AAR within British concepts offers valuable insight into how differing national strategic and financial contexts shape the development of operational capabilities. Here, the 1947 Air Ministry assertion that AAR did not represent 'a paying proposition' had established inauspicious foundations, from which the difficulty of attracting resource to AAR soon became apparent.²⁷ Not for the last time, the force multiplying potential of AAR would prove insufficient to justify reductions in basic force mass, with Fighter Command expressing concern at the impact of the cost of this capability on overall fighter force sizes.²⁸

Nevertheless, by 1954, attitudes had begun to soften, with initial British interest mirroring early US perceptions of AAR as a mechanism to augment strategic bombing capabilities. Within such visions, all 'V-class aircraft [were to have] fixed fittings to enable them to be operated as either tankers or receivers', placing AAR of significant status within the V-bomber concept.²⁹ Critically, however, such developments were not intended to generate a dedicated tanker force. Rather, existing aircraft would be required to provide this capability without compromising the strategic bomber footprint. Recognition of the need for a dedicated AAR force, both for V-bomber aircraft, and increasingly also for transport and fighter aircraft, would finally come in 1959. Indeed, the latter held particular significance in light of the limited unrefuelled range and endurance of the English Electric Lightning air defence aircraft. However, Treasury concern remained readily apparent regarding entry-ism and the affordability of providing AAR to a 'large part of the total frontline strength of the RAF'.³⁰

Financial hesitance despite the increasing utility of AAR likely reflects the reality of the wider political climate. The legacy of World War II and intervention in Suez had significantly strained the British economy, with marked consequences for defence expenditure, initially epitomised in the publication of the 1957 *Sandys White Paper*. While the most severe outcomes envisioned for manned combat air power by this paper did not materialise, both this and subsequent defence reviews would increasingly focus Britain's defence posture toward collective self-defence in Europe. Trends to erode expeditionary capabilities and extra-European commitments would culminate in the 1974 *Mason Review*, which limited Britain's strategic priorities to four areas: NATO in Europe; defence of the eastern Atlantic; defence of the UK and the strategic nuclear deterrent.³¹

Despite such trends, the exact impact of iterative defence reviews between 1957 and 1974 upon Britain's overall AAR capabilities is difficult to quantify. Certainly they were not fatally undermined: the challenging procurement environment created by these reviews did not preclude the approval of two replacement AAR platforms in the period, nor did it prevent the capability from becoming closely associated with UK air defence and fast-jet deployments. Nevertheless, the anti-expeditionary climate that Conservative Prime Minister Margaret Thatcher would subsequently ascribe to 'Suez syndrome' ensured that extended-range capabilities were not at the fore of the RAF's procurement activities.³² In consequence, by 1982, Britain operated an aging and modestly-sized tanker force with AAR receiver capabilities absent in a number of key aircraft.

AAR in the Falklands

In light of the above, the Argentinian invasion of the Falkland Islands presented UK politicians and strategists with a considerable challenge: Britain's declining expeditionary posture had ensured that no large-scale out-of-area contingency plans were available, yet the islands were located more than 8,000 miles from the UK. Furthermore, given the diplomatic difficulties of operating from the South American mainland, the nearest overt staging post available was at Ascension Island, approximately 4,000 miles from the Falkland Islands. The resulting Access, Basing and Overflight challenges were rapidly recognised as placing AAR to the fore in any candidate RAF response plans.³³

Both the operational benefits of AAR, and the impact of non-expeditionary posturing upon the capability, are evident across the RAF contribution to this campaign, not least in the case of the Harrier GR.3. Here, the vertical landing capability of this aircraft rendered it the only RAF fast-jet aircraft with any prospect of operating from Royal Navy carriers, and it was duly identified by planning staff as a potential attrition replacement for the Sea Harrier. However, the air-to-air mission set of the Sea Harrier represented a significant change of role for the GR.3, requiring both aircraft modification and aircrew training. In consequence, AAR-augmented deployment was used to buy No. 1(F) Squadron vital pre-deployment preparation time, enabling them to meet their onward transport, *SS Atlantic Conveyor*, at Ascension Island, without further delay to their arrival in-theatre. This action utilised the only RAF Harrier squadron qualified in AAR at the time.³⁴

Beyond facilitating GR.3 theatre entry, AAR's most direct contribution to kinetic elements of the campaign came in the form of supporting the Vulcan Black Buck operations. In this regard, AAR-extended Vulcan sorties were offered alongside a number of candidate options as a means to initiate offensive action against Argentine positions on the islands. This option presented no small technical complication to the Vulcan force, whose AAR capability had atrophied significantly: crew training had ceased in 1962 and much of the refuelling equipment had fallen into disrepair. Nevertheless, between the options, AAR-extended Vulcan strikes appeared to minimise both the risk of collateral damage, and the risk to the Sea Harrier force that was deemed vital to the defence of the naval task group. With AAR deemed a surmountable development requirement, the Vulcan option was duly selected.³⁵

The first Vulcan sortie against Port Stanley was successfully mounted on 1 May 1982, establishing a new record for the longest-range air attack. In the course of the next 42 days, a further six Black Buck sorties would be planned, of which four resulted in bombing or anti-radiation missile strikes against the islands. The direct operational impact of these strikes appears limited; however, they are also ascribed deterrent significance, drawing Argentine fighter aircraft toward defence of the homeland and away from offensive operations against the task force. Given such strikes were simply unfeasible without AAR, the capability can therefore justifiably claim a significant contribution within this action.³⁶

Beyond direct action, AAR also contributed fundamentally to non-kinetic efforts by RAF aircraft during the campaign, including Maritime Radar Reconnaissance by Nimrod MR.2 aircraft and long-range re-supply by C-130K aircraft. Critically, preparation for such operations would highlight fundamental shortfalls in AAR receiving capabilities on both platforms, with highly expedited modifications underpinning their subsequent operational contribution. Indeed, the pace of industry response was such that both aircraft types would complete AAR-assisted missions within a month of the instructions to proceed with industry. For the Nimrod, this newly-installed capability was integral to enabling maritime reconnaissance close to the Argentinian coast, providing vital information on the location of the Argentine fleet in missions lasting up to 19 hours. Separately, AAR was central to C-130K missions in the vicinity of the Falkland Islands, including Special Forces support flights to dispatch stores and paratroopers. Twelve such missions, each lasting a minimum of 20 hours, had been completed at the point of the Argentinian surrender.³⁷ The C-130K aircraft would also be swiftly modified to provide an AAR donor capability, albeit this was not fielded until shortly after the conflict.³⁸

Central to all the above contributions was the Victor K.2 tanker aircraft. During ten weeks of conflict, Victor tankers are estimated to have completed 600 AAR missions while transferring in excess of five million tonnes of fuel from a fleet of only 23 aircraft. Furthermore, the Victor contribution was not solely in the AAR donor role. Prior to the arrival of the Nimrod MR.2 in-theatre, AAR-extended Victor aircraft were also used to conduct limited Maritime Radar Reconnaissance, providing intelligence to the Royal Navy Task Force on shipping and ice floe locations.³⁹

In recognising the contribution of AAR, it is necessary to identify a key limitation of the capability in this campaign, namely efficiency. In this regard, extreme-range AAR operations were highly asset intensive, requiring a large number of tanker aircraft solely to refuel other tankers. By way of example, almost three times as much fuel was transferred to supporting Victors than was provided to the Vulcan during the first Black Buck operation.⁴⁰ Indeed, demand was such that the number of Victor aircraft required to achieve this mission consumed almost all of the operational capacity of the airfield at Ascension Island. In consequence, limitations in both tanker fleet efficiency and airfield capacity often necessitated a choice between the generation of Hercules re-supply, Nimrod reconnaissance or Vulcan strike sorties.⁴¹

When considering the utility of AAR to this campaign, brief mention of the impact of Argentinian AAR capabilities is also valuable. Here, two KC-130H tanker aircraft were able to contribute significantly to the results achieved by Argentina, with more than 100 refuelling serials completed during the hostilities. Most prominently, this capability enabled Argentine Super Etendard and A-4 aircraft to strike against the British task force from mainland Argentina, mitigating the unsuitability of Falkland Island runways for such aircraft. Moreover, this capability was integral to allowing these aircraft to operate in the fuel-intensive environment of ultra-low-level, and thereby to the ability of Argentinian strike aircraft to penetrate British defences.⁴² More broadly, this capability was also sufficient to generate perceptions of threat at Ascension Island, resulting in the positioning of a number of Harrier GR.3 and latterly Phantom aircraft in a deterrent role at the airfield. Thus, both directly and indirectly, Argentina also benefited appreciably from the capabilities of AAR.⁴³

Lessons

The contribution of AAR to the Falklands campaign, and the capability shortfalls that had been exposed therein, provided significant momentum for change in the aftermath of the conflict. Reflecting on the lessons of the campaign, the UK Ministry of Defence (MOD) ceded that by 1982, the RAF had become 'essentially a short-range or medium-range air force', focussed towards NATO and the defence of Europe.⁴⁴ Within this context, AAR had come to be regarded as 'a means of increasing time on task, not of extending range.'⁴⁵ In consequence, the Falklands conflict had forced the RAF 'to turn into a long-range air force', which in the eyes of the MOD had resulted in 'a significant change in the outlook and capability' of the RAF.⁴⁶ This transformation had included the pre-planned introduction of the VC-10 tanker role, in addition to the new purchase of nine wide-bodied Tristar AAR aircraft. Notably, the latter aircraft was listed first amongst a number of required post-conflict capability enhancements across the armed forces.⁴⁷ In light of the above, the performance of AAR in the Falklands campaign can be seen as closely coupled to a significant transformation in the operational perspective of the RAF, albeit AAR fleet sizes would ultimately remain modest.

