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Cover pictures

Buccaneers of Nos 12 and 208 Squadrons RAF

Front cover: No 12 Squadron
Back cover: No 208 Squadron

The Buccaneer was designed to a naval requirement for a low-level, high-speed carrier strike aircraft for the Fleet Air Arm (FAA). The first prototype made its maiden flight in 1958, and the aircraft formed part of the FAA front-line between 1962 and 1978.

In 1968 the Buccaneer S2 was also selected by the RAF to serve in the low-level strike/attack role. A total of 111 new and ex-FAA Buccaneer S2s were received by the RAF. Nos 12, XV, 16 and 208 Squadrons and No 237 Operational Conversion Unit flew the Buccaneer in the UK and Germany during the 1970s; a fifth squadron (No 216) formed to operate former Royal Navy Buccaneers in 1979, only to disband in 1980.

RAF Buccaneer units based in Germany transitioned to the Tornado GR1 in 1983-84. However, Nos 12 and 208 Squadrons continued to fly the Buccaneer in the anti-shipping role for another decade. During the Gulf War (Operation Granby), a Buccaneer detachment operated from Muharraq, Bahrain, using their Pave Spike laser designators to mark targets for Tornados armed with Paveway LGBs.

Operation Granby was to prove the swansong of the Buccaneer. No 12 Squadron re-equipped with Tornado GR1Bs in 1993 and in the following year No 208 Squadron disbanded, bringing to an end the twenty-five year career of the Buccaneer in the RAF service.

Main cover picture: AHB(RAF)

CONTRIBUTIONS TO THE ROYAL AIR FORCE AIR POWER REVIEW

The Royal air Force *Air Power Review* is published four times a year under the auspices of the Director of Defence Studies (RAF) and has the sponsorship of the Assistant Chief of the Air Staff. It is intended to provide an open forum for study which stimulates discussion and thought on air power in its broadest context. This publication is also intended to support the British armed forces in general and the Royal Air Force in particular with respect to the development and application of air power.

Contribution from both Service and civilian authors are sought which will contribute to existing knowledge and understanding of the subject. Any topic will be considered by the Air Power Review Management Board and a payment of £200 will be made for each article published.

Articles should be original and preferably not previously published, although those of sufficient merit will not be precluded. Between 2,000 and 10,000 words in length, articles should list bibliographical references as end notes, and state a word count. Lengthy articles may be published in instalments. Contributions from serving military personnel should be in accordance with DCI GEN 313 dated 26 November 1999.

Submissions can be sent in any Microsoft Word IBM or AppleMac format, on floppy disk, Zip or CD and should be accompanied by numbered page copy plus any photographs and illustrations. Digital pictures should be saved as TIFFS or JPEGS @ 300dpi.

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FOREWORD

In his foreword to the inaugural issue of the Royal Air Force Air Power Review, the then CAS, Air Chief Marshal Sir Richard Johns, stated that the articles were intended primarily to provoke debate and to feed our thinking about the future, and the part the Royal Air Force will play as an independent service and within the framework of joint operations; Mr Eric Thale's article on Dresden in the Spring 2002 issue has certainly done the former. In his article Mr Thale quotes David Irving's figure of 135,000 people killed in the attack on Dresden, however Irving later rescinded this figure stating that civilian casualties were more in the 50-60,000 bracket. More recent research, including examination of the records of the city of Dresden, puts the figure at around 25,000, as my predecessor stated in his article in the Spring 2001 issue. More recently, if one looks at the Kosovo conflict initial statements by such people as Mary Robinson, the UN High Commissioner for Human Rights, were to the effect that "Thousands of people were being killed by NATO air action". Subsequent research by Human Rights Watch showed that the casualties were actually around 560. The lesson, then, is that we should not take supposedly authoritative figures at face value, particularly when collateral damage and casualty figures are such a sensitive issue as they are today.

This issue starts with an article by Group Captain Peter Gray on the asymmetric edge that air power can apply in conflicts and in which he makes the point that to be successful all warfare should be asymmetric. There is no point taking an enemy head-on when one can exploit differences of equipment or tactics, and this is the essential nature of manoeuvrist warfare.

The second article, by Dr David Hall, traces the development of the air support system from 1914 to 1945, which culminated in the formation, and employment of the 2nd Tactical Air Force. The article, unsurprisingly, has a Canadian flavour. It is a very useful exposé of the arguments concerning the command and control and ownership of aircraft used in the direct support of the land battle, and of the relevance of the concept of battlefield air interdiction.

Lieutenant Colonel Paul Boag's article on Operation ROLLING THUNDER, the strategic bombing of Vietnam from 1965-1968, also examines command and control issues but from a more strategic perspective by examining the views of senior air force leaders on the conduct of that campaign. His article is particularly pertinent in the questions it poses concerning increasing political involvement in what, up until then had been seen as tactical decisions.

The fourth article is the second part of a 2-part work by John Sweetman examining the contribution of Barnes Wallis to World War II technology. The article examines in detail the development of a smaller version of the bouncing bomb. The 'Highball' weapon was to be delivered by Mosquito against the Tirpitz. However, Highball never got beyond the trial stage, in one instance bouncing up and taking the tail off the delivering aeroplane with fatal results. The article provides an object lesson in the difficulties of conducting trials when under the pressures of combat, and one has only to think of the trials that took place on the GR1 Tornado in the months leading up to the Gulf War air campaign to see that lessons such as the article identifies are equally applicable today.

Dr Richard Lock-Pullan is a member of the Defence Studies Department at the Joint Services Command and Staff College. The trigger for his article was the desire to understand more about the concept of the use of air power for strategic effect as it is expressed in AP3000, and the current Staff College teaching on centre of gravity analysis. The article is deliberately provocative and will hopefully trigger both debate and deeper thought on the fundamental differences between strategic bombing and the use of air power, in its broadest sense, for strategic effect.

Dr Alfred Price's article is a detailed examination of the employment of air power at El Alamein. It is interesting to compare his comments on the advantages of huge numerical superiority in the degree of control of the air that was achieved at the start of the battle, with the employment of air power over Kosovo and more recently Afghanistan where similar levels of control of the air were achieved.

The final article is an extract from *The Aeroplane* magazine from 17 December 1919 by its editor Charles Grey Grey. CGG was, as Marshal of the Royal Air Force The Lord Trenchard said after his death, "A supporter of aviation, both military and civil, since its earliest days, and everyone in the Royal Flying Corps and later the Royal Air Force appreciated the great help he gave to the air service by his pungent pen". 'The Trenchard Memorandum', as it has become known, is the model of a pithy and analytical service paper and does much to counter the generally held view of Trenchard as a poor communicator. The closing paragraph of CGG's introduction is particularly prophetic.

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AIR POWER

The Asymmetric Edge

1

By Gp Capt Peter W Gray RAF

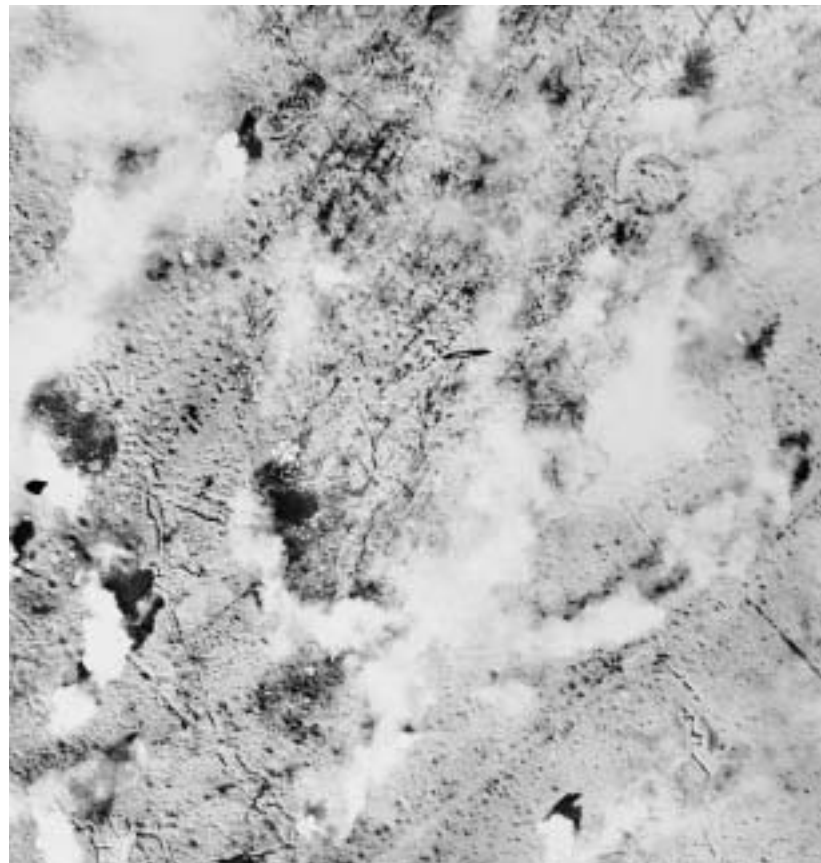
The tragic events of 11 September 2001 brought renewed emphasis to the dangers of asymmetric warfare. The fear of such an attack, for the cognoscenti, had long been a very real contingency.¹ The apparent immunity of the United States, and her allies, was such that few actors – whether they are nation states or lesser groupings – could sensibly consider a force-on-force option. Although the potential for China eventually to rise to peer competitor status has been generally acknowledged, the scope for serious conflict has tended to be downplayed.² Beyond scenarios such as a NATO Article V defence of Turkey (possibly following water disputes with Syria), the most likely conceivable conflict therefore tended to boil down to some form of asymmetric attack. This is not in the least surprising as it could easily be argued that this should be the norm. After all, only the bold, or the foolish, would engage in a wasteful exchange of men and materiel for little apparent gain. Images of the carnage of the trenches of the First World War, overlain by the Blackadder interpretations of mindless strategy, collectively commend an asymmetric or indirect approach.³

The dictionary definition is simple and straightforward – asymmetric merely betokens a lack of symmetry. The quest for advantage is therefore an integral part of warfare and has been for as long as mankind has resorted to force for the settlement of disputes; indeed according to Professor Sir Michael Howard, it is peace that is the modern invention.⁴ Beyond the heavyweight boxers content to slug out their differences, mankind has resorted to numerical superiority to gain advantage over otherwise peer competitors. The alternative approach has been to develop more capable weaponry either to avoid pawn for pawn attrition or gain both qualitative and quantitative advantage. Some of these quests for the edge have failed; others have been part of an arms race of which the Cold War was an ideal example. Some developments have been so successful that the ensuing improvements have been categorised as being revolutions in military affairs.⁵ Of all of the step changes, revolutions or transformations that have occurred, the use of the third dimension has invariably had considerable appeal. This paper will review the asymmetric edge that air power has provided to the battlefield and will then analyse future potential.

The first military use of air power occurred during the revolutionary wars where Mauberge was under siege by Dutch and Austrian forces whose disposition was reported in detail by the aeronaut.⁶ This success was repeated on 26 June 1794 when the French used a balloon to observe Austrian troop movements at the Battle of Fleurus.⁷ The need to know your enemy extends beyond the psychological imperative of understanding his mindset; one must also attempt to ascertain his dispositions, strength and where possible his intentions. Although the early balloonists were constrained to reporting strength and obvious movement, the efforts expended on gaining the aerial perspective provide eloquent testimony to the benefits that could have accrued. It may, however, be overstating the case to say that the balloons actually gave their side an asymmetric edge; but the potential was clearly there.

The First World War saw powered flight and balloons being used extensively for reconnaissance purposes

A reconnaissance photograph taken on 3 June 1917 by No 6 Squadron, Royal Flying Corps, showing part of the artillery bombardment which preceded the British Army attack at Messines. This photograph was one of 975 taken by the RFC on the Western Front that day.