However, with key lessons regarding AAR seemingly learned in the aftermath of this campaign, it is worth noting one area of tension, namely the exceptional performance of industry. Here, the viewpoint of Air Vice-Marshal George Chesworth is informative:

At Northwood we understood that the installation of a completely new system in the Nimrod, resurrection of the Vulcan system and providing longer legs for the Hercules was a mammoth task. But such was our confidence in the ability of MOD, industry... and the Service...in this war situation...we took for granted the improved capability of the air assets.⁴⁸

Air Vice-Marshal Chesworth's trust is similarly reflected in the lessons identified by the Secretary of State for Defence in the immediate aftermath of the campaign. For him, the campaign was deemed to have demonstrated 'the value of a broadly based national defence industry, and the benefits of an in-house research capability'.⁴⁹ In light of such perspectives, the ever-increasing trend towards privatisation, enhanced safety regulation, multi-national procurement and aircraft complexity in the years following this conflict must be viewed as weakening the relevance of this lesson. Certainly, it is difficult to foresee the exceptional modification timelines demonstrated in this campaign being repeated at scale, even factoring for the impact of operational imperative upon risk taking. Such logic implies a significant risk to future operations in the event deficiencies in contingent AAR capabilities become established.

AAR in the Post-Cold War Environment

Gulf War I

With the majority of the fundamental benefits of AAR both demonstrated and understood by Western powers during the Cold War, the return to expeditionary operations at the end of this period provides useful further insight into the value and limitations of the capability. Within this, the 1990-91 Gulf War represents a particularly valuable case study, with the largely dormant capabilities of air power dramatically re-emphasised in large-scale and high-tempo expeditionary warfare. Here, AAR would prove fundamental to the conduct and success of the operation, with US Chief of Staff General Merrill McPeak asserting that 'the tanker contribution to Desert Storm is what made [the air campaign] work'; 'no tankers, no airlift, no Desert Storm'.⁵⁰

The force enabling capacity of AAR was reasserted from the outset under Operation Desert Shield, with in excess of 1,000 aircraft deploying directly to the operational theatre from bases in the US. The contribution of this action to deterrence posturing is epitomised by the deployment of armed F-15C fighter aircraft, which were able to assume an alert posture in Saudi Arabia within a day of being notified to deploy. Beyond such rapid deployment, AAR also reprised the lessons of Vietnam, enabling vulnerable aircraft to operate from secure and suitable locations beyond their unrefuelled radius of action. Notably, this approach underpinned F-117 stealth strikes in the opening days of the conflict, in addition to B-52 cruise missile sorties conducted round-trip from the US.⁵¹

In addition to force enabling, AAR also offered force multiplying contributions to combat operations against Iraq. In this regard, favourable access and basing conditions supported the generation of AAR missions close to Iraqi airspace, maximising the offensive reach available to combat elements. This was coupled with robust *Counter-Air* and *Suppression of Enemy Air*

Defence capabilities to ensure that such high-value, high-vulnerability assets could do so at tolerable operational risk, while also denying enemy forces the ability to exploit their own AAR capabilities. The overall contribution of AAR is evident within post-war statistics: during the course of combat operations, on average 18 per cent of aircraft in the air were tanker aircraft; more than 60 per cent of attack sorties were dependent upon AAR, with AAR aircraft refuelling more than 1,400 aircraft per day.⁵²

The above statistics add significant weight to AAR's centrality to coalition operations, with AAR-contributing nations comprising the US, the UK, Saudi Arabia, France and Canada. However, despite improvements in partner capability, not least the UK, the vast majority of the AAR task was met by the US; wider nations conducted approximately 10 per cent of AAR sorties flown. This figure is substantially below the equivalent across all mission sets, in which non-US aircraft provided approximately 15 per cent of total sorties generated. Accordingly, AAR can be seen as a disproportionately US-centric undertaking in this campaign, the scale of which demanded almost half of the USAF tanker force. Such demand is likely to have held consequences for the US airborne strategic deterrent capability, albeit at a time of improved US-Russia relations.⁵³

In addition to evident restrictions in the ability of coalition partners to contribute to the AAR effort, further limitations were also exposed by the campaign. Despite the prevalence of tankers in the force mix, this capability at times remained a limiting factor, constraining both the combat sortie rate and the maximum force size of a given strike package. Here, the saturation of suitable air bases, and more pressingly, the operational airspace itself exacerbated issues of capacity, emphasising the importance of efficiency within operational planning. In light of this, pessimistic pre-mission fuel requests proved a particular frustration, with 85 per cent of AAR aircraft transferring less than 50 per cent of their available offload during operations, resulting in the airborne 'dumping' of fuel on numerous occasions.⁵⁴

Post-First Gulf War: Mounting US Strain

In the aftermath of the Gulf War, AAR continued to demonstrate its status as an established and central supporting capability, with little let up in the demand for expeditionary combat operations. AAR remained a coalition effort in this period: by way of example, the RAF had provided AAR support to deterrence and containment operations over Northern and Southern Iraq, in addition to supporting combat operations over Bosnia and Kosovo by the turn of the millennium. Indeed, the latter campaign would see more than 200 NATO AAR aircraft dedicated to the operation. Nevertheless, US assets continued to meet the majority of demand, with growing evidence that the limits of US capacity were being approached.⁵⁵

Strain upon the US AAR capability was exacerbated by the response to the terror attacks of 2001. This aircraft-based attack had introduced a further task for USAF AAR aircraft, with airborne tanker coverage required to support combat air patrols over key US sites. Furthermore, the ensuing transition to retaliatory operations against landlocked Afghanistan

had created a parallel AAR requirement, without which both carrier and land-based operations could not be effectively brought to bear. Indeed, demand was such that the ratio of AAR missions to strike sorties had at times approached 1:1.⁵⁶ This challenge was further emphasised by the return to combat operations against Iraq under Operation Iraqi Freedom, where the number of committed USAF AAR aircraft peaked at 319 aircraft from a mission capable pool of 379 and a total fleet of 539. Such heavy AAR demand carried particular concern for wider US warfighting: a 2004 US report noted that despite the evident strain, the overall weight of effort of this campaign was likely some way below US ambitions for future high-intensity conflict. This report also highlighted a further change in the usage of AAR in the Afghanistan and Iraq campaigns, whereby a more permissive air environment had been exploited to routinely provide AAR directly over the battlefield. Through this technique, AAR was enabling the footprint of ground forces and firepower to be offset by loitering combat aircraft, again at increasing commitment to AAR assets.⁵⁷

Against the backdrop of mounting pressure on US resource, coalition efforts against Libya in 2011 can be seen as a significant cautionary indicator. Here, it is critical to note that the strongest overt pressure to intervene came not from the US, but rather the UK and France. In consequence, while the campaign ultimately transferred to NATO leadership, the performance of non-US nations in this operation offers particularly valuable insight into wider Western AAR capabilities.⁵⁸ In this regard, non-US nations were able to provide between 12-15 AAR aircraft over the course of the campaign, with France dominating this contribution. Britain was able to offer limited support in the face of concurrent operational demand, while broader coalition contributions came from Italy, the Netherlands and non-NATO Sweden; Turkey limited the provision of AAR to its own forces.⁵⁹

Overall, the non-US contribution equated to approximately 23 per cent of AAR missions flown, representing a comparable if not favourable ratio to that of previous campaigns. However, serious shortfalls remain apparent, with non-US AAR aircraft capable of supporting a force ratio of only 1:10 between AAR and offensive air power elements, hugely below the near 1:1 peak observed in Afghanistan. This ratio undoubtedly constrained the offensive capabilities of the coalition: even when improved to a ratio of 1:4 by US efforts, post-operation analysis identified that 'tanker availability was the main limiting factor for the pace of air operations'.⁶⁰

The significance of this shortfall is amplified by the declared impact upon the US. Post-operational assessments would conclude that 'Libyan air operations placed [US] refueler units under stress and would have been beyond the capacity of the Air Force to produce, had [reservist] volunteers not saved the day'.⁶¹ Such strain suggested observable limits in the ability of the US to underwrite coalition shortfalls, particularly in discretionary interventions. US politicians were similarly scathing. For US Secretary of Defense Robert Gates, the campaign exposed 'shortcomings – in capability and will – [that had] the potential to jeopardize the alliance's ability to conduct an integrated, effective and sustained air-sea campaign'. He further warned of 'dwindling appetite and patience in [US politics]...to expend increasingly precious

funds on behalf of nations...[that were themselves]...apparently unwilling to devote the necessary resources'.⁶² AAR deficiencies thus formed an important component within public US frustrations at the capabilities of its alliance partners.

Given the starkness of the US message, it is perhaps encouraging to note indicators of change. Then NATO Secretary-General Anders Fogh Rasmussen was swift to recognise the scale of non-US dependency upon US capabilities such as refuelling, ceding that 'more Allies should be willing to obtain them'.⁶³ There is also evidence of action to underpin the narrative: by 2018, the UK, France, Germany, Norway, the Netherlands, Belgium and Luxembourg were all amongst nations to refresh or to seek to renew their refuelling fleets.⁶⁴ With little sign of alleviation to the operational demand, there appear cautious grounds for optimism regarding NATO and coalition AAR.

AAR: The Challenge for Future Operations

With US ability and willingness to meet the AAR requirements of coalition operations seemingly in decline, and little evidence of abatement in the associated demand, the AAR capabilities of Western-oriented powers would appear to be approaching an important crossroads. However, such an assessment has thus far been made with little reference to trends in future conflict, despite evidently rapid evolution in both the political and operational domains. In consequence, this paper will now explore the challenge facing future AAR operations.

Case Study: The UK

Initially, the UK will be used as a case study to expose the difficulties facing non-US nations. Here, UK AAR capability for the foreseeable future is provided by the RAF through a private finance initiative that employs a core pool of nine Voyager aircraft, with the contractual potential to utilise a further five aircraft under surge conditions. Notably, this fleet represents both the sole AAR donor capability, and also the sole strategic passenger transport capability, approved within the UK inventory. Thus, it is necessary to recognise that the day-to-day-demands placed upon this fleet are substantial even before considering emerging threats to the capability. Specifically, Voyager aircraft provide 24/7 standby support to the UK air defence deterrence posture, with a further aircraft supporting a similar requirement in an enduring deployment in the Falkland Islands. Beyond air defence, the UK is also currently maintaining a deployed AAR presence supporting operations in Iraq and Syria, thus committing at least one third of all core aircraft to priority AAR operations. Even in the absence of further operational tasking, the remainder are required to accommodate the separate demands of passenger and fast-jet deployments, in addition to AAR training and periods of aircraft maintenance. Thus, while the surge pool remained largely unused as at 2016, it is readily apparent that surplus core capacity is likely to be limited even at current scales of operation.⁶⁵

Recognising a degree of strain on current capabilities, two key emerging areas of tension will now be considered, the first of which concerns Voyager compatibility with wider UK military

aircraft. In this regard, a critical impact derives from the UK adoption of the *probe and drogue* method of refuelling at the expense of the alternative *boom* method favoured by the USAF. This incompatibility is most evident within the UK's large aircraft fleet: the C-17 transport, P-8 maritime reconnaissance and RC-135 intelligence aircraft fleets are all optimised to utilise the USAF system despite the lack of a UK capability. Critically, this suggests a particular limitation for UK airborne intelligence collection, especially when considered alongside runway limitations that ensure UK RC-135 crews 'require a tanker for every mission' from their home base, according to USAF Colonel Thomas Torkelson.⁶⁶ Notwithstanding wider developments in aircraft range and endurance, this limitation therefore appears to risk a return to the limited expeditionary posture at the time of the Falklands campaign for large aircraft. Beyond such aircraft, the UK also lacks a helicopter airborne refuelling capability, with particular impact upon the timely deployment of Special Forces.⁶⁷

The introduction of the F-35 aircraft carries further consequences for UK AAR, with the lack of a boom capability complicating the mooted procurement of F-35A aircraft given the latter's lack of a refuelling probe. In itself, this is not un concerning given the F-35A's lower unit cost and higher combat radius compared to the carrier-adapted F-35B variant. Indeed, there is evident potential for this incompatibility to threaten overall UK F-35 force capacity, if unit cost is assumed to correlate closely with affordable fleet size. However, more fundamental impacts can also be seen, most significantly in the ratio of sovereign AAR assets to strike aircraft. In this regard, the intended UK purchase of 138 F-35 aircraft would at best represent a ratio in excess of 1:9, predicated on the unrealistic assumptions of maximum Voyager surge and no wider calls on the platform. When such a ratio is considered with regard to force ratios desired in preceding campaigns, this would suggest that UK maximum offensive capability would likely only be available with international AAR support. High-intensity sovereign operations may be unlikely; nevertheless, placing a dependency upon a wider capability pool that is recognised as being under-resourced would appear to suggest a degree of imbalance in current UK force plans.⁶⁸

Wider Challenges

Given the likelihood of enduring coalition dependencies, the wider challenges facing Western nations in future conflicts will now be explored. Here, beyond ceding sovereign capability, two significant frictions are apparent. At a basic level, approval for receiver aircraft to refuel from coalition partners remains underdeveloped: in 2014, 40 per cent of the potential donor-receiver combinations within the European inventory were not cleared for use, risking delay to operational reaction times even in the event of latent equipment compatibility.⁶⁹ Beyond clearances, a further issue is presented in the implicit connection between AAR and the mission conducted by the receiving aircraft, potentially staking the offensive actions of one actor to the enabling activities of another. This latter friction risks substantially complicating mission co-ordination and strike planning.⁷⁰

With challenges evident, the necessity of coalition action has nevertheless been enhanced given the rising interest in warfighting at scale associated with Russian resurgence.

However, despite European procurement messaging, a NATO-led air power review in support of the 2016 Warsaw Summit continued to emphasise the urgent shortfalls in coalition AAR capability previously identified in the after-action analysis of Libya. Again, European capability deficits were particularly stressed, with such nations reportedly contributing less than 10 per cent of the 709 AAR aircraft available to the alliance.⁷¹ Thus, should future escalatory posturing or action be required, NATO's ability to maintain a credible air power stance appears to remain somewhat staked to US AAR; the intended US pivot towards Asia can only exacerbate this issue.⁷²

Compounding this problem, not least among European nations, are the spiralling costs of equipment programmes when set against profound budgetary constraints. Thus, having previously identified renewed commitment amongst a number of European partners to re-invest in AAR capabilities, it is useful to examine the detail of planned procurement. Here, the overall uplift in European AAR aircraft in the 2020-25 timeframe is estimated to be approximately 22 aircraft, potentially representing a 40 per cent improvement from the 2014 position.⁷³ However, much of this uplift reflects the optional use of A400M in the refuelling role, with issues of capacity and off-role utilisation potentially limiting the realisation of much of this benefit. In consequence, the absolute impact of this activity is likely to remain modest despite encouraging headline figures. Moreover, mounting unit costs for both modern fighter and AAR platforms are likely to do little to encourage the adoption of an AAR capability amongst the 40 per cent of European nations who possess AAR receiver capabilities but no organic tanker aircraft; the notable absence of Hungary and Poland from current European procurement efforts despite apparent initial interest may well speak to such difficulties.⁷⁴

Beyond evident issues with capacity, it is also important to recognise that warfighting at scale significantly complicates the conduct of AAR. At the heart of this issue are the Anti-Access and Area Denial (A2AD) capabilities fielded by an increasing array of actors, not least Russia and China. Such measures drastically increase the range at which static, high-value or vulnerable assets can be placed under threat, with attendant impact on both basing and airborne AAR operations. Paradoxically, therefore, effective A2AD can be seen to both increase the necessity for AAR while decreasing the feasibility of completing it.⁷⁵

The A2AD threat carries particular consequences for the interdependency between AAR and future Western carrier operations given the limited unrefuelled combat radius of the F-35B. Estimated to be 450 nautical miles, this radius risks drawing the carrier group perilously close to the anti-surface capabilities of developed states, even if employed against targets close to hostile borders.⁷⁶ This logic adds a degree of weight to suggestions that AAR might be essential to extend the range of carrier strike aircraft. It is therefore significant that current carrier-based AAR capabilities are at best limited, and are entirely absent in the case of the UK. In consequence, without further development, UK carrier operations requiring AAR will either be dependent on land-based assets, which may be impracticable given the A2AD environment, or reliant on US carrier-based AAR with little guarantee of availability. Thus, given

the limitations inherent in either dependency, there would appear significant utility in pursuing a carrier-based AAR platform with at least some ability to operate within a contested environment. Here, the buddy refuelling capability of the F-35, the V-22, or the autonomous capability in development under the MQ-25 programme, would all appear credible candidate options.⁷⁷