Imperial German Navy Zeppelin.

From the outset of the War, the shadow of the Zeppelin exerted a real and decided influence over those in London

The advent of powered flight in 1903 gave an irreversible impetus to the exploitation of the third dimension. The First World War saw powered flight and balloons being used extensively for reconnaissance purposes. As early as August 1914, British and French aircraft spotted the German dispositions that led to the Battle of the Marne.⁸ The next month saw the first use of aerial photography providing direct evidence of the emerging German trenches in the Aisne Hills. Wireless reduced the time lag in the decision-making cycle or what was eventually to become known as the OODA-loop (Observe, Orientate, Decide and Act). But it rapidly became evident that the Germans were playing the same game with no absolute asymmetric edge for either side. As the trench lines became more established, and the deadly concentration of fire between opponents, so the need for some form of advantage became more crucial. Attempts to use artillery were frequently thwarted by lack of information as to what was on the 'other side of the hill'; this led rapidly to the regular use of the Royal Flying Corps in conjunction with the Gunners. The ability of air power to provide a disproportionate advantage through information superiority inevitably stimulated the need for a counter. Surface-to-air gunnery was only part of the solution and air-to-air combat (the sport of kings) became an integral part of the quest for control of the air. The symbiotic relationship between control of the air and the asymmetric edge became firmly established as early as October 1914 with the first conclusive aerial combat.⁹ This form of fighting developed in concert with, and often at the forefront of, aviation design and technology. As aircraft became more robust, and engines more powerful, the ability to prosecute the enemy directly was finally realised. Small bombs were dropped on the trench positions and on more distant communications targets. Parallel developments within the Royal Naval Air Service ensured that air power was active in support of the Fleet. With the increasing scope to attack the homeland, all of the core capabilities of air power were in place by 1916.¹⁰

From the outset of the War, the shadow of the Zeppelin exerted a real and decided influence over those in London. As with many things where anticipation is high, the reality does not always live up to the promise. The first airship did not appear over the United Kingdom until early 1915 occasioning little real damage.¹¹ The RNAS attempted to tackle the problem at source with attacks on the Zeppelin sheds and home defence was enhanced. As even the primitive air defence systems (including ground artillery) had effect, so the raiders took cover under darkness. A very young Lieutenant Harris (later to be better known as 'Bomber' Harris) was just one of those destined to feel the frustrations of night air defence in the days before ground and airborne radar.¹² The switch to night raids had an immediate effect on accuracy with a diminution of the asymmetric edge. The clamour in London for reprisals ensured that the trend towards symmetry was maintained. The reality of the actual damage done has been well covered elsewhere, as have the implications for future conflicts.¹³ Suffice it to say at this juncture that the quest for real strategic impact developed a momentum of its own. That this movement was considerably accelerated by the desire for independent air arms – in Britain and America – only tells part of the story. For many airmen, air power in general and the bomber in particular was the epitome of the Holy Grail in the search for the ultimate asymmetric edge.

The popular perception is that RAF inter-war doctrine was dominated by the strategic bomber. This generalisation, like all of its kind, is fraught with danger. There has long been a tendency, especially in America, to link Trenchard with Douhet and Mitchell as prophets of air power. The reality is that Trenchard actually wrote little in the way of air power theory. What he, or more prosaically his staff, did put together had more to do with the survival of the fledgling Royal Air Force in the face of hostility from our sister Services and the Treasury. Nevertheless, central to their theme was that air power was essentially offensive. All thoughts were coloured by the trinity of offensive action, cost effectiveness and avoidance of the carnage of trench warfare. It must also be remembered that British national interests still centred on the Empire.

Thoughts in Whitehall in 1919 would have been largely shared between domestic matters and concern over the Empire – Europe was by no means as central as it was to become in later years. A combination of wishful thinking, economic necessity and opportunism gave rise to a defence policy based on there not being a war in Europe for the foreseeable future – ten years or more. All planning was therefore based on this premise. The primary function of the Army would be maintenance of law and order at home with Imperial policing as the overseas commitment for the next decade.¹⁴ Britain was absolutely determined that its routes to India would not be jeopardised by instability, misrule or foreign intervention (Turkey or Russia). Furthermore, increasing dependence on oil reserves with the wane of the age of steam meant that the middle-east region was, even then, taking on its own strategic importance. But it is evident that the chosen modus operandi was not just a simple acquisition of territory – economic activity and strategic stability did not require such a blunt approach. But stability could not be guaranteed by diplomatic means alone and garrison forces were required in many critical locations. Notwithstanding the evident potential for trouble, Churchill as Secretary of State for War and Air warned that the garrison in Mesopotamia would have to be cut from its existing level (25,000 British and 80,000 Indian troops).¹⁵ His attempts to find novel, and cheap, solutions fell on ground as stony as the desert. Even after the first round of cuts, the garrison was still costing over £18 million per year. In mid-February 1920, Churchill asked Trenchard if he would be prepared 'to take Mesopotamia on'. The deal would involve the reduction of the standing garrison to 4,000 British and 10,000 Indian troops, but with an Air Officer as C-in-C and an extra £5 million on the air estimates. The Air Staff plan envisaged ten squadrons mainly based around Baghdad.

After the inevitable round of bickering, his proposals went before the Cabinet in August 1921 with the suggestion that eight squadrons take over the policing duties in October 1922. They would be supported by 2 British and 2 Indian battalions, 3 companies of armoured cars and various ancillary units. (On the due take-over date there were actually 9 battalions.)

Air Vice-Marshal John Salmond took over as AOC in less than auspicious circumstances. The Turks were threatening the northern province of Mosul and the Kurds were fighting a guerrilla war in Sulaymaniyah. A small-scale bombing attack on Turkish positions achieved striking success that was quickly capitalised on by Iraqi levies.¹⁶ The air control method was very much a joint operation involving considerable co-operation between air and land assets, often with the Royal Air Force ferrying troops, dropping supplies and evacuating the wounded – as well as bombing. By May 1923, Salmond had achieved what Maurice Dean has described as a 'tremendous victory'.¹⁷ For those unfamiliar with the 'finer points' of air control, a part of Salmond's despatch to Trenchard gives the details and is repeated below:

'No action is ever taken (wrote Salmond) except at the request of the British civilian adviser on the spot, and only after this request has been duly weighed by the (Iraqi) Minister of the Interior and by the British Adviser and by the High Commissioner (in Baghdad). Even after a request has passed this three-fold scrutiny, I have on more than one occasion, as the High Commissioner's chief Military Adviser, opposed it on the military grounds that I did not consider that the offensive action which I had been asked to take would lead to the result desired; and His Excellency has always acceded to such advice on the acknowledged basis that I am more perfectly acquainted with the effects it may be expected to achieve... It is a commonplace here that aircraft achieve their results by their effect on morale, and by the material damage they do, and by the interference they cause to the daily routine of life, and not through the infliction of casualties. The casualties inflicted have been most remarkably small. A tribe that is out for trouble is



Germany deployed 20 Junkers-52 transports to Morocco (refuelling in Italy en route). These aircraft provided the airlift necessary to transport Nationalist forces loyal to Franco back to Seville

well aware when the patience of Government has reached breaking point; and negotiations inevitably end in what is in effect an ultimatum in some form or other. Complete surprise is impossible and the real weight of air action lies in the daily interruption of normal life which it can affect, if necessary for an indefinite period, while offering negligible chances of loot or of hitting back....

It (air action) can knock the roofs of huts about and prevent their repair, a considerable inconvenience in wintertime. It can seriously interfere with ploughing or harvesting – a vital matter – or burn up the stores laboriously piled up and garnered for the winter. By attacks on livestock, which is the main form of capital and source of wealth to the less settled tribes, it can impose in effect a considerable fine or seriously interfere with the actual sources of the tribe – and in the end the tribesman finds it is much the best to obey the Government.'

Occasionally the house or fort of a rebel leader like Sheikh Mahmud would be selected as a target of individual attack and this called for a high degree of bombing accuracy. Otherwise it was unnecessary, and indeed undesirable, to inflict serious or extensive damage. The object was really the air blockade of the recalcitrant village by means of intermittent light attacks, which were never delivered without due warning to the villagers so that they could leave their dwellings. After they had surrendered, troops or police would be flown in, with medical staff, to restore order, stop looting, treat the sick and the injured, distribute food and rehabilitate the area generally.¹⁸

It can be seen from this description that air power avoided the not inconsiderable casualties that had resulted – on both sides – from force-on-force police actions; it was financially cost effective; and was sufficiently offensive in nature to satisfy honour on both sides. In short, air power provided the Empire with the asymmetric edge. Control of the air was not contested and had no need therefore to be considered a campaign decisive point.

The Luftwaffe gained similar experience in Spain during the Civil War. Early in the conflict, Germany deployed 20 Junkers-52 transports to Morocco (refuelling in Italy en route).¹⁹ These aircraft provided the airlift necessary to transport Nationalist forces loyal to Franco back to Seville. Between the end of July and mid-October 1936, over 20,000 troops and their equipment were moved representing what James Corum has described as one 'the decisive military operations of the Spanish Civil War'.²⁰ Air power thus played, not only a decisive role in the Civil War, but arguably in European history: it certainly provided the asymmetric edge, albeit not in the manner envisaged by the air power prophets. What the Germans hoped would be a quickly decisive edge became force-on-force when the Soviets intervened on behalf of the Republic. Both sides used air power in support of their armies for the duration of the campaign.

Similarly both sides attempted to use their aircraft in the quest for the Holy Grail – strategic bombing. The weight of bombs dropped occasioned little damage and only temporary erosion in morale. Furthermore, Franco was wily enough to realise that heavy civilian casualties could be counter-productive.²¹ The Italian attempt to vindicate Douhet's theories by bombing Barcelona failed. The irony of this policy was that 'lesser' targets – if one accepts this de facto dogmatic, orthodox view of their importance – such as munitions factories and central communications' nodes were attacked with some success.

Over the course of the campaign the Luftwaffe shot down 327 Republican aircraft and flak accounted for a further 59



A Polikarpov I-16, as operated by Republican forces.

Over the course of the campaign the Luftwaffe shot down 327 Republican aircraft and flak accounted for a further 59.²² They only lost 72 of their own aircraft. In the meantime, the relative control of the air allowed the concentrated use of air power in the 1938 campaign. This saw the Republican front lines completely shattered and the Nationalists able to exploit open country. The scope for manoeuvre warfare, again with control of the air, allowed the nationalists to split their enemy forces from the Atlantic to the Mediterranean. When the inevitable counter-attack in force came in July 1938, the inherent flexibility of air power allowed the Luftwaffe to regroup and contest the local air superiority that the Russians had gained over their own troops. With enemy fighters thus distracted, the Luftwaffe was able to conduct an intensive interdiction campaign against lines of communication. The counter-attack failed and the Republicans were forced back, eventually surrendering Madrid in March 1939.²³ From the initial airlift through to final push on the capital, air power provided the cutting edge both by providing control of the air per se and by disrupting the symmetry of matched forces supported by peer benefactors. Both sides took lessons forward.



Luftwaffe HE-111s over Poland.

German aggression against Czechoslovakia and then Poland amply demonstrated the warfighting potential of their army with the Luftwaffe providing control of the air

German aggression against Czechoslovakia and then Poland amply demonstrated the warfighting potential of their army with the Luftwaffe providing control of the air. France suffered a similar fate under the cosh of Blitzkrieg. The ability to contest control of the air had a significant impact on the beaches and moles of Dunkirk as the British desperately attempted to withdraw their shattered army. Air Vice-Marshal Keith Park's fighters from 11 Group provided 'Big Wings' (notwithstanding the later controversy) at dawn and dusk to provide some degree of air parity for the crucial periods of embarkation. Thousands of lives were saved and the kernel of the Army was retained because the lack of control of the air prevented the Luftwaffe from acquiring the asymmetric edge. The Battle of Britain consolidated the overall position preventing full-scale invasion.