Consideration of autonomous capabilities provides a useful final focus regarding future challenges. Such developments may in fact reduce the otherwise mounting burden: current capabilities in this area, including the MQ-9A Reaper, already possess unrefuelled loiter capabilities in excess of 12 hours, with concepts such as the solar-powered Zephyr aircraft seeking to vastly extend this.⁷⁸ Indeed, given the additional system weight and complexity of incorporating AAR, there appears little incentive to reverse such developments, particularly for roles such as reconnaissance. However, factoring for the above-mentioned A2AD threats, it remains more likely that future autonomous combat systems will share the AAR dependencies of current piloted platforms, given the greater manoeuvrability and overall system complexity required by such aircraft. In consequence, the US Navy's 2015 demonstration of remotely-piloted AAR may offer early insight into an important next-generation capability.⁷⁹

Conclusion

The above analysis has sought to present AAR as a critical yet underappreciated capability within Western air inventories. In light of this, a review of contemporary doctrine has been shown to support both aspects to this contention: beyond the US, there is at best limited exploration of this capability but nevertheless, the potential for AAR to emphasise the strengths of air power, while alleviating key weaknesses, is evident when considered holistically. Beyond doctrine, divergence between the US and wider actors has been identified even in the early development of AAR, with slow progress limiting the ability of AAR to demonstrate operational utility during World War II. Thus, post-war forces have been shown to have accelerated US interest while frustrating early UK efforts, rendering Korea and Vietnam important proving grounds for the military potential of aerial refuelling. Indeed, the latter conflict has been presented as holding particular significance for the integration of AAR with tactical forces, while also serving to expedite and enhance the development of wider AAR principles. Early evidence of the ability for AAR demand to stretch supply capacity has also been highlighted in this campaign.

Turning to the parallel evolution of Britain's AAR capability, it has been argued that political and financial strictures were important in limiting the growth and centrality of AAR within UK air power concepts. Viewed in this context, shortfalls in UK AAR capability at the outbreak of the Falklands conflict can be seen to have epitomised a wider lack of expeditionary focus. From here, the performance of AAR during this conflict has been demonstrated to have yielded important benefits for both sides. For the UK, AAR enabled strategic strikes against Argentine positions on the islands, in addition to supporting reconnaissance and re-supply missions, while also enhancing the flexibility of force deployment. Separately, this capability

underpinned Argentine operational tactics and created a wider deterrent effect on UK forces at Ascension Island. Overall, the performance of AAR in this conflict has been shown to have re-emphasised the importance of such expeditionary capabilities within the strategic mind-set of the RAF.

The ensuing analysis of AAR in more recent operations has underscored the potential and centrality of AAR previously identified. Here, force multiplying and force enabling contributions rendered the capability fundamental to the air power campaign of the First Gulf War in the eyes of senior military officials, despite mounting evidence of capacity limitations. This campaign has also been used to offer tangible evidence of the deepening capability divide between the US and wider coalition partners. The increasing challenge presented by this division to coalition cohesion in post-First Gulf War operations has also been demonstrated, particularly in light of the diverse and sustained commitments faced by the US post-2001; AAR shortfalls in the 2011 Libya conflict epitomised such deficiencies. The attendant threat to Western high-intensity warfighting potential has also been shown, with recent European procurement behaviours offering some evidence of improvement.

With significant complexity facing current AAR operations, the additional challenges of future conflict have also been considered. Here, the RAF has been used to exemplify these difficulties, most notably the inherent tension between standing commitments, expeditionary demands and firmly finite resources. The RAF has also been used to highlight the potential for equipment compatibility to shape the operational capabilities of a nation, in addition to exposing an apparent imbalance within its intended future force construct. Beyond the RAF, the enhanced complexity and necessity of coalition AAR operations has also been demonstrated, particularly in light of the threat from rising and resurgent actors. A2AD has been shown to be a particular threat to vulnerable AAR assets, with even greater risk to carrier force projection. With automation likely to offer at best partial alleviation, the future of AAR therefore appears unlikely to be less demanding than the contemporary challenge. In consequence, efforts to improve doctrinal and physical investment in AAR amongst Western nations are likely to be of firm significance to the wider warfighting capacity of such actors in future conflict.

Notes

¹ Quoted in Jeffrey Ethell and Alfred Price, *Air War South Atlantic* (London: Sidgwick and Jackson, 1983), 129.

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³ Quoted in Humphrey Wynn, *The RAF Strategic Nuclear Deterrent Forces: Their Origins, Roles and Deployment 1946-69. A Documentary History* (London: The Stationery Office: 1997), 153-154.

⁴ NATO, *AJP-3.3: Allied Joint Doctrine for Air and Space Operations*, Ed. B Version 1 (n.p.: NATO Standardization Office, 2016), 1-12.

⁵ Ibid., 1-14.

⁶ Australia. Air Power Development Centre. *The Air Power Manual*. Australian Air Publication 1000-D. 6th ed. (Canberra: Department of Defence, 2014), 69; United Kingdom. Developments, Concepts and Doctrine Centre. *UK Air and Space Power*, Joint Doctrine Publication 0-30. 2nd ed. (Shrivenham: DCDC, 2017), 39; Canada. Royal Canadian Air Force. *B-GA-400-000/FP-001: Royal Canadian Air Force Doctrine*, 3rd ed. (Canada: Royal Canadian Air Force, 2016), 35.

⁷ United States. LeMay Center for Doctrine, "Annex 3-17 - Air Mobility Operations," *U.S. Air Force Doctrine*, <http://www.doctrine.af.mil/Doctrine-Annexes/Annex-3-17-Air-Mobility-Ops/> (accessed 1 May 2018).

⁸ Canada. Canadian Forces Aerospace Warfare Centre. *B-GA-404-000/FP-001: Canadian Forces Aerospace Move Doctrine*, 1st ed. (Canada: Canadian Forces Aerospace Warfare Centre, 2011), 31.

⁹ United States. LeMay Center for Doctrine, "Annex 3-17 - Air Mobility Operations: Air Refueling Operations," *U.S. Air Force Doctrine*, http://www.doctrine.af.mil/Portals/61/documents/Annex_3-17/3-17-D25-Mobility-Refuel-Ops.pdf (accessed 1 May 2018).

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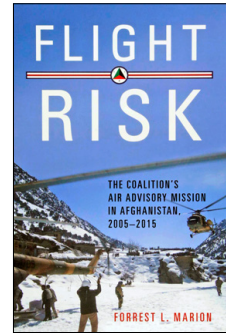
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Book Review

Flight Risk



By Forrest L. Marion

Publisher: Naval Institute Press, 2018 (ISBN: 978-1682473368), 376 pages

Reviewed by Dr Frank Ledwidge

Biography: Frank Ledwidge is a Senior Lecturer in Law and Strategy at the University of Portsmouth, currently teaching at the ACS in RAF Halton. Amongst other books, he is the author of *Losing Small Wars* (Yale 2011/2017) and *Aerial Warfare* (OUP 2018) both of which were selected for the relevant CAS Reading Lists.

Introduction

This is a fine book which might be summarised as a story of strategic failure in miniature. It will be essential reading for anyone involved in advising or assisting developing air forces. Given that the topic is the Afghan Air Arm, it is fair to say that most problems that will be encountered by RAF personnel in an advisory capacity will have been encountered by the (largely American) coalition air advisory team in Afghanistan. In 2011 it was designated the NATO Air Training Command-Afghanistan or NATC-A. *Flight Risk* is their story.

The book begins with a concise history of Afghan Air Power from 1919 to the period just prior to the western interventions in 2001. This is an interesting story in itself; it is also instructive. The most telling account is that of the time of the Soviet invasion from 1979-1989 and indeed for the three years subsequent when Afghan forces remained reasonably intact. This reviewer is not the first to remark upon the achievements of Soviet advisors during that particular bloody occupation, Roderick Braithwaite in *Afghantsy* (Profile Books 2012) being the most distinguished. By the end of the Soviet invasion the Afghan air force was a functioning service comprising over 400 aircraft. An account of how the Soviets achieved this remarkable growth would have been very useful, if only to counterpoint the failures of the later ISAF mission.

I should say that this is the only major criticism I have of this book. For now, it is enough to say that for the Soviet Union Afghanistan was, and more importantly was treated, as a genuine strategic national priority.

No effort was spared by the Soviets in ensuring that personnel involved in Afghan civilian and military roles were trained not by contractors in makeshift surroundings, but brought to the Soviet Union in their thousands. There they were taught Russian and trained to Soviet standards. It is for this reason, as many who have served in Afghanistan will note, that in dealing with senior Afghan officials during the ISAF period, knowledge of the Russian language was very often just as useful as either of the main Afghan languages, Dari or Pashtun. Interestingly Marion makes the point that the small Czech team attached to the mission, most of whom knew at least some Russian and of course knew the airframes used by the nascent new Afghan Air Arm, were some of the most effective advisors.

The Coalition air mission got under way in 2002 from a standing start. As Marion points out, 'It was literally designing an Air Force from scratch' (p. 58). Very, very few airframes had survived the NATO attacks. By 2005, the Afghan Air Arm, always and still very much the junior element of the army, had managed to produce the capability to transport the president around the country reasonably safely, hardly a ringing endorsement of an effective reconstruction mission.

Several themes percolate the subsequent account. With a great deal of effort, the problems of selecting and training aircrew were painstakingly dealt with if not entirely solved. However, serious issues around Command and Control, a dearth of suitable ground personnel available for recruitment, effective and safe maintenance and above all endemic corruption run through the book. It is the latter, and specifically the influence of what are termed 'Corrupt Patronage Networks' ('CPN's) which cuts through much of the book. The most sinister manifestation of this was, or seems to be, the killing of nine members of the mission. Marion's most controversial conclusions relate to this 'Green on Blue' assault in April 2011. The evidence as it is now available suggests that the first US investigation into the murders may, wittingly or otherwise, have ignored or sidelined evidence that CPNs were involved, and not the Taliban as was first alleged. Why this should be the case is not immediately clear from the text. Were there secrets that needed to be hidden? Was the killing some form of warning? We are not told.

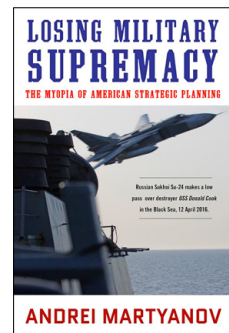
A second investigation informed the commander of the first that they had concluded that organised crime in the Afghan Armed Forces was behind the murder. 'Bingo' he replied, 'you solved it; now good luck getting it past the command' (p. 113). The theme of the burial of bad news by senior command is another that runs through the book, and very strongly so in its later sections. Marion summarises this; 'unfavorable [sic] reports were simply not permitted' (p. 193). As one advisor is quoted as saying 'We highlighted every small advance and downplayed or just didn't mention the many epic failures' (p. 193).

Subsequent to the killing of the nine, the practice of 'Guardian angels' was instituted; it was generally believed that this 'was necessary but killed advising' (p. 128). As the mission proceeded, a sense of waste seems to pervade the mission. Between 2002 and 2011 the US spent an amazing \$72 Billion on this effort. The issue of culture clash is another perennial. Again, everyone who has served in Afghanistan alongside Afghans will be closely familiar with this. One interesting manifestation of cultural dissonance was the surprising prioritisation of bringing the bodies of dead soldiers to their families over the delivery of the wounded to hospital. There were many others. On a lighter note, concerning Command and Control, more than one reader may reflect that the practice of senior officers co-opting aircraft for their own (apparently private) use or convenience, is not confined to Central Asia.

Away from the details of the perils and pitfalls of advising in what might be described as an unfavourable environment, the book describes the vicissitudes of the overall Western mission. It points up a wider lack of a strategic approach to identifying realistic objectives and what happens when there is a failure by senior officials to be transparent about what is going right and what is going wrong. The author is a Staff Historian at the US Air Force Historical Research Agency. He makes it clear that the text has been 'cleared' in the introduction. Perhaps paradoxically given its focus on a lack of transparency regarding failures of the Mission in theatre, this book is a remarkable testament to the willingness of the USAF, or at least some elements of it, to be almost as blunt about failure as about success; in doing so it seems to indicate an openness to critique which other air forces could consider replicating.

Book Review

Losing Military Supremacy: The Myopia of American Strategic Planning



By Andrei Martyanov

Publisher: Clarity Press, Inc. (14 May 2018) (ISBN: 978-0998694757), 250 pages

Reviewed by Paul Stoddart

Biography: Paul Stoddart served in the RAF from 1983 to 1991 as an aerosystems engineer officer and, following a short stint as a journalist on a car magazine, has worked in MOD since 1993. He worked on the Tornado successor study at Farnborough, managed the Harrier and Sea Harrier trials programmes at Boscombe Down and attended the Advanced Command & Staff Course at the Joint Services Command & Staff College. He is currently a scientific adviser at the Air Warfare Centre. He is a Fellow of the RAeS and a member of the RAeS Air Power Group committee.

Introduction

Andrei Martyanov was born in 1963 in the USSR in Baku (now the capital of Azerbaijan). He graduated from the Kirov Naval Red Banner Academy and served in the Soviet Coast Guard until 1990, before moving to the USA in the mid-1990s. Martyanov does not adopt a diplomatic tone or pull his punches in expressing his views; nor does he flatter his adopted country with lavish praise. On the contrary, he is highly critical of many aspects of American outlook and behaviour while claiming a greater degree of realism by Russia (and Russians) especially on the realities of war. For example, on the second page, he claims that 'American vaingloriousness ... has today become a clear and present danger to the world and it is, in the end, a direct threat to what's left of America's democratic institutions and processes'. Whether he makes the case for this claim is debatable. He goes on to state that the USA devises excessive assessments both of its own capabilities and of the dangers it faces. The former condition stems from America's sense of its own 'exceptionalism' dating

from the 19th century (with reference to Alexis de Tocqueville's 1835 work *Democracy in America*). The latter appears to be a product of the 'military-industrial complex' exaggerating the threat to justify higher defence spending. Allowing that this will always be the case to an extent, Martyanov then emphasises the fact that Russia is one of the few other nations able to develop, build and field advanced military systems. He also frequently mentions the quality of Russian weapons and hence the threat they pose to American forces, e.g. the development of long-range anti-ship missiles rewriting the book on naval warfare having 'made large surface fleets and combatants obsolete' (p. 222). This is not the only instance where Martyanov contradicts himself or, at least, seems to apply the same argument in opposite directions according to his aim.

The publisher's synopsis makes the theme and tone of the book very clear: 'Starting from the Korean War the United States hasn't won a single war against a technologically inferior, but mentally tough enemy'. It is somewhat reminiscent of Dr Sean McFate's recent work 'Goliath. Why the West doesn't win wars and what we need to do about it'.¹ Martyanov is even more critical than McFate of the American approach to the various challenging events of the past and present but though he makes some reasonable points, overall he is less convincing. He is, however, unequivocal in his views. For example, he sees America's future as one of decline paraphrasing the British historian, Corelli Barnett's conclusion on the decline of UK power to describe his view of the US equivalent in current times 'US Power had quietly vanished amid stupendous events of the 21st Century, like a ship-of-the-line going down unperceived in the smoke and confusion of battle' (p. 177). Even plainer is his opinion of Boris Yeltsin during his time as President: 'largely incapacitated and despicable' (p. 156) though he does not explain his view.

A major element of Martyanov's beliefs is that there has been a significant change in Russia's view of the West – and that this is the fault of the West, especially America. He characterises the Russian elite as regarding NATO's expansion into Eastern Europe, including the Baltic States that were previously part of the Soviet Union, as a breaking of an explicit promise to Russia not to enlarge its influence and presence (pp. 154-5). He emphasises that Russia is essentially a European nation and culture (albeit with a foundation in Orthodox Christianity) yet feels rejected and alienated by the West. 'Russia's Europeanism was to a very large degree contingent upon the West's **behavior** towards her. ... While there were serious economic interests linking Russia to Western Europe, the Western aggression against Serbia began the contemporary process of alienation. It was just a matter of time before a final cultural break with West [sic] in general and Europe in particular would happen' (p. 156). Martyanov implicitly admits that this break took some time to come about owing to a core of pro-Western senior politicians. For example, 'the 1999 NATO aggression against Serbia would sober Russia dramatically with regard to the combined West's intentions' and 'The rejection [by the Russian people of "imported globalist values"] was wrongly interpreted by Western observers as Russians hating their inability to deter NATO's destroying Russia's historic Orthodox brethren in Serbia. ... even in 1999 Russia still had the resources to influence the outcome of NATO's

¹ Reviewed in ASPR Volume 22 Number 3

campaign over Serbia. But at that time the extremely pro-Western political elites in Russia had sabotaged any serious attempt to offer military help to Serbia' (pp. 152-3). Unfortunately, he gives no further information on or evidence of this claim in what remains the still debated reasons for Slobodan Milosevic's capitulation. There is the interesting, and plausible, claim that initially Russia and Russians were largely sympathetic towards America regarding the 9/11 attacks yet a survey in 2017 found that more than 80% of Russians wanted to have neutral or even hostile relations with the US. Martyanov lays the blame for this negative change squarely on America foreign policy and expeditionary action.

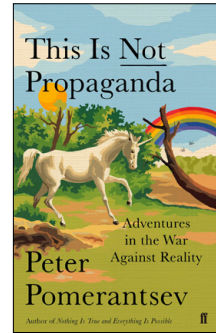
His charge of arrogance among the American policy makers can bear some scrutiny. He offers the example of Karl Rove, Deputy Chief of Staff to George W. Bush: 'We're an empire now, and when we act, we create our own reality. ... We're history's actors ... and you, all of you, will be left to just study what we do' (pp. 150-1). Martyanov responds that 'In some sense it was a very contemporary American statement insofar as it was offered by a man who had no background, skills, education of life experience whatsoever in the fields which define real national power, a pattern which today defines US decision making. It was offered by a political operative with a major in political science, a discipline which hasn't fared that well as a "science" and has a rather startling record of failures in its forecasts'. He goes on to criticise (those probably self-proclaimed) experts on military matters who have no real knowledge or understanding: '...millions of people have gotten most of what they know about warfare and the US military from an ex-insurance agent who never served a day on active duty' in a reference to the apparent significant influence of the writings of Tom Clancy (p. 147).