A blow-by-blow account of the Second World War – and the role of air power therein – is clearly outside the scope of this paper, due in part to the reality that major offensives such as the war between Russia and Germany were fought as a classic force-on-force war of attrition. That said, control of the air was of vital importance throughout – not least to prevent the other side gaining advantage.

Much ink has been spilled on the efficacy, or otherwise, of the strategic bombing campaign – or more correctly the bombing offensive against a wide range of targets in Germany, not all of which had real strategic value. To some extent, the early bomber raids amounted to something akin to force-on-force attacks – albeit by proxy. Cities were attacked because of their industrial potential, or occasionally out of spite (such as the so-called Baedeker offensive against places of cultural worth in England). Control of the air was largely established by day over the respective homelands forcing the bombers to operate by night. There was nevertheless no lack of determination to take the war to Germany.

Writing in July 1940, Churchill was unequivocal in his determination that the only way to get through to the enemy was through 'an absolutely devastating, exterminating attack by heavy bombers from this country upon the Nazi homeland'. The move to area bombing was consolidated by the Air Ministry in a directive to Sir Richard Peirse (Harris's predecessor as C-in-C) dated 9 July 1941. This missive accepted the difficulties of finding and hitting precise targets in Germany by night; it proposed that, in reality, concentration on large towns and cities would mean that the military installations and economic facilities contained therein would be suitably attacked. The move to 'area' targets also allowed morale of civilian workers, and of the population as a whole, to be attacked.

As the combined weight of the USAAF Eighth Air Force and Bomber Command were brought to bear, the gruelling contest for control of the air was won – not over the beaches of Normandy as Leigh-Mallory expected, but over the heartland of the Reich

How much this could be termed an asymmetric edge is, at first sight, open to conjecture. The reality, however, was that the increasingly effective bomber offensive left the Hitler and the German High Command with no option but to defend the homeland. As anti-aircraft artillery units were reinforced, front-lines in Russia, and subsequently in France, were depleted.²⁴ Likewise, fighter units were concentrated in Germany and were increasingly required to specialise in night air defence. As the combined weight of the USAAF Eighth Air Force and Bomber Command was brought to bear, the gruelling contest for control of the air was won – not over the beaches of Normandy as Leigh-Mallory expected, but over the heartland of the Reich. The asymmetric edge could then be applied in support of Overlord and the ensuing breakout.

Notwithstanding the often vitriolic debates over bombing priorities, some unity of purpose was imposed on the scene in the lead-up to the Normandy landings with the attacks on the German transportation system. Once the land offensive was established, however, differences of opinion again surfaced over priorities. Tedder (as Deputy to Eisenhower) advocated that priority continue to be given to transportation and communications targets. Spaatz (Commander of the USAAF Eighth Air Force) favoured attacks on oil, while 'Bomber' Harris continued to insist on the maintenance of area bombing.

Throughout this debate, Harris fervently believed that the carnage that he had witnessed in the Great War could be avoided through the application of undiluted air power – with no diversions to panacea targets. The practitioners of air power had little doubt as to the potency of its potential – the debate was over where the most asymmetric leverage could be applied.

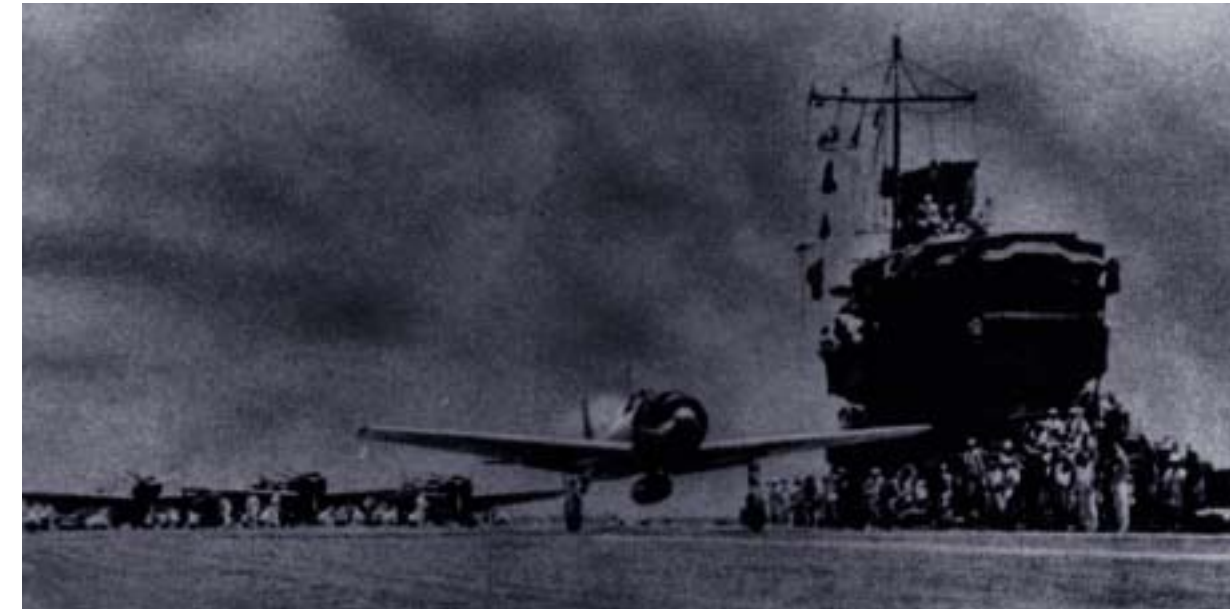
The devastation wrought in the fire raids on Hamburg and the destruction of Dresden provided examples in Germany of what air power could achieve

Dresden after the Allied air raids.



Asymmetry is at its most potent when the means can be applied with little risk of concomitant retribution. The near total air supremacy exercised by the allies over Northern France allowed air power to roam and attack at will with severe consequences for the ground forces who were forced to skulk in ditches by day. The devastation wrought in the fire raids on Hamburg and the destruction of Dresden provided examples in Germany of what air power could achieve. In retaliation, Hitler never finally relinquished the concept of war-winning super weapons that would provide the ultimate asymmetric edge.²⁵ The V-weapons achieved some measure of terror, and once launched, the V2 was invulnerable. But these weapons could be neither produced nor launched in sufficient quantity to have a real strategic effect. At the end of the day, conventional explosives and incendiaries were dropped in sufficient quantity by the allies for them to have a quality all of their own.

Japan's surprise attack on Pearl Harbor provided another example of asymmetric application of force



Japanese aircraft taking off for Pearl Harbor.

Japan's surprise attack on Pearl Harbor provided another example of asymmetric application of force. The fact that the two sides were not at war provided the necessary edge. The ruthlessness of the attack inevitably provoked a desire for retribution. The early Doolittle raids on Tokyo warned of more to come. Japanese control of the air was insufficient to deter the USAAF. Attacks on urban areas using fire bombs were therefore authorised in March 1945 (after the furore over Dresden had died down). By May 1945, incendiaries comprised 75% on the bomb load.²⁶ LeMay considered his strategic bombing force capable of coercing the Japanese into surrender without physical invasion. Some 58 cities were destroyed by fire-bombing between May and August 1945. In the face of such destruction – against which there was little scope for retaliation and virtually no defence – Japanese economic strength and morale crumbled. The nuclear attacks on Hiroshima and Nagasaki helped to accelerate the decision to surrender. In essence, air power had come of age and its proselytisers, and especially those arguing for an independent force, had seen the realisation of the ultimate asymmetric edge.

Notwithstanding the domestic and international impact of the advent of the nuclear age, the reality was that the weapons themselves were small and available only in very limited quantities. The devastation at the two ground zeroes was no greater than that already achieved in many other Japanese cities. But the potential was huge, and the young superpowers began to race for the ultimate edge.

The implied threat of nuclear attack, allied with credible means of delivery, is at the heart of deterrence theory

In the immediate aftermath of the Second World War, it was far from obvious that Britain would go down the nuclear weapons route. The recently elected Labour government formed a committee of senior ministers (known as Gen 75) to discuss atomic energy policy.²⁷ This body first met on 10 August 1945 – the day after the second bomb was dropped on Japan. Gen 75 was soon supplemented by the Advisory Committee on Atomic Energy which focused attention on the need to iterate major policy on weaponisation. Prime Minister Atlee recognised that warfare had changed fundamentally and expressed the importance of having the ability to retaliate: ‘The answer to an atomic bomb on London is an atomic bomb on another great city’. Deterrence theory was thus expounded.²⁸ Atlee derided the feasibility of keeping the technology secret and this view was independently endorsed by the Chiefs of Staff. Means of retaliation had to include the weapons and their delivery systems – manned bombers for at least the next ten years. It is interesting though not surprising, to reflect that in the United Kingdom at least, the atomic bomb was not sought as the ‘ultimate edge’ but as the deterrent thereto. That said, it was undoubtedly significant that the first Controller of Production of Atomic Energy (within the Ministry of Supply) was Marshal of the RAF Lord Portal of Hungerford – former CAS and C-in-C Bomber Command.

In the United States, The McMahon Bill was passed in August 1946 effectively prohibiting the transfer of nuclear secrets to Britain (notwithstanding the earlier sharing of research). Portal pointed out the stark reality that Britain would have to ‘think big’ if she was not to be left far behind America, and probably Russia. Notwithstanding the dire financial circumstances, Cabinet approval was eventually given for the secret stockpiling of some 1,000 such weapons and the development of suitable bombers.²⁹ Work then commenced at Fort Halstead in Kent on the development of *Blue Danube*, a weapon similar to the plutonium device used at Nagasaki.

Optimism that Britain would be the second nuclear power was shattered on 29 August 1949 when the USSR exploded its first atomic bomb. Britain’s first test – Operation Hurricane - followed on 3 October 1952.³⁰ Parallel work continued apace in the development of the Canberra, Victor, Valiant and Vulcan aircraft. Deterrence theory was similarly developed and expounded; defences were bolstered against massive attack; and huge stockpiles were manufactured along with ever more sophisticated means of delivery. What started as an asymmetric edge rapidly moved towards massive and dreadful symmetry.

The implied threat of nuclear attack, allied with credible means of delivery, is at the heart of deterrence theory. Perceptions, security and credibility were crucial in the early days of development when the scope to call bluffs was at its greatest. The Soviet Union imposed a surface blockade on Berlin on 24 June 1948. The United States almost immediately deployed B-29 bombers to the UK. As Professor Mason points out, it was widely believed that these aircraft were nuclear capable despite the reality that few weapons could have been scraped together and even fewer technicians to prepare them.³¹ The Russians either did not know this or want to risk the consequences because they refrained from interfering with the ongoing airlift. Air power, but not in the sense normally advocated, provided the strategic level asymmetric edge. ‘Trash-haulers’ won the day: but nuclear weapons provided the backdrop.

International conflict broke out in Korea in 1950...Allied air forces flew over a million missions dropping nearly half a million tons of ordnance

The transformational nature of nuclear weapons has, of course, been reflected in the extreme reluctance to employ them – even in the early days of development when their attributes were still aligned to conventional means of warfare. International conflict broke out in Korea in 1950; conventional strategic bombardment was impractical because of paucity of targets and nuclear usage was politically unacceptable. Nevertheless air power was used in quantity and with considerable effect. Allied air forces flew over a million missions dropping nearly half a million tons of ordnance.³² Opportunities for asymmetry were relatively few – not least because of the political constraints on attacking airfields in China. Control of the air was therefore an ongoing process and air power was only decisive on a small number of occasions.



A B-29A unloading its bombs over North Korea.

Advocates, and so-called apologists, of air power have had considerable scope to discuss the utility of air power over Vietnam. The generally accepted consensus is that American air power – equipment and doctrine - (deliberately phrased to avoid the tribalism prevalent at the time between the Services) was more attuned to nuclear weapons delivery than to conventional attacks against a very unconventional army. The political constraints were evident throughout the process from selection of individual targets to the overriding need to avoid escalation. This latter factor precluded strategic targeting or overt action outside home borders. Air power effectiveness was limited in the early part of the conflict due to lack of suitable target arrays. The Vietcong operated on the basis of insurgency tactics with limited scope for interdiction of materiel. After the evident failure of Rolling Thunder, Linebacker (I&II) was more successful. North Vietnamese tactics had evolved to a more conventional military approach thereby providing more lucrative targets; similarly political restrictions were increasingly relaxed.³³ Some air power advocates still claim that bombing could have provided the war-winning edge to the Vietnam conflict. The reality is that the whole mess was so lacking in symmetry that only a combination of factors could ever produce a solution.³⁴

The years between Vietnam and the Gulf War did little to assuage the bitterness felt by many over the conflict in South-east Asia. The Cold War ensured that defence budgets, doctrine and concepts would remain at best conservative. Some moves were made to foster the manoeuvrist approach with highlights emanating from the British Army in Germany and the US Marine Corps.³⁵ Matters were inevitably exacerbated when the Berlin Wall had collapsed and the ensuing euphoria gave way to strident demands for peace dividends. Competition for ever-scarcer funding left Ministries of Defence with the prospects of

The ensuing conflict through Desert Shield into Desert Storm was manna from heaven for air power advocates

internecine warfare that had, for example, dominated relations between Trenchard and Beattie in the aftermath of the Great War. Or, alternatively, they were forced to take on a joint or purple view. This was cynically portrayed by one commentator as the colour that most people go when nooses are tightened; he added that when the pressure is relieved a more normal complexion is quickly restored. Saddam Hussein relieved the pressure, at least temporarily, with his invasion and occupation of Kuwait. Rapid coalition response was effected by the almost instant deployment of air power to a seriously worried Saudi Arabia. This provided an asymmetric response to a potentially disastrous situation.

The ensuing conflict through Desert Shield into Desert Storm was manna from heaven for air power advocates. For one expert commentator, 'The Gulf War marked the apotheosis of twentieth century air power'. This elevation of a form of warfare to divine status has been subsequently cited and approved by others.³⁶ But these advocates were not alone in their praise: President George Bush stated that 'Gulf Lesson One is the value of air power'; and Secretary of Defence Dick Cheney confirmed that 'the air campaign was decisive'.³⁷ The synergy in names and appointments is obvious to students of air power a decade later.

From the Yugoslav perspective, air power was primarily used for local reinforcement with helicopters in frequent use

A Yugoslav Mi-8 HIP.



Air power cannot be said to have won the war on its own as the Iraqi regime, its allies and, arguably most importantly, the fellow members of the coalition must have been impressed by the deployment of ground forces on a serious war fighting scale. The willingness to be prepared to take casualties on an equally serious scale was obvious. The subsequent hundred-hour offensive was a vindication for the totality – not just air power. Manoeuvre warfare, on a large scale, swept the board. But the impact of weeks of air power changed the level of the victory, taking us beyond manoeuvre warfare to genuine manoeuvrist conflict – cohesion and will was shattered.³⁸

Furthermore, air (and aerospace) power had reached into the heart of Iraq itself where no target was immune from scrutiny, surveillance and attack. Control of the air was not ceded, as some detractors imply with a casual, myopic sweep of a very large hand over a small map of Iraq - and of history. It was fought for, won and then had to be maintained. Those who recall the early losses in the Tornado force recall that these were tense times. Clodfelter's concern over a 'Verdun in the air' could have become a Somme for control of the air. Once this contest, or to stretch a point the potential for the fight, had been decisively won, air power certainly produced the asymmetric edge: ground force on force was avoided until cohesion and will were shattered.

The Gulf War also generated new conceptual thinking on the deployment of air power with Colonel John A Warden's work on targeting and planning the Air Campaign.³⁹ This book originally started life as a research paper in the US National War College (thereby demonstrating conclusively that such exercises have the potential for real value) and subsequently formed the basis of the air campaign plan presented to General Schwartzkopf. Warden was moved quickly into the Air Force planning staff in the Pentagon where he ran the planning staff, better known as 'Checkmate'.⁴⁰

No sooner was the euphoria in the process of evaporation when Yugoslavia started to unravel in a serious manner. In this conflict force on force was deliberately eschewed – by all sides; and there were no heroes, only bad guys and victims. The low level of the fighting did not mask the viciousness and the brutality with arson, rape and murder the norm. This was Hobbes rather than Clausewitz. From the Yugoslav perspective, air power was primarily used for local reinforcement with helicopters in frequent use. The air defence was largely dormant, albeit with odd exceptions.⁴¹ Fast jet operations using Galeb and Jastreb aircraft were of limited utility with more psychological effect than military impact. James Gow points out that there were occasional attacks on towns such as Brcko and Gradacac, but by mid-1993 these fixed wing sorties had largely stopped following attempts to transfer aircraft to Serbia.⁴² That said, each sortie caused uproar, frustration and indignation in various segments of the international community (especially America) and with those involved in the negotiation process.⁴³

The relatively small scale of the air operations did not, however, prevent an increasing clamour for the imposition of a no-fly zone over Bosnia. This stemmed in part from a wish to level the playing field slightly given the imbalance of weaponry (especially artillery and heavy mortars) between the Bosnia-Herzegovina Government forces and those of the Bosnian Serbs⁴⁴, who had inherited much of the JNA equipment and command structure. Some also considered that robust implementation of the no-fly zones would show resolve on the part of the international community. Operation Deny Flight was instigated following the passage of UNSCR 816 on 31 March 1993 and replaced the less aggressive Operation Sky Watch that had been monitoring the air space.

The nature, and scale, of the violence within Bosnia-Herzegovina, coupled with the immediate access to media, raised the stakes with increasing demands for peace enforcement. There was considerable concern, however, that a rash NATO air attack, possibly fuelled by high-level political frustration, could seriously endanger the lives of the peacekeepers on the ground.⁴⁵ This resulted in the so-called dual-key approach under which a given target had to be approved at high level in both organisations.⁴⁶ Ambivalence in Washington over the desired end-state versus the art of the achievable was also evident.⁴⁷ Coalition air power was used on occasions such as the attack on Ubdina airfield in late 1994; NATO proudly

announced that this had been the largest air raid in Europe since World War II – Richard Holbrooke described it in horror as being closer to ‘pinpricks’.⁴⁸ General Sir Michael Rose defended similar actions as being ‘textbook examples of the precise use of force in a peacekeeping mission’.⁴⁹ From these two viewpoints, it is evident that perceptions are all-important.

Deliberate Force was unleashed on 30 August and continued through to 14 September 1995. NATO air units flew 3,535 sorties, dropped over 1,100 bombs with the loss of one aircraft



F-15E Eagles formed the backbone of the strike force, Operation Allied Force.

Continued political intransigence, and a worsening situation on the ground, increased the demand for resolute action. Deliberate Force was unleashed on 30 August and continued through to 14 September 1995. NATO air units flew 3,535 sorties, dropped over 1,100 bombs with the loss of one aircraft.⁵⁰ For presentational purposes, the NATO attacks were carried out as part of the campaign to protect the safe

areas – directly and indirectly. It is obvious from Holbrooke, however, that any coercion of the Bosnian Serbs towards a peace settlement would be beneficial.⁵¹ Furthermore, the air campaign was materially assisting an ongoing Croatian Army⁵² /Muslim ground offensive – much to the discomfiture of the Bosnian Serb Army who found that the concentrations of tanks and artillery necessary to counter this assault made excellent targets for air power. Holbrooke suggested to Milosevic that the air campaign was not coordinated with the ground offensive, but later in his account admits to having advised President Tudjman of Croatia as to which towns his troops should occupy to facilitate later negotiations.⁵³ The marked escalation in external military involvement resulted in a new momentum for the talks’ process.

Subsequent reaction has varied from restrained suggestions that air power achieved far more than could have been expected,⁵⁴ through confirmation that it was a decisive element in shaping the outcome (emphasis in the original),⁵⁵ to suggestions that the air campaign had delivered the Dayton peace accord. This was challenged unequivocally by General Sir Michael Rose who commented that:

*‘Tragically, NATO came to believe its own rhetoric that it was the air campaign that had delivered the Dayton Peace Accord’.*⁵⁶

Similar bold statements followed success in Allied Force with exaggerated claims over what air power had achieved.⁵⁷



A radio relay station destroyed by Nato air strikes.

The air campaign began with a series of strikes on air defences across Serbia and Montenegro and against a limited number of military targets in Kosovo and elsewhere in Southern Serbia

Regrettably, some of these statements were taken to heart, and with an unhealthy dose of optimism, politicians and planners had again to turn to air power in the hope of pressurising Milosevic into backing down over the situation in Kosovo. What had effectively degenerated into a 10-year cycle of ‘call my bluff’ failed to produce a result that was satisfactory to any of the sides. Military action seemed to be the only

way forward. Allied Force commenced at 1900 GMT on 24 March 1999 and continued for 78 days. Some 38,004 sorties were flown of which 10,484 were strike missions. The UK flew 1,618 sorties of which 1,008 were strike.⁵⁸ The air campaign began with a series of strikes on air defences across Serbia and Montenegro and against a limited number of military targets in Kosovo and elsewhere in Southern Serbia. Targeting policy was under political control in NATO and nationally. Fond hopes that Milosevic would collapse immediately were quickly shown to be wrong as his special forces and para-military units set about an ethnic cleansing operation of unprecedented brutality.⁵⁹

This scope for air power to be employed remote from land and naval forces was part of the original rationale for its employment to be in the hands of a separate service with its own staff

As the Campaign continued, the range of targets was gradually expanded and, with no sign of NATO disintegration, the Serbian economy was gradually worn down to the point where it is almost certain that Milosevic and his cronies were running out of influence and black market profits. Settlement was reached, albeit on looser terms than had been tabled prior to the start of hostilities.⁶⁰ Whatever the sceptics may say about both Deliberate and Allied Force, the reality is that air power did make a major and significant contribution.

Furthermore, for many governments, air power was the only game in town. There was an unmistakeable reluctance, or inability, on the part of most governments not to deploy serious numbers of troops on the ground with a genuine war-fighting mandate. Control of the air, certainly in the later campaign, had again to be fought for, won and then maintained. Thereafter, it could easily be argued that air power was not only the asymmetric edge – it was the only feasible option.

The events of 11 September 2001 rocked much of the Western world and left many wondering how quickly the President of the United States would resort to air reprisals. Surrounded by senior and seasoned colleagues, the response was largely measured and reasoned (some rhetoric such as references to a ‘crusade’ were less than wise). The subsequent operations were inevitably based around air and space power using the widest spectrum of capabilities. Air power was used extensively for the projection of special forces, with carrier air in support. Long-range attack aircraft were again deployed direct from the continental United States. Close co-operation with indigenous forces enabled rapid progress to be made in restoring Afghanistan to some semblance of civilised governance. An interesting element of the contest for control of the air came with Warden’s prediction coming true that this need not be done air-to-air, or even air-to-ground, but could be achieved by ground troops clearing out surface-to-air missile cells. In terms of providing the asymmetric edge the range of sensors deployed, either air/space-borne or air-delivered coupled with witheringly accurate fire, have again proved their value beyond reasonable doubt.