As for other contradictions, Martyanov describes the Iraqi Army of 1990/1 as a 'grossly incompetent adversary' and as 'demoralized, corrupt and underequipped' (p. 151). At the time, the Iraqis had the world's fourth largest army and sixth largest air force; if the weapons were not state of the art, neither were they obsolete. Martyanov points out that Iraq's 1990 GPD was nineteen times smaller than that of New York City (p. 32) - though presumably this was a result of the city being a leading financial centre which is arguably not an entirely fair comparison. His point is that Iraq stood no chance against the economic and military might of the USA. However, shortly after that (p. 39) he criticises those who judge Russia on the size of its economy rather than the size of its armed forces and the quality of its equipment. On page 204, he then describes Iran as having a 'more or less competent and battle seasoned military'. This was the nation that fought Iraq to a standstill through a bitter and bloody war from 1980 to 1988 so casting into doubt his assessment of the 1991 Iraqi military. Martyanov is very critical of the effectiveness of various US weapons, for example, comparing the range of the TLAM unfavourably with that of more recent Russian systems. He can be overly selective in his examples, and miss the context, in one case claiming the F-35 to be ineffective on the basis of its performance as a dogfighter against the F-16. Martyanov does not make any comment on the fact that the F-35 is designed to fight other aircraft at range where its low radar signature and powerful sensors will offer a significant advantage.

Fluently written but more often strident than measured, *Losing Military Supremacy* is readable and informative but it lacks the balance and detail to be fully convincing. In some ways, it seems closer to a collection of essays than a cohesive book given the range of topics addressed – though that variety has an appeal. Indeed, a longer review is justified to cover some of the chapter subjects in more detail. By all means read this book, but I would recommend that you read Sean McFate's *Goliath* first.

Book Review

This Is Not Propaganda: Adventures in the War Against Reality



By Peter Pomerantsev

Publisher: Faber & Faber, London, 2019

(ISBN: 978-0571338634), 288 pages

Reviewed by Honorary Group Captain Dr Keith Dear

Biography: Dr Keith Dear was an 18-year RAF Intelligence Officer, then expert advisor on the No10 Integrated Review Taskforce. A CAS Fellow, he holds an MA in Counter-Terrorism and a PhD in Experimental Psychology. Now a 601 Squadron Group Captain, Keith is Director AI Innovation at Fujitsu Defence and National Security, and a Director's Fellow at Cambridge Judge Business School.

Introduction

Pomerantsev has been essential reading for understanding the contemporary operating environment since authoring *Nothing is True & Everything is Possible*, a reflection on his time as a television producer in Russia and more broadly on the sophistication and occasional absurdity of the Kremlin's manipulation of Russian public opinion. In *This Is Not Propaganda*, Pomerantsev documents Russia's development and export of its misinformation model through elegiac reflection on his parents' experience as dissidents in the USSR and later as emigrés in London, alongside examples of contemporaneous manipulation – sometimes sophisticated, sometimes crude, frequently startling.

Why should you read it? As Pomerantsev writes, 'When information is a weapon, everyone is at war'. If you're in any doubt as to how serious this might be, consider the glee with which the Kremlin state broadcaster RT reported a recent US poll suggesting 46% of US troops now consider Russia an ally – discussion as to whether the poll is representative, or if it is, whether Russia's information campaigns caused the perception shift, continues. But if you are member

of a NATO military organisation, you ought to understand how there is even a realistic possibility that one country could deliberately and effectively subvert the views of the soldiery of another. Pomerantsev is the best guide out there to help understand how we got here.

He disarms the reader by beginning not with the familiar examples of Russia's 'troll farm', or self-styled 'Internet Research Agency' and its manipulation of the 2016 US Presidential election, but with the Philippines. In doing so, he implicitly makes the point that while Russia is central to the challenge of disinformation, it is now merely one manifestation of a much deeper and more pervasive problem. He shows how self-starting individuals – such as 'P' in Manila – have married psychological research to scalable manipulation campaigns on social media, to acts of performative violence, protests or policies, with web-based news and set-piece conferences – to change the way elections are fought in ways that will leave most readers uncomfortable, with the emphasis on division, scapegoating and misinformation. He shows how these networks often receive support from Russia's Internet Research Agency, blurring national boundaries as national citizens in the digital realm find themselves surrounded by voices claiming to be local but which, in reality, are a mixture of workers at funded troll farms and global volunteers.

There are examples from across Eastern Europe, Spain, France, and the UK, to the US, Brazil, Venezuela, the Philippines, Syria and more. Exploring online manipulation in Mexico Pomerantsev introduces us to the complex mathematical and network modelling that underlies much 'behavioural manipulation' in typically engaging fashion. Talking us through his encounters with 'Alberto', a man who claims to study search engine patterns to predict – and then through online manipulation to 'summon up' – protests, Pomerantsev introduces us to sock-puppets, bots, trolls and cyborgs, to web-enabled networks fighting back against mafia groups, live-tweeted executions – propaganda of the deed, cyber-attacks and meme factories and the way all of this and more can be used to 'manufacture consensus'. Pomerantsev's greatest talent is as a story-teller – he takes the reader with him on his journey through evidence, analysis, anecdote and interview. The characters we meet along the way give insights into a viscosity that often draws on Pomerantsev's research, but never gets so waylaid by it as to distract the reader from the compelling narrative. There are useful discussions of the Cambridge Analytica scandal and related campaigns and approaches, as well as a look at 'surveillance capitalism' and the role of Facebook, Google and others in enabling misinformation campaigns and algorithmic manipulation. Plenty to learn and rehearse for general and Defence readers alike.

Air Force and other military readers might be struck by the repurposing of terms and organisations we are familiar with as part of the lexicon and organizational structure of online influencers and trolls. Networks built in closed sites such as gaming forums and crowd-sourcing sites define and refine tactics in what are, in effect, virtual doctrine and concepts development centres. They are producing manuals, guides and words of command for armies of volunteers. For example, using the hashtag '#AirSupport' lets your virtual colleagues

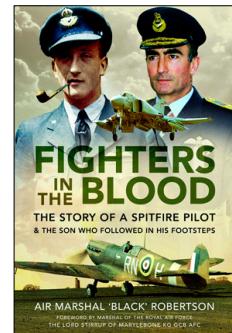
know you've successfully engaged a target on social media, and they will then bombard opponents, voting down their videos on YouTube, drowning them in vitriol on Twitter, or sending others off conducting 'sniper missions' to bait 'mainstream' journalists.

Perhaps the most important point for military readers is linguistic and conceptual. Pomerantsev rejects the framing of all that he describes as an 'information war'. He makes the argument that the militarization of language enables violence – the war on drugs as a precursor to President Duterte's enabling of vigilante killings across the Philippines, for example. He points out the danger of adopting the framework offered by Russia when it discusses 'information wars'. The term 'information war' suggests we are fighting not for truth, but for the influence over people. As such, there is no irrefutable truth, only contestable opinion. If everything is an information war, what can and should people believe? What can they trust? If we accept that we are all actors in an information war, Pomerantsev ponders, is the long-term solution a series of information peace agreements, giving individual states sovereignty over the truth within their territory – a licence to censor to a lie?

With both Russia and China advocating for the concept of information sovereignty, this is a line of thought that those in Defence, security and, indeed, across Government must ponder. Should it be accepted that opinion is simply just that, and that, as one senior British civil servant speaking under the Chatham House rule recently pronounced, the question of whether truth exists is 'a matter for [Archbishop of Canterbury] Justin Welby'? Is the concept of information warfare helpful? How should the UK respond to the challenges of the information age? What is Defence's role, if any, in any response? Pomerantsev's *This Is Not Propaganda* won't answer questions, but it's the best guide out there to understanding the questions, and their pressing importance.

Book Review

Fighters in the Blood: The Story of a Spitfire Pilot – And the Son Who Followed in his Footsteps



By Air Marshal 'Black' Robertson CBE, BA, FRAeS, FRSA

Publisher: Air World (19th August 2020)

(ISBN-13: 978-1526784865), 336 pages

Reviewed by Group Captain James Beldon

Biography: Group Captain James Beldon currently serves as the RAF's ISTAR Deputy Force Commander at RAF Waddington. An intelligence, Surveillance and Reconnaissance expert, he previously commanded 8 Sqn (AWACS) and has flown on operations in the Balkans, Afghanistan and Iraq, amassing more than 3,000 flying hours in the process. He previously served as the RAF's Director of Defence Studies and holds an MPhil in International Relations from the University of Cambridge.