The foregoing account cannot take every skirmish, conflict and war into consideration. It is nevertheless a comprehensive overview of warfare from the earliest use of air power. Control of the air has been a key factor in its effectiveness – a true decisive point – from the point where Austrian commanders considered observation from balloons an affront to the laws of war and attempted to shoot them down. Even the opposition achieving air parity can blunt a commander’s intent – as was shown at Dunkirk. Air superiority or supremacy must therefore be the aim. This does not happen by accident; and it certainly will not be ceded. As Professor Tony Mason has pointed out, land and naval commanders should look to their plans in the event that command of the air is not achieved.⁶¹

Air power has therefore increasingly become the weapon of first political choice

As air power and technology have matured hand-in-hand, so the capability has increased many-fold. Even after Allied Force, however, only the very bold among air power advocates would suggest that air power could ‘do it alone’. Furthermore, there remains considerable scope for air power to act in close, and indirect, support of other components – often providing them with the asymmetric edge. Nevertheless, it is the ability to react rapidly and to operate over long distances that gives air power the scope for independent action.

This scope for air power to be employed remote from land and naval forces was part of the original rationale for its employment to be in the hands of a separate service with its own staff. Amidst considerable controversy, the Royal Air Force was formed on this premise. It is submitted that the case for professional airmen to be at the forefront of the planning and execution of this capability is more overwhelming now than it was in 1918, or in the aftermath of World War II when the United States Air Force came into being. The lower the scale of conflict, or the more intransigent the foe, the broader based the strategic planning will need to be. This will necessitate more conceptually based and more visionary approaches to conflict resolution. Doctrine, in both the joint and environmental arenas, will need to evolve to meet these challenges, lest it descend into dogma. This will need pro-active intellectual effort beyond Professor Richard Overly’s admonition that the process should be subject to ‘constant and critical interrogation’.⁶² No aviator, of whatever colour cloth, would claim a monopoly on wisdom on air matters. Nor would any air power advocate, academic or apologist stake a claim to be the only voice. Nevertheless, operational experience carries its own weight in air power debate as it does in any field of military endeavour. In most fields of study, the opening perspective of the student will colour her or his analysis of the subject area. A real understanding of air power history, of doctrine and, most importantly, of conceptual thinking is therefore best done by air-minded folk.

One of the prime sources of air power conceptual thinking will therefore be from air forces, and clearly from those closely associated with them. Likewise air campaign planning is best done by those intimately aware of the nuances of aircraft systems, weapons and doctrine; this will invariably mean aviators and, with due respect to those in other colour suits, the truly independent capabilities of air power are best exercised by those from the air force. In these days of financial stringency, the ideal may be sacrificed for the economical. But woe betide the ‘purple commander’, the civil servant or the contractor who risks not having control of the air. Similarly the crisis manager needs to guard against the descent from conceptual thought into quantitative management-speak in which counting the number of tanks ‘plinked’ is regarded as a more meaningful exercise than analysing the real effect achieved on the enemy.

Air power has therefore increasingly become the weapon of first political choice. Indeed over the last decade it has often been the only weapon acceptable to some nations, their politicians and their people. Some may argue, and this author does, that casualty aversion has been overstated in the aftermath of the American experience in Somalia. It may well be that history will regard that regrettable episode as a blip rather than a watershed. Nations, and their media, will always be ready to criticise governments for hasty intervention where national interests (however defined) are not evidently at stake. But support for military action, with the ensuing consequences, can be very robust when the stakes are high. That said, unnecessary waste of life should be eschewed whenever possible. Air power will therefore frequently offer the safest way forward – especially in conjunction with precision weaponry. As has been shown, the wise will always elect to avoid symmetric conflict. The asymmetric edge should therefore always be sought.

One could therefore argue that Trenchard's trinity of offensive action, cost-effectiveness and avoidance of symmetric force-on-force carnage have either come full-circle – or have been an enduring theme of air power utilisation. There can be little doubt that for politicians either in search of 'something to be done', or in the quest for 'the force for good', air power will provide immediate scope for offensive action. For detractors of an earlier age, its impermanence has become a virtue. Whilst not, at first sight, a cheap option, modern air power can be cost effective – especially when set against the alternative of fielding large and highly manoeuvrable armies equipped for network centric warfare. For the casualty averse, however, it is the asymmetric edge – the avoidance of mass casualties – that gives air power the greatest appeal. When action is taken in defence of national security – 'in clear and present danger' – public support will be immediate. Where action is taken in pursuit of more nebulous national interests, rather than national security, there will be greater need for precise, and often long range, offensive action which can only be provided by air power.

In sum, air power — in its widest form — is likely to remain the weapon of first political choice. With control of the air it will be the most likely form of military force to achieve the asymmetric edge and hence the most efficient victory. If air power is to be used to best effect, it is best exercised by airmen, and most of them come from air forces. Air power is therefore destined to remain — to borrow the esteemed John Terraine's title — 'to the right of the line'.⁶³

Notes:

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4 Professor Sir Michael Howard, The Invention of Peace,

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20 Corum, The Luftwaffe, Creating the Operational Air War, 1918 – 1940, page 184.

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23 Corum, The Luftwaffe, Creating the Operational Air War, 1918 – 1940, pages 201 – 209.

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*The long gestation and difficult birth of the 2nd Tactical Air Force (RAF)*¹

By David Ian Hall²

The operational success eventually enjoyed by Anglo-Canadian and American armies in the latter half of the Second World War was due in large measure to effective air support. First in North Africa, and later in Italy and North West Europe, American, British and Empire armies fought most if not all of their battles with the knowledge that they enjoyed unassailable air superiority throughout the battle area and, consequently, they expected considerable tactical air support for all of their operations. By the summer of 1944, it was a decisive advantage made possible by the active combination of matériel superiority and a common doctrine. The latter – an accepted common doctrine and standardised operating procedures – was the product of costly and hard-earned battle experience and the resolution of a hotly contested debate on air co-operation that had raged throughout much of the war, primarily between the British Army and the Royal Air Force, but also with small yet relevant Canadian participation.

This article is a very brief canter through the debate, charting the rise, fall, and rise of an effective British and Imperial air support system from 1914 to 1945. At issue were the questions of 'who should control aircraft on the battlefield, what type of aircraft should be employed and how these aircraft should be used'. The emphasis is on the operational level – the development of doctrine and organisation to achieve a decisive military result in battle – but there is also a 'symbiotic relationship' between the operational and tactical levels of war, and interaction (both direct and indirect) between the RAF and the RCAF in turning theory into practice and then refining practical procedures to obtain optimum results: a process of innovation within co-operation.

At the start of the war there were many joint and combined difficulties to overcome. 'When the first squadron [RCAF army co-operation squadron] went to Britain in early 1940', wrote Canada's official historians, 'it inevitably became embroiled in all the troubles which frustrated its RAF peers, in addition to those problems inherent in the broader picture of Anglo-Canadian co-operation.'³ Airmen and soldiers did not work well together at the outset of the war, and Anglo-Canadian co-operation did struggle on a number of practical and political levels. But equally the Anglo-Canadian partnership had many benefits, especially in terms of the combined resources marshalled for war, including matériel, manpower, and, in the case of army-air co-operation, intellectual capital. Building on the recent scholarship of historians Terry Copp, Alex Douglas, Bereton Greenhous, Stephen Harris, and Ian Gooderson,⁴ this article highlights the beneficial effect of Anglo-Canadian co-operation in reaching a solution to one of the great operational and tactical riddles of the Second World War: the provision of comprehensive, effective and flexible air support for ground forces.

The initial problems in providing British and Imperial armies with effective air support during the early years of the Second World War and the solution to this dilemma are found in the ten or twenty years before the war began. It is axiomatic that the strategy and operations of any war can be understood only in the light of the conditions and preparations that preceded them. Technology, doctrine, training, and leadership – what the eminent historian Peter Paret calls the essentials of action in war – are the products of peacetime developments and neglect. Battle experience often leads to change but equally pre-war elements continue to affect the way nations and their armed forces fight even the longest wars. Paret's theory that the nature of military action has its antecedents in the past has proven merit as a methodological approach to the study of military history. Highly acclaimed studies by Shelford Bidwell and Dominick Graham, Harold Winton, John English, and James Corum attest to a rich historiography.⁵

In less than five years of war, British combat aviation had undergone an extraordinary transformation from its humble pre-war beginning of two small reconnaissance forces...

An extraordinary transformation had taken place during WW1 with the RAF able to call upon 22,000 aircraft at the close of hostilities.



At the end of the First World War, Great Britain stood alone amongst the great Powers as the pre-eminent air Power in the world. During the last two years of the war, British aircraft accounted for 7,054 enemy aircraft destroyed, dropped 6,942 tons of bombs, flew over 900,000 operational hours and fired over 10.5 million rounds at targets on the ground.⁶ When the Armistice took effect on 11 November 1918, the Royal Air Force (RAF) mustered some 22,000 aircraft and just under 300,000 personnel.⁷ In less than five years of war, British combat aviation had undergone an extraordinary transformation from its humble pre-war beginning of two small reconnaissance forces of fifty front-line aircraft each for the Army and the Royal Navy.⁸ Between 1914 and 1918, the Royal Flying Corps (RFC) and the Royal Naval Air Service (RNAS), followed by the RAF, had performed every major air power role and mission,⁹ the very roles and missions that are the core capabilities of modern air forces today. The wide variety of these first experiences in air operations, however, should not mask the fact that Britain's first air war was an army co-operation war.¹⁰ Most of Britain's air effort was subordinate to the Army's military campaigns on the Western Front where army commanders increasingly were pre-occupied with the tactical problems of achieving a breakthrough. The Army viewed aircraft as auxiliary forces, similar to artillery and the new tanks, which were sub-allotted to army Corps at the front, and placed under the direct control of each respective Corps commander.

The Army viewed aircraft as auxiliary forces, similar to artillery and the new tanks...

Aircraft were used as 'flying artillery' to help the infantry advance. Army commanders, seeking the ultimate in close air support – to the exclusion of all other forms of combat aviation – employed as many aircraft as possible in a ground attack role at the forefront of their contact battle.¹¹



The primitive beginnings of ground attack.

Aircraft were used as 'flying artillery' to help the infantry advance...

These practices became increasingly problematic for Britain's airmen. Reflecting on their own operational experience, it was not long before they identified a number of enduring air power characteristics – height, speed, and reach. They also deduced the benefits to be had from a system of centralised command and control. Employment of such a system would enable an air commander to concentrate all available aircraft at critical times and points in a battle and, most importantly, ensure a maximum effort 'in support of the decisive tasks' or, as it is called today, the operational main effort. The army's preferred method of decentralised command was increasingly regarded by many airmen as wasteful and inefficient; it also entailed dispersion of effort on inconsequential objectives. At the Battle of Amiens, fought in August 1918, the RAF tried, for the first time in the war, a rudimentary system of centralised control. Both Services, also for the first time in the war, conducted their operations in accordance with a joint army-air plan. The air operations were only a limited success, but Amiens, and

At the Battle of Amiens, fought in August 1918, the RAF tried, for the first time in the war, a rudimentary system of centralised control...

subsequent air operations flown during the last hundred days of the war, convinced British airmen that better results were achieved when air forces were concentrated against targets both above and beyond those traditionally selected by army commanders. When the attainment of air superiority was the first objective, followed by operations designed to isolate the battlefield, air forces proved their growing potential to make a decisive impact on operations taking place on the ground. Boyed by their recent discoveries, Britain's airmen, with great certainty, espoused a yet unwritten doctrine that emphasised a more strategic application of air forces based on air power's core capabilities of air superiority, interdiction and long-range bombing.¹²

Air power, Britain's air practitioners and fledgling theorists believed, offered a new way of approaching the strategic and operational challenges of war...



Britain's primary air superiority and long-range bombing aircraft at the end of the First World War: an SE 5a fighter is dwarfed by a Handley Page O/100 bomber, February 1918.

Air power, Britain's air practitioners and fledgling theorists believed, offered a new way of approaching the strategic and operational challenges of war. Their faith in the ability of air forces to exert a strategic influence on the conduct of war in the future led naturally to a number of ambitious post-war plans.

Even before the war had ended, the Air Council tendered its plan to increase the RAF by 154 squadrons, thus raising its peacetime establishment to no less than 348 squadrons.¹³ The Air Staff also had high hopes for the RAF's future role in providing for Britain's post-war security. They envisaged both an independent strike force for home defence and an air policing force to patrol the Empire. A broad outline of the RAF's strategic plan was submitted to the Cabinet in December 1918, by the then Chief of the Air Staff, Major-General Sir Frederick Sykes.¹⁴

By all accounts the future should have looked very bright for the new Service with its special contribution to safeguarding national interests and fighting any future war. But this was not to be. Instead of expansion the RAF underwent a massive reduction. Lloyd George's coalition government needed money to pay for its war-time promises, such as 'Homes fit for Heroes' and other long-delayed social programmes.¹⁵ Moreover, a war-weary Britain was in no mood to start planning for the next war when the 'Great War to end all Wars' had just been fought and won.¹⁶ In January 1919, Winston Churchill was appointed Secretary of State for both War and Air. His task was straightforward; he was to roll up the RAF. Before the end of the month the process of dissolution had begun, and, in less than a year, the world's largest air force was reduced to twenty-five squadrons and less than 27,000 officers and other ranks.¹⁷

The post-war years were difficult ones for the Royal Canadian Air Force (RCAF) too. Canada did not have a national air force during the First World War. Thousands of Canadian airmen did make a contribution to the advent of air warfare but most of them did so as individuals serving in British air forces. The Royal Canadian Naval Air Service and the Canadian Air Force (overseas), both small and very late creations, were established and disbanded during the last year of the war. Two years would pass before the Canadian government established a small, non-permanent Canadian Air Force (CAF), designed along 'militia' lines, and firmly tied to the civil sector. In 1924, it received 'Royal' designation, became a permanent force that was a directorate of the Army, and mustered some 68 officers and 307 other ranks. Air defence following RAF concepts was the RCAF's primary military role, but throughout the 1920s and most of the 1930s, and despite its small size, it was responsible for a wide variety of civil and military functions. Whilst Canadian airmen favoured the development of an independent air force similar to that of the RAF, Canada's soldiers preferred a force that corresponded to the old Military Wing of the Royal Flying Corps. Heavily influenced by Brigadier General A.G.L. McNaughton, a dedicated advocate of air power in the land battle, the RCAF's inter-war experience and training leaned more towards co-operation with the Army than the exercise of independent air power.¹⁸

The rise of international tensions in the mid-1930s did lead to a reduction of the RCAF's civil duties and in 1938 the RCAF became an independent Service. Still small in size, numbering some 150 officers and less than 1,000 other ranks, and operating 31 obsolete aircraft, the RCAF was hardly a modern air force ready to go to war. Constrained by acute shortages in equipment and personnel, training in 1939 was both difficult and less than realistic. Training, such as it was, was carried out by individual squadrons, and emphasised tactical procedures in air-to-air fighting, ground attack, and torpedo runs. The RCAF would start the war as an auxiliary air arm to land and naval units. As an interesting aside, the Canadians' approach to army co-operation was exactly what the British Army wanted, and would have had, had its vision of air support rather than that of the RAF's been accepted policy. In the autumn of 1939, the 1st Canadian Division (1 Cdn Div) sailed for England; 1 Cdn Div was accompanied by one army co-operation squadron, No.110 Sqn., RCAF, equipped with Westland Lysanders.¹⁹

The debate over the strategic application of air forces in national defence had been more hotly contested in Britain during the 1920s than it was in Canada. Air Marshal Sir Hugh Trenchard, Chief of the Air Staff for the second time, was increasingly worried that his colleagues in the Army and the Royal Navy neither had the ability nor the desire to develop air power properly. In the spring of 1921, Trenchard warned: The nation that considers and develops its air forces as an auxiliary arm to the older services will suffer a rude awakening if faced by a nation which has recognised that the air may become a primary medium of war and has developed its air power accordingly.²⁰

After extensive analysis of the use and misuse of air forces, Trenchard and the Air Staff established a set of first principles of air warfare – offensive initiative, air superiority, concentration of force, and the need for centralised command and control – principles which served the RAF well in its development of theory and doctrine throughout the inter-war years and the Second World War.²¹ The RAF's advocacy of these principles, and its advancement of the concept of 'air power', however, exacerbated already severely strained relations with the Army and the Royal Navy after the deep cuts in defence expenditures. Division and hostility were compounded further by the lack of a common approach within the Services to the planning and conduct of war at the strategic level.

Whilst the RAF concentrated on how to defend Britain from air attack and the Royal Navy concerned itself with maintaining open seas – both strategic tasks – the Army focused on the tactical practicalities of defending the Empire. Worse still, none of the Services, either individually or in any combination, possessed the doctrine, force structure, or operational level of command necessary to make the vital link between the strategic direction of war and its tactical execution.²²

On the subject of air support for the army, the RAF and the Army waged a fierce political battle over the proper employment of finite air forces in war – an acrimonious and divisive struggle that remained unresolved until the spring of 1943.²³ As a general rule, the airmen tended to see a wider, strategic application of air power. In a land battle, once command of the air over the intended area of operations had been established, air forces would make their greatest impact through offensive action designed to 'isolate the battlefield' from enemy reinforcement and supply. Both training exercises in the UK and war experience in China and Spain convinced the airmen that air attacks in the forward battlefield area were ineffective and uneconomical.²⁴ Targets were difficult to find and hit, losses in aircraft and crews were unacceptably high, and finite air forces quickly depleted in a close support role also lost their ability to maintain the all-important condition of air superiority. Army officers were unimpressed by this logic. They wanted large numbers of specialised aircraft sub-allotted to field commanders to shield their men from enemy air attack and to provide offensive air support – loosely described by the soldiers as flying artillery – to destroy enemy armour, artillery and strong points at the forefront of the battlefield. This is what air forces did in the Great War. The Army, therefore, concluded the soldiers, required its own army air arm. Anything less was unacceptable.²⁵

Irreconcilable differences on matters of principle and deep-seated mistrust over intent bedevilled most dealings between the two Services as they struggled to find a mutually acceptable solution to the air support dilemma. The ignominious defeat of the British Expeditionary Forces in France in June 1940, and early setbacks in the Middle East against Rommel and the Deutsche Afrika Korps, merely made a bad situation worse. A severe lack of resources, and technical problems both with aircraft and rudimentary communications systems, also hindered the rapid development of a comprehensive, flexible and quick-to-react air support system. But these problems, severe as they were, were still much easier to overcome than the conceptual differences over air-ground co-operation between Britain's soldiers and airmen.

To achieve this superiority demanded an air force superior in strength to the enemy air force opposite...

Defeat at the hands of the Wehrmacht convinced most soldiers that they had been right all along: the army required its own aircraft if it was to have any chance of success in a modern war. Furthermore, the War Office claimed that the army required its own specialised air forces, consisting of a fighter umbrella for defence and dive-bombers for close offensive support, sub-allotted to ground commanders at both corps and divisional levels. This, claimed the General Staff, was what the German Army enjoyed.²⁶ The Air Staff disagreed. Effective air support, responded the airmen, was dependent on a high degree of air superiority. To achieve this superiority demanded an air force superior in strength to the enemy air force opposite: a unified air force consisting of bombers, fighters, reconnaissance, communication and transportation aircraft

Success was not to be found in vast numbers of specialised support aircraft tethered to the ground forces...



RAF air support in 1940: Lysander army co-operation aircraft of No 225 Squadron.

all operated under centralised command with the flexibility to switch from one task to another as strategic circumstances dictated. Success was not to be found in vast numbers of specialised support aircraft tethered to the ground forces.²⁷

During the exceedingly anxious late summer and autumn of 1940, the two services searched for answers to the air support question. Despite a most unhelpful report produced by General Bartholomew – which blamed the RAF for most of the Army's woes in France, demanded the immediate creation of an army air arm, and confirmed the War Office's obsolete understanding of how air power should be applied in a land battle – some soldiers and airmen worked well together on a number of effective joint army-air reforms. The most important of these were the air support experiments conducted in Northern Ireland by Group Captain A.H. Wann and Colonel J.D. Woodall.²⁸ Wann and Woodall identified the need for a tactical air force: an RAF formation that was equipped and trained to obtain air superiority by offensive air action and to attack battlefield targets in close co-operation with the ground forces. From 5 September to 28 October 1940, they directed a series of signals exercises and command and control trials that led to the formation of a rudimentary combined (army/air) battle headquarters equipped with direct communication links to forward troops and both forward and rear airfields. By the end of the year both the Army and the RAF would celebrate three notable achievements: the creation of a Combined Central Operations Room at GHQ Home Forces, the adoption of Close Support Bomber Controls following the extensive experiments and trials in Northern Ireland and, on 1 December, the formation of Army Co-operation Command.²⁹ For almost three years, from 1941 to mid-1943, RCAF army co-operation squadrons and most RCAF fighter squadrons in the UK developed and refined their tactical procedures for close and direct support operations in a land battle.³⁰

A parallel air-support system was forged in the hard test of battle in North Africa during the spring and summer months of 1941. Immediately following the two failed attempts to relieve Tobruk in May and June – Operations Brevity (15-17 May) and Battleaxe (15-17 June) – the two newly appointed air and land commanders, Air Vice-Marshal Arthur Tedder and General Sir Claude Auchinleck, initiated a series

of joint army-air conferences and exercises aimed at solving the air support problem.³¹ Air Support Controls (ASC) – an innovative joint command structure, similar to the Wann Woodall system, to control combined land-air operations – was constructed and tested. In addition to command and control exercises, a number of air trials tested bomber and fighter aircraft in a variety of tasks to determine their optimum roles in ground support operations. Out of these efforts emerged a new tactical air system, one that eventually proved effective in both attack and defence and against both pre-arranged and impromptu targets. The joint command and signals network was the nervous system of the new air support system and the fighter-bomber was its talons and teeth.

Important as these technical and tactical developments were to the success eventually achieved in British air support operations, effective co-operation, for Tedder, still required major improvements in co-ordination between soldiers and airmen. Air superiority over the battle area was an essential pre-condition for an effective and sustained contribution by air forces to a land battle. Once a satisfactory air situation was attained the whole air force with all of its available strength could be switched to direct support: in effect, saturating the battlefield with air power. If the army was to take full advantage of the air effort it would, on occasion and under certain circumstances, have to adapt both the timing and the location of its operations on the ground. To attain a sufficient level of mutual understanding, Tedder believed that a combined land and air plan, drafted by the two Services working as equals, was required. Army and air commanders, he further counselled, must work together throughout all stages of drafting, planning and executing their operations. Unity of purpose would be their guide.³² The accuracy of Tedder's theory was confirmed a year later by the successful partnership of General Bernard Montgomery, commander of the Eighth Army, and Air Vice-Marshal Arthur Coningham, AOC-in-C, Western Desert Air Force. Later in the war Montgomery's monumental ego would sabotage his relationship with Coningham and other British, American and Canadian commanders, but it was that same ego and burning desire to defeat the Germans that led him in the summer of 1942 to search out his air counterpart in Egypt and construct a winning air-land strategy.

RAF historian, Sir Maurice Dean, identified three vital elements necessary for effective army air co-operation. They are goodwill (the willingness to co-operate), sound principles and tactics, and reliable

Teeth of the Desert Air Force — a Tomahawk of No 112 Squadron RAF, 1941.