Introduction

For those who have had the privilege of poring over the exquisite entries in 8 Squadron's 1960s photograph albums and wondered when, why and where the shock-haired Fg Off Robertson had acquired his now long-established given name of 'Black', the answer is revealed in his book, *Fighters in the Blood*. Air Marshal Robertson rose to the highest ranks of the Royal Air Force during a period that encompassed Britain's withdrawal from Empire, the sharp-end of the Cold War in Germany and the 'Peace Dividend' that followed. As a pilot, tactical commander and Whitehall Warrior, Black Robertson was at the heart of an Air Force tuned for war's ultimate expression which mercifully never materialised. Deterrence succeeded, which meant that for Royal Air Force fighter pilots of Robertson's

generation, relatively few experienced combat, and none (with the arguable exception of RAF pilots seconded to the Fleet Air Arm during the Falklands Conflict of 1982) experienced air-to-air combat.

Understandably, therefore, a theme to which Robertson turns repeatedly throughout the book is the question of how he would have performed in aerial combat himself. An examination of Royal Air Force history strongly suggests that there is little doubt that he and his contemporaries would have 'done the business'; more importantly from a deterrence perspective, it is clear that their adversaries were equally convinced of their capabilities. But it is his comparison with the past, and particularly in relation to his father's career as a distinguished Spitfire pilot, that serves as Robertson's lodestone for self-analysis. It is this aspect which sets this autobiography apart. Feeling that he might have been intruding on his parents' nascent relationship, it was evidently with some trepidation that Robertson first delved into a bundle of wartime correspondence between his fighter pilot father and his then fiancée. Robertson has distilled from those letters a rich testimony that sheds an important light on the RAF's wartime culture and training system, as well as exposing new insights into life as an operational fighter pilot in some of the most harshly contested theatres of the war. In recognition of his operational excellence, Robertson's father was awarded the Distinguished Flying Cross, but his exploits also required him to bale out of a burning Spitfire over Sussex and later cost him an eye and his flying career when he was shot down over the Western Desert. Although the young Graeme Robertson initially considered cricket as a future career, there was, as was to prove the case, every likelihood that he would follow in his father's footsteps – there was, after all, no finer role-model that he could have looked to for inspiration.

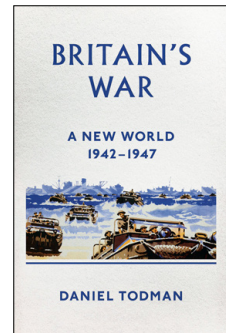
Robertson's description of his flying career as a junior Hunter pilot through to being an F-4 instructor with the USAF and later as a Phantom squadron commander in RAF Germany and station commander in Suffolk have much to offer the aspirant pilot and serving officer climbing the career ladder alike. His analysis of the challenges facing UK Defence in the 1990s are of equal value to the student of strategy. But, most of all, through his own reflections and the light he casts on his father's experiences, Black Robertson manages to convey the continuity of excellence that suffuses all generations of the Royal Air Force. That is not to say that he ignores the negative aspects, and he does not hold back in his criticism of those he felt fell short – perhaps most notably during his time as RAF Germany's Deputy Commander-in-Chief.

Marked by amusing anecdotes from training at the Royal Air Force College Cranwell (where he was a stablemate of a future Chief of the Air Staff in the form of Peter Squire), Robertson's account of his own career is precise, elegant and fun. He makes no bones about the 'almost impossibly high' standards he set as a leader and instructor throughout his career, but, in mitigation, he clearly held himself to similar standards. There is, however, a lingering sense of regret over the outcome of his own Royal Air Force career, a point made plain by the title of Chapter 22: 'Reflections of a nearly man – and the ultimate frustration'. In the view of this reviewer, he is too harsh on himself. He was a 'nearly man' only insofar as he was never tested in

the cauldron of combat and didn't make it to 4* rank. However, it was a more than creditable career, which seems at the end, not to have been recognised as generously as it should have been. Ultimately, however, it is Black Robertson himself who is his harshest critic. In the opinion of this reviewer, his was a career carved out of great determination and rather more skill than he credits himself with. Entertaining and in places poignant, *Fighters in the Blood* adds a unique twist to the standard autobiographical form, which is a 'must read' for those embarking on, or already part-way through, a Royal Air Force career.

Book Review

Britain's War: A New World, 1942-1947



By Daniel Todman

Publisher: Allen Lane, (26th March 2020)

(ISBN-13: 978-0241249994), 976 pages

Reviewed by Flight Sergeant Paul Marr

Biography: Flight Sergeant Paul Marr joined the RAF in 1997. Trained as a Weapons System Operator (EW), his first tour was on Nimrods at RAF Kinloss. Subsequent tours included A2, the UKMAOC at Northwood, and the Directorate of Defence Studies. Currently he is an EW analyst in the P-8 Tactical Operations Centre at RAF Lossiemouth.

Introduction

Daniel Todman's, *Britain's War: A New World, 1942-1947*, is a fascinating and timely addition to the historiography of World War Two coming, as it does, during the seventy-fifth anniversary year of the end of that climactic global struggle. The second of two volumes, *Britain's War: A New World* combines, for the first time, the military, social, political and economic histories of the war and immediate aftermath laying bare to the reader virtually all aspects of the British experience. Currently a Professor of Modern History at Queen Mary, University of London, Todman is one of a new generation of historians rewriting the account of the Second World War for modern readers. During twenty years of research he has amassed an extraordinary collection of primary and secondary sources with which to drive his narrative. The scale of the book might seem daunting, but it very quickly becomes apparent to the reader that Todman is a master of his craft.

A short introduction skilfully sets out the book's scope to show to what extent Britain was changed by the 'total war' it endured and won, and what it cost. *Britain's War* is then structured chronologically, which some may view as unimaginative but, as the author explains, 'Wars have their own dynamic, and they change as they go on (p. 1)'. The book's division into four parts (entitled: Nadir; Peak; Victory, and Resolutions) therefore allows Todman to chart the changing nature of the Britain's war at key points. The first three sections deal with the War, from one of the greatest military defeats to befall the British Empire (the fall of Singapore) to eventual victory in the European and the Pacific Theatres. The final part, Resolutions, covers the short period after the war up to December 1947 because, as Todman states, with so much uncertainty as to the consequences of the War yet to be resolved, it could 'hardly be considered to be over' (p. 777) in 1945. Although *Britain's War* could not be considered light reading by any standard, Todman pulls together all the strands of his argument and drives his narrative with flair and imagination which makes *Britain's War* a very enjoyable reading experience. Throughout he brings to life historical figures with colourful descriptions of personality traits and physical attributes – you can almost see Churchill arguing long into the night with Chief of the Imperial General Staff (CIGS) Field Marshal Alan Brooke – and makes even the longest list of statistics interesting with occasional humorous insights. His depiction of half a million Britons visiting 'a mock medieval relic' as a demonstration of 'how much they still loved a good queue' (p. 331) being an example of the latter.

Perhaps, more than anything, *Britain's War* is a tale of strategy: of the conference table, and of political and military battlefields. Throughout, Todman demonstrates how Allied strategy was influenced by relatively few leaders particularly, from a British perspective, by Churchill whose 'determination to "move all the pieces himself" meant there was "no day to day direction of the war except by Chiefs of Staff and Winston" (p. 186)'. However, from the start, Todman charts the relative decline of British influence over the 'Grand Alliance' presided over by Churchill to the point where the 'British had lost the power to determine the post war system' (p. 611). *Britain's War* places more emphasis on the imperial nature of British strategy-making than most other histories, a device which highlights the competing priorities of the US anti-colonial policies and Britain's commitment to Empire and the resulting frictions in Allied strategies until, eventually, the US became the unrivalled leader of the 'Grand Alliance'. This, Todman argues, was due in large part to Britain's inability to win victories quickly and decisively enough to maintain its level of influence in the 'Grand Alliance' rather than individual failings of the country's leaders. He also brings out Churchill's influence in the domestic arena, and here Todman is less forgiving. Todman argues, convincingly, that Churchill's reluctance to tackle the issues presented by post-war social reconstruction – and acknowledge the obvious shift in the political leanings of the electorate – cost him the election in 1945, and had long-term ramifications for him and his party.

There is also much to consider from an air power perspective. Although less than enthused with the Combined Bomber Offensive in general, Todman is generally positive of the contributions of air power to eventual victory. He repeatedly credits the success of the

Allied amphibious landings in Italy and Normandy to the gaining and maintaining of Allied air superiority over the beachheads. Pointing particularly to the US Ninth Air Force and the British Second Tactical Air Force as important elements of the preparations for Operation Overlord. Additionally, he argues that the success of the 'Oil' and 'Transport' bombing plans 'accelerated the march to victory' (p. 653). As in other areas, Todman is keen to demonstrate the interconnectedness of all things, pointing out that whilst the achievement of air power had ensured the success of the Normandy landings, after the Allied breakout the dramatic advances on the ground 'allowed Allied aircraft to do much more damage to Germany' (p. 649). Without overstepping, Todman deftly places the role of air power in the context of eventual Allied victory.