The joint command and signals network was the nervous system of the new air support system and the fighter-bomber was its talons and teeth...

communications.³³ By the summer of 1942, all three were in evidence in the Western Desert. Similar levels of co-operation and understanding between the Army and the RAF did not exist back in England. In March 1942, the CIGS, General Sir Alan Brooke, re-opened the bitter and protracted debate on an air arm for the Army. Brooke and many of his colleagues at the War Office believed that only the creation of a separate army air force, made up of specially designed aircraft, flown by carefully trained pilots, and controlled by an army commander-in-chief in the field, would guarantee the Army adequate air support. A number of proposals were put forward throughout the spring. The most fanciful was Brooke's own demand of 111 squadrons of specialised close support aircraft and another 207 squadrons of transport aircraft to meet the Army's minimum requirements. Additional support, namely fighter protection and bomber attacks against enemy troops and positions, was also requested from the independent air forces. Air Chief Marshal Sir Charles Portal, Chief of the Air Staff, correctly pointed out that additional air support was not possible if the army's demand for permanently assigned squadrons was met; the army air arm proposed by the CIGS exceeded the first-line strength of the entire RAF.³⁴ Experience in North Africa confirmed that when fighting with limited air resources against an enemy of comparable quality and strength 'only a centralised and flexible organisation can achieve ... the air situation in which naval and land forces can operate [successfully]'. Portal, therefore urged his army counterpart to adopt the principles of the Middle East system as the basis for developing future army air support.³⁵

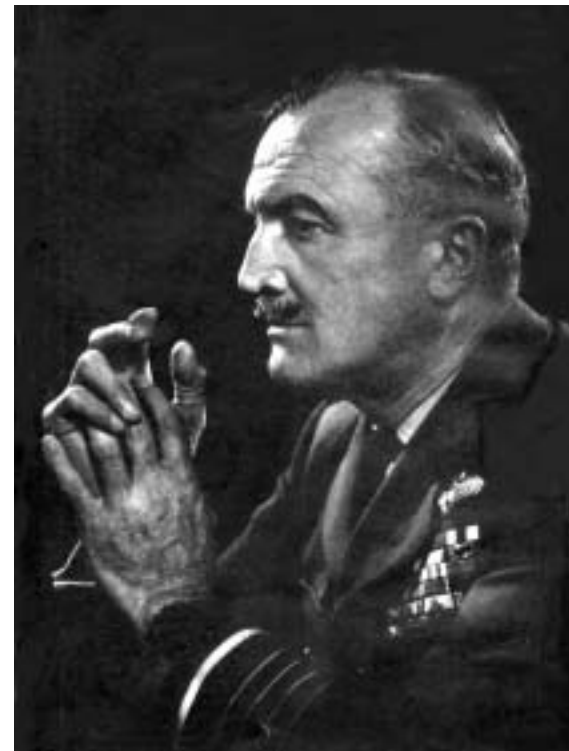
The soldiers were not impressed with Portal's suggestion. Many generals, including Canadian General A G L McNaughton, and even a few airmen, were openly critical of the RAF's approach to integrated air-ground operations.³⁶ The General Staff wanted No.2 Group, Bomber Command, built up to twenty squadrons and transferred to Army Co-operation Command. Another proposal originating out of GHQ Home Forces, entitled the Thorold Paper, and drafted by Air Commodore Henry Thorold and Colonel Claude Oxborrow, called for the creation of a new RAF Army Air Support Group of twelve squadrons of bombers and fighters specially designed for ground attack.³⁷ All of the Army's proposals violated the RAF's principles of centralised command and concentration of force. Perhaps most telling, however, was a report written by the Joint Planning Committee, which warned:

*Under the existing set-up there are too many RAF Commands concerned . . . For Round-Up [the pre-Overlord codeword for the Allied cross-channel invasion of the continent] we must have a single air force command. The nucleus of this command must be established now.*³⁸

Support was growing for a composite group of all types of aircraft under one air commander 'who could see the air situation as a whole and co-ordinate support and reconnaissance operations with fighter operations to maintain the air situation'. On 21 July 1942, Air Marshal Sir John Slessor presented his proposal for such a force: a mixed force of fighters, light bombers, army support and reconnaissance squadrons organised in

Slessor therefore proposed to amalgamate Army Co-operation Command into his new composite force – what would eventually become the 2nd Tactical Air Force – and establish it in No.11 Group, Fighter Command...

Marshal of the RAF Sir John Slessor.



groups all under the command of a single AOC-in-C. In the United Kingdom, only Fighter Command had a communication system robust enough to provide the centralised control that the RAF desired as well as the flexibility to expand and extend the Air Support Control system along Western Desert Air Force lines. Slessor therefore proposed to amalgamate Army Co-operation Command into his new composite force – what would eventually become the 2nd Tactical Air Force – and establish it in No.11 Group, Fighter Command.³⁹

After almost a year of rancour over who would develop Britain's tactical air forces, either Fighter Command or Army Co-operation Command, the new Air Expeditionary Force Headquarters was established in Fighter Command. Support for this decision came from many quarters outside of the Air Staff and Fighter Command. Churchill favoured the Air Staff's proposal and, after the RAF's Composite Group demonstrated its clear advantages in Exercise Spartan, from 1 to 12 March 1943, Air Marshal Sir Arthur Barratt, AOC-in-C Army Co-operation Command gave his endorsement to the new system.⁴⁰ Support also came from Field Marshal Montgomery who publicly renounced the old War Office belief that army commanders should control their own supporting air forces.⁴¹

The Chiefs of Staff approved the RAF's Air Expeditionary Force (AEF) on 1 May. AEF would provide a Composite Group for each British and Canadian army taking part in the Normandy invasion and all subsequent operations thereafter. Each Composite Group contained fighter, bomber and reconnaissance aircraft but they were not restricted to a prescribed 'fixed strength'. The AOC-in-C was free to move aircraft from one group to another as circumstances and opportunities dictated in order to exploit the inherent flexibility and striking power of his force. Command arrangements conformed closely with the proven methods of the Western Desert Air Force but a larger and more sophisticated version of the desert air support controls linked the GHQ/AHQ to joint army/air headquarters along the

Throughout the Northwest Europe campaign, two RCAF fighter wings (Nos 126 and 127) and one fighter-bomber wing provided a small part of the overwhelming air superiority enjoyed by Allied armies...

Spitfires of the first Canadian fighter wing to move to France after D-Day — Nos 441, 442 and 443 Squadrons RCAF — on landing ground B-3, St Croix-sur-Mer, June 1944.



entire chain of command right down to the most forward units. All air support requests were evaluated by the AOC with priority going to those objectives deemed vital to the overall success of the land operations. In this way, air support was not frittered away on attractive yet inconsequential tasks.⁴²

AEF was renamed the 2nd Tactical Air Force on 1 June 1943, and eventually it comprised No 2 Group (transferred from Bomber Command) and Nos 83 and 84 Composite Groups. About half of the squadrons attached to No 83 Group were Canadian. Seventeen RCAF squadrons eventually served in 2nd TAF in a variety of air superiority and ground attack roles. Throughout the

Northwest Europe campaign, two RCAF fighter wings (Nos. 126 and 127) and one fighter-bomber wing provided a small part of the overwhelming air superiority enjoyed by Allied armies.⁴³

The Anglo-Canadian partnership was multi-faceted and highly successful. In particular, the RAF and the RCAF drew on their respective differences in operational heritage, exchanged ideas and shared tactical experiences to their mutual advantage. From the summer of 1944 onward British and Canadian armies finally had in operation a joint army/air system that provided effective and timely air support at the operational level. Problems with tactical execution were still encountered. At times unfamiliar operating procedures confused both soldiers and airmen alike, and inaccurate weapons, namely rockets and free-fall bombs, made for a fairly blunt and resource intense instrument.⁴⁴ These shortcomings do not, however, detract from what was a remarkable achievement in inter-Service and Anglo-Canadian co-operation during the Second World War.

Notes:

1. A shorter version of this paper was presented at the Canadian Military History Conference held in Ottawa, Ontario, Canada, 5-9 May 2000.
2. Dr Hall is an Air Warfare Historian on the Higher Command and Staff Course, Defence Studies Department, Joint Services Command and Staff College, Shrivenham, and Lecturer at King's College London (War Studies Group). The analysis, opinions and conclusions expressed or implied in this article are those of the author and do not necessarily represent the views of the JSCSC, the UK MoD or any other British government agency.
3. Brereton Greenhous, Stephen Harris, William Johnston and William Rawlings, 'The Crucible of War 1939-1945', The Official History of the Royal Canadian Air Force v.III (Toronto, 1994) p.173.
4. Terry Copp and Robert Vogel, 'Anglo-Canadian Tactical Air Power in Normandy: A Reassessment' (unpublished, Virginia, American Military Institute, 1987); W.A.B. Douglas, 'The Creation of a National Air Force', The Official History of the Royal Canadian Air Force v.III (Toronto, 1986); B. Greenhous, S. Harris, et al., op cit; and Ian Gooderson, Air Power at the Battlefield: Allied Close Air Support in Europe 1943-45 (London, 1998).
5. Shelford Bidwell and Dominick Graham, Fire-Power. British Army Weapons and the Theories of War 1904-1945 (London, 1982); Harold Winton, To Change and Army. General Sir John Burnett-Stuart and British Armoured Doctrine, 1927-1938 (London, 1988); John A. English, The Canadian Army and the Normandy Campaign: A Study of Failure in High Command (New York, 1991); James S. Corum, The Roots of Blitzkrieg. Hans von Seeckt and German Military Reform (Lawrence, Kansas, 1992); and Peter Paret, Understanding War (Princeton, New Jersey, 1992).
6. Sykes Papers MFC 77/13/62 'Synopsis of British air effort throughout the war', 1 January 1919, RAF Museum, RAF Hendon; and Malcolm Cooper, The Birth of Independent Air Power. British Air Policy in the First World War (London, 1986) p.154.
7. Norman Gibbs, Grand Strategy vol.I (London, 1976) p.46; and Malcolm Cooper, op cit, p.xv.
8. At the beginning of August 1914, the Royal Flying Corps despatched 50 aircraft to France with the BEF. It left behind in the UK another 75 aircraft of assorted types, most of which were not fit to fly. The Royal Naval Air Service counted 100 aircraft and one air ship on its order of battle but half of its aircraft were unable to fly. Both air arms planned to use their small number of aircraft as 'eyes in the air', and employed them accordingly on observation and reconnaissance missions. See Malcolm Cooper, op cit, pp.9 and 18; and Shelford Bidwell and Dominick Graham, op cit, pp.101-103.
9. During the war, British aircraft were deployed on reconnaissance missions, artillery observation, air transportation, escort and interceptor missions, air-to-air combat, bombing and strafing enemy troops and positions, close air support, direct air support, indirect air support, fighter sweeps and air superiority work, and independent bombing operations of a strategic nature. Detailed accounts of Britain's air effort during the First World War are provided in Sir Walter Raleigh and H.A. Jones, The War in the Air 6 vols. (Oxford, 1922-1937); Sir W. Sholto Douglas, Years of Combat. A Personal Story of the First World War in the Air (London, 1963); Lee Kennett, The first air war, 1914-1918 (New York, 1991); and S.F. Wise, 'Canadian Airmen and the First World War', The Official History of the Royal Canadian Air Force vol.1, (Toronto, 1980).
10. J.C. Slessor, Air Power and Armies (Oxford, 1936) p.1.

11. Malcolm Cooper, op cit pp.62-62; J.C. Slessor, op cit pp.87-88; Sir Maurice Dean, The Royal Air force and Two World Wars (London, 1971) pp.21-23; and Lee Kennett, 'Developments to 1939', in B.F. Cooling, Close Air Support (Washington, DC, 1990) pp.15-16.

12. PRO AIR 8/13 Cmd Paper 100: Synopsis of British Air Effort During the War (1 January 1919); MRAF Lord Trenchard Papers MFC 76/1/357 Lecture XII 'The Value of a Centralised Air Force', RAF Museum, RAF Hendon; J.C. Slessor, op cit, passim; Shelford Bidwell and Dominick Graham, op cit, pp.143-145; and Peter Daybell, 'The March Retreat of 1918 – The last battle of the Royal Flying Corps', Air Power Review vol.1, no.1 (1998) pp.86-101.

13. PRO AIR 6/13 57th Meeting of the Air Council, 4 November 1918.

14. PRO CAB 24/71 Memorandum on the Air Power Requirements of the Empire from the CAS to the Cabinet, 9 December 1918.

15. Philip Abrams, 'The Failure of Social Reform: 1918-1920', Past and Present no.24, April 1963, pp.43-64.

16. Michael Howard, The Continental Commitment (London, 1971) pp.74-75; and D.C. Watt, Too Serious a Business (London, 1975) pp.32-34, 47.

17. Brooke-Popham Papers: VII/22, 'RAF History – The first 25 Years' (unpublished, 1943), Liddell Hart Centre for Military Archives, King's College London; and Malcolm Smith, British Air Strategy Between the Wars (Oxford, 1984) p.22.

18. S.F. Wise, op cit, pp.579-620; and W.A.B. Douglas, op cit, pp.37-90.

19. W.A.B. Douglas, op cit, pp.119-148; and B. Greenhous, S. Harris, et al., op cit, pp.172-174.

20. PRO AIR 8/2 Remarks by the Chief of the Air Staff, 30 May 1921.

21. PRO AIR 5/299 The RAF's first official attempt to codify the lessons of the 1914-1918 War and produce an air doctrine began in 1922 with the publication of RAF Operations Manual CD 22 (sometimes referred to as Air Publication (AP) 882. This manual was re-named and re-issued in 1928 as AP 1300 RAF War Manual, Part I – Operations.

22. Shelford Bidwell and Dominick Graham, op cit, pp.1-4; and Harold Winton, op cit, pp.1-2.

23. See David Ian Hall, 'The Birth of the Tactical Air Force: British Theory and Practice of Air Support in the West, 1939-1943', D.Phil Thesis (University of Oxford, 1996).

24. PRO AIR 10/5547 Air Publication 3235, The Second World War 1939-1945. The Royal Air Force, Air Support (London, 1955) pp.9-11. See also AIR 40/342 and 343 Air Staff Notes on Air Operations in China; and AIR 40/219 and 222 Air Staff Notes on Air Aspects of the Spanish Civil War.

25. PRO WO 193/685 Notes on the General Staff Memorandum on Services Required from the RAF for the Field Force, May-June 1939.

26. PRO CAB 106/246 Despatch from the C-in-C, BEF, General the Viscount Gort, 25 July 1940; and WO 106/1754 Co-operation of the Air Forces with the BEF during the period 10-31 May 1940, Memorandum prepared by MO7, 18 June 1940.

27. PRO AIR 35/354 Battle of France: BAFF, Despatch by AOC-in-C Air Marshal Sir Arthur Barratt, July 1940.

28. Group Captain A.H. Wann commanded the Advanced Air Striking Force, RAF (AASF) light bomber squadrons in France in 1940 and Colonel J.D. Woodall was Air Marshal Barratt's Military Staff Officer at Headquarters British Air Forces in France (BAFF). A copy of the Wann Woodall Report is reprinted in full in the War Office narrative 'Army Air Support', PRO WO 277/34 Appendix C (1945). See also PRO AIR 39/140 Close Support by Bomber and Fighter Aircraft (1940-41); and Ian Gooderson, op cit, pp.24-25.

29. C.E. Carrington, 'Army/Air Co-operation, 1939-1943', Journal of the Royal United Services Institute vol.115 (December 1970) pp.38-43.

30. No.414 Sqn RCAF joined no.400 Sqn RCAF in Army Co-operation Command in August 1941. Both squadrons were equipped with Curtiss Tomahawks and later with North American Mustang Is. Brought together into No.39 Army Co-operation Wing, RCAF, they were joined by No.430 Sqn in January 1943. Following brief stints with Fighter Command, and later a fighter-reconnaissance role, the three squadrons again served together as no.39 Wing in No.83 Group, 2nd Tactical Air Force. See B. Greenhous, S. Harris, et al., op cit, p.164.

31. Lord Tedder, With Prejudice (London, 1966) pp.124, 127-8, 138-143; and Sir Maurice Dean, op cit, p.212.

32. Portal Papers, File 12, Nos. 4 and 4a, Correspondence between Portal and Tedder, 5 and 11 September 1941, Christ Church, Oxford; and Lord Tedder, op cit, pp.163-4.

33. Sir Maurice Dean, op cit, p.215.

34. PRO CAB 80/35 COS(42)164, 10 March 1942; and J.R.M. Butler, Grand Strategy vol.III, pt.II, pp.529-544.

35. PRO AIR 8/989 Air Forces for co-operation with the Army and the Navy, DO(42)34, 1 April 1942.

36. B. Greenhous, S. Harris, et al., op cit, pp.226-227.

37. PRO AIR 20/2812 Army Co-operation: The "Thorold" Paper, 25 May 1942; and C.E. Carrington, Soldier at Bomber Command (London, 1987) pp.83-4.

38. PRO AIR 8/1063 Command and Planning, JP(42)517, 21 May 1942.

39. PRO CAB 80/37 COS(42)351 Continental Operations 1943: Operational Organisation and System of Command of the RAF, 21 July 1942. The 'Slessor' Report is reprinted in full in WO 277/34 Army Air Support, Appendix K.

40. PRO AIR 39/128 Exercise "Spartan": Report, March 1943; AIR 10/5547 Air Support, p.41; and C.E. Carrington, op cit, pp.113-114.

41. PRO AIR 20/4582 'Air Power in the Land Battle' Pamphlet (February 1943); and AIR 29/2490 Tedder to Portal, 17 February 1943.

42. PRO AIR 10/5547 Air Support, pp.41-3.

43. B. Greenhous, S. Harris, et al., op cit, p.165.

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Control, Coordinate, or Deconflict? Senior Air Force Leaders' Views of Rolling Thunder Joint Air Operations, 1965 - 1968

By Lt Col Paul D Berg USAF

The Rolling Thunder bombing campaign the United States conducted against North Vietnam from 1965 to 1968 was a protracted and unsuccessful joint air operation. The campaign's political purpose was to help coerce the communist regime in Hanoi to accept an independent South Vietnam without provoking direct Chinese or Soviet intervention. President Lyndon Johnson hoped to convince the North that a military conquest was unattainable and that a negotiated political settlement was the only viable alternative. American policy makers intended Rolling Thunder to support a broader military strategy emphasizing ground combat in South Vietnam. Desiring careful integration between bombing in the North and ground combat in the South, President Johnson personally supervised the bombing very closely. Based on advice from Secretary of Defense Robert S McNamara and other officials, the President specified many operational details such as targets, allowable numbers of strike sorties, and the geographic areas within which bombing was permitted. Senior American officials thought the infiltration of men and war materiel into the South was the North's primary way of threatening South Vietnam's independence so Rolling Thunder featured gradually escalating US Air Force (USAF) and US Navy (USN) air strikes throughout the North to interdict southbound men and supplies. Some bombing sorties struck preplanned fixed targets such as railroad yards, but most were armed reconnaissance sorties that patrolled transportation routes and attacked vehicles or other authorized targets they encountered. Military leaders chafed under the Johnson Administration's bombing restrictions and advocated heavier attacks. President Johnson ultimately suspended the bombing without having persuaded the North to end the war.

Rolling Thunder's joint command structure was complex and split along several lines. Pacific Command (PACOM), the joint Army, Navy, Air Force, and Marine Corps regional command responsible for practically all US military activities in the Pacific region, exercised overall supervision from its Hawaiian headquarters...



A B-52 attacking North Vietnamese artillery positions. Although a strategic bombing asset, the B-52 played little part in Rolling Thunder; the lion's share of USAF sorties were flown by units equipped with tactical fighter-bombers such as the F-105 Thunderchief and F-4 Phantom.

Writers have attributed Rolling Thunder's failure to various American errors such as inappropriate air doctrine, misunderstanding the war's nature, and excessive political meddling in military affairs.¹ Criticisms of the U.S. military's joint operations performance are often blended with those explanations.²

Joint operations are military activities requiring coordination between two or more military services. Rolling Thunder was a joint Air Force – Navy campaign. Interservice coordination is a multifaceted process, but Rolling Thunder criticisms frequently involve three interrelated items: the command structure, route packages, and interservice rivalry. However, during and shortly after Rolling Thunder, top Air Force and Navy officers were more apt to praise than condemn those three aspects of the campaign. If interservice cooperation were indeed faulty, why would senior Air Force and Navy officers so seldom complain about it? This paper is not intended to rehabilitate Rolling Thunder's tarnished joint credentials, but to suggest possible reasons why senior commanders seemed so satisfied with them. With an emphasis on the Air Force perspective, the discussion will also show that the command structure and route packages had some merits and that the relations between high-ranking Air Force and Navy members were at least partially harmonious. Lower ranking Air Force and Navy members had a different perspective of Rolling Thunder's joint operations qualities, but their views fall outside the limited scope of this paper. Rolling Thunder's joint command structure was complex and split along several lines. Pacific Command (PACOM), the joint Army, Navy, Air Force, and Marine Corps regional command responsible for practically all US military activities in the Pacific region, exercised overall supervision from its Hawaiian headquarters. Admiral U. S. Grant Sharp served as Commander-in-Chief, Pacific Command (CINCPAC) until Rolling Thunder's final months, but Rolling Thunder was only one of the many operations that fell under CINCPAC's purview. No single commander controlled the Rolling Thunder effort. Instead, separate service commands existed under PACOM. Pacific Air Forces (PACAF) was PACOM's Air Force component, while Pacific Fleet (PACFLT) was the Navy component. During most of Rolling Thunder, Seventh Air Force, a PACAF subsidiary headquartered near Saigon, coordinated Air Force operations throughout Southeast Asia, while Carrier Task Force 77 (CTF-77), a PACFLT

Unity of command is a basic joint operations concept that entails giving a single commander the authority to orchestrate various military efforts to achieve common objectives...

subsidiary operating off the coast of Vietnam, handled Navy air operations in the area, but neither organization was in overall charge of Rolling Thunder. Additional splits existed within the Air Force command structure. Seventh AF exercised operational control of USAF units and decided when Air Force missions would fly against permissible targets and armed reconnaissance areas. Meanwhile, Thirteenth AF, headquartered in the Philippines, exercised administrative control of those same units. Administrative control meant authority over personnel issues such as assignments, but did not confer authority to direct combat operations. Therefore two numbered Air Force headquarters exercised different types of authority over the same units. Unity of command is a basic joint operations concept that entails giving a single commander the authority to orchestrate various military efforts to achieve common objectives. Military officers normally deem unity of command a virtue, and Air Force commanders have traditionally been vigorous advocates of the centralized control of airpower. As the World War II era Field Manual 100-20 explained, "Control of available air power must be centralized and command must be exercised through the air force commander."³

The campaign's long duration afforded them ample opportunities to redress any perceived command arrangement problems, but they made few changes from 1965 to 1968...

Despite the doctrinal precedent, air commanders applied a different standard to Rolling Thunder's command structure. The campaign's long duration afforded them ample opportunities to redress any perceived command arrangement problems, but they made few changes from 1965 to 1968. One notable exception involved the Air Force organization in South Vietnam. Second Air Division (2nd AD) controlled Air Force activities when Rolling Thunder began. As additional air units arrived in the region, Air Force Chief of Staff General John P. McConnell convinced the other service chiefs to upgrade the

The lack of basic organizational change reflected the fact that senior Air Force and Navy leaders expressed outright satisfaction with the divided command arrangements

air division to the more prestigious numbered air force status. On April 1, 1966, 2nd AD was therefore redesignated Seventh Air Force. The