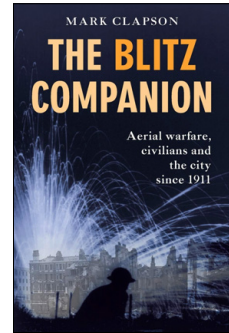
However, there is more to Todman's history than conference tables, battlefields and politics including a willingness to tackle more ignoble subjects. For example, following the loss of Empire in South East Asia, Britain had to rely more heavily on imports from the African colonies. In this section Todman describes the measures brought in to force, such as forced labour and conscription bringing in to stark relief the dichotomy of a war being fought for freedom and Britain's treatment of native peoples. This may be uncomfortable reading for the modern audience but Todman strives to situate such decisions within the context of a global war for survival to better understand why they were made. Through such insights Todman forces the reader to confront the unsavoury realities of Britain's War.

Although the focus is generally set at the grand strategic and strategic levels, a history told from the top down would never be complete and Todman endeavours to reveal the whole experience of the war. Descriptions of strategy setting conferences and exciting depictions of set piece battles are interspersed with observations from the Mass Observation Surveys and the diary entries of 'Great Men' are countered with diary entries from those on the front lines and descriptions of life at home. Todman's ability to capture the element of 'history from below' within the overarching narrative of the great strategic events unfolding around them, sets his history apart from others of the genre.

Todman's greatest achievement is the manner in which he weaves together all elements of the military, political, economic and social histories to convincingly reveal to the reader not only why events happened but, perhaps more importantly, 'how they were represented and understood at the time' (p. 1). The result is nothing short of a masterpiece and should be read by anyone with a more than passing interest in the Second World War and *how* and *why* Britain emerged into the brave new post-war world a very different country from the nation it was in the 1930s.

Book Review

The Blitz Companion: Aerial warfare, civilians and the city since 1911



By Professor Mark Clapson

Publisher: University of Westminster Press, London, (2nd April 2019)

(ISBN-13: 978-1911534488), 316 pages

Reviewed by Mark Russell

Biography: Mark Russell graduated with a 2:1 in History in 1985, and has worked in professional services ever since. Following a return to academia in 2015, he graduated with an MA in Air Power: History, Theory and Evolution from the University of Birmingham in December 2017. His dissertation looked at whether the RAF was a 'learning organisation' in the period 1925-1935, with special reference to how its 'Air Exercises' helped to develop and test tactics and technology. He continues to work in professional services, but his current research interest is the RAF in the inter-war years and how the organisation managed technological change.

Introduction

The publisher describes this book as 'An introductory international reader for students, teachers and members of the public interested in the impact of air raids on civilians and cities since the birth of air warfare' and it does this job well. Building on Clapson's undergraduate modules at the University of Westminster on the Blitz (i.e. the Luftwaffe's attacks on the UK in World War Two), as the title indicates, it expands on this in both chronology and geography, starting with the first Italian air raid in Libya in 1911 right up to comments (albeit brief) on Russian bombing in Syria following their involvement from 2015.

It is not, and does not claim to be, a comprehensive history of aerial bombing; its major theme is the 'targeting of civilians, and the consequences of air raids upon urban populations.' As Clapson says in the introduction, he has been 'heavily reliant' on some key works, with some chapters owing a 'considerable debt' to other scholars. This comes through in the book, but does not necessarily reduce its value; if one wants more specifics on the bombing war in Europe, for example, one is appropriately referred to Richard Overly's 'peerless histories of the bombing war in Europe' (p. 78).

Instead, this book aims to steer a neutral path between those who claim that bombing civilians is always bad, and those who would see collateral damage as acceptable; 'any blanket denunciation of bombing ... ignores historical realities' (p. 8), but while this is the aim, one does have the sense that, if pushed, Clapson would fall into the camp condemning bombing. What he does not do is engage with the 'philosophy' of bombing in the same way that Hippler does, for example.¹ Having said this, Clapson does a good job of outlining the evolution of the debate over the rights and wrongs of bombing, especially Allied bombing in World War Two. Having outlined the debate, he clearly provides his view on those in Germany and Japan who have sought to place Allied bombing on a par with the Holocaust and other genocidal actions, describing a series of events from the twentieth century as 'examples of genocide. Allied air raids from 1940-5 are not' (p. 225).

The book is at its strongest when discussing these debates, and the historiography and evidence available to historians around the experience of being bombed. These range from contemporaneous sources such as first-hand accounts in letters and diaries, through to Mass Observation sources and then Her Majesty's Stationery Office publications soon after the Blitz, to cite UK examples, through to other sources including photography and film, and how all of these have evolved over time. The bulk of the discussion centres around the British and German experience of being bombed, although there is a fair amount on the description and commemoration in Japan of Hiroshima and Nagasaki. What is not clear is whether this focus on these countries is a deliberate choice, or one forced on Clapson by lack of available sources in other countries – although Tanaka and Young, for example, have a chapter on the bombing of Chongqing by the Japanese.² While Clapson does identify common reactions to bombing (e.g. 'trekking', the wholly understandable movement by people away from locations that are being bombed) across both time and geography, this is done more by noting these common behaviours than through any analytical framework. He also does not then explicitly look across time and geography to show how civilians adapt to being bombed; one can see such a framework as being a useful tool, both now and in the future, in assessing whether air power is indeed the answer in a given situation (with the evidence suggesting not, starting in Iraq in the early 1920s right back to Iraq in this decade).

Where the book is weakest is in some of the statements and analysis around the military and political history of the bombing itself, rather than the impact on those on the ground. For example, he takes Churchill's post-Dresden comment that 'the question of bombing of

German cities simply for the sake of increasing the terror, though under other pretexts, should be reviewed' (p. 93) as a question motivated at least partly by humanitarian concerns, whereas other writers suggest this was Churchill trying to actively distance himself from Bomber Command's offensive for political reasons, something the RAF resisted in the strongest possible terms. Another example is Vietnam, where he says 'America lost the air war' (p. 162), a claim it is hard to understand unless he means that air power failed to win the war. In looking at Vietnam, he does not build on the political context around the air war examined so effectively by Clodfelter to explain both why air power was never the right answer, and why what many airmen saw as unnecessary limitations placed on them were indeed strategically appropriate at the time.³

What he perhaps does not explore as much as he could is what drove America after 1945 to adopt this reliance on bombing – why it made apparent sense both militarily and politically at the time, and hence was a rational choice rather than the choice of a bloodthirsty imperialist power who cared little for the lives of non-Americans. The book also, inevitably, feels anti-American, since it is America that has done the vast bulk of the bombing since 1945, although it is good to see that Russia's bombing in Syria and the Ukraine are acknowledged. What is not acknowledged is the impact that technology has had in making bombing more discriminate and effective, such that civilian casualties are a fraction of what they were over Vietnam (for example). And as Peter Lee has shown, the impact of these capabilities in reducing civilian casualties is taken very seriously in the RAF, for example, to an extent that would have been unthinkable in earlier decades.⁴ At the same time, the opponents in the last twenty years have had no such scruples, and this moral balance is not described; in describing the car bomb as the 'poor man's air force,' Davis is surely doing modern targeting technologies a disservice.⁵

Some factual errors exist, which as always, undermine one's faith in the rest of the book; the USAF lost 31 B-52s in the Vietnam war per McCarthy and Allison, not the 'hundreds' Clapson suggests (p. 157); it was John Hershey that wrote the 1946 book *Hiroshima*, not Henry Hersey (p. 209), it is the Yasukuni shrine in Tokyo, not the Yasakuni shrine (p. 212), and so on.

In summary, this is a useful introduction to the historiography and sources around the civilian experience of being bombed; it has some interesting things to say in these areas and is a quick way to get an overview of the main debates that have taken place and where one should go for more, both on the debates and for material for further research. As a history of bombing itself, it has shortcomings, and the reader would be better advised to look at what Clapson himself acknowledges as being the leading texts in that field.

Notes

¹ Thomas Hippler translated by David Fernbach, *Governing from the Skies: A Global History of Aerial Bombing*, (Verso, London, 2017) – although this in its turn has some serious flaws as a history of bombing.

² Tanaka, Y, and Young, M. B. (eds), *Bombing Civilians: a twentieth-century history*, The New Press, London, 2009.

³ M Clodfelter, *The Limits of Air Power: The American Bombing of North Vietnam* (Macmillan, London, 1989).

⁴ Dr P. Lee, *Reaper Force: Inside Britain's Drone Wars*, (John Blake Publishing, London, 2018).

⁵ M. Davis, *Buda's Wagon: A Brief History of the Car Bomb* (Verso, London, 2017).

⁶ J.R. McCarthy, James R. and G. B. Allison. *Linebacker II: A View from the Rock*. (Darby, Pennsylvania: DIANE Publishing, 1985), p. 209.

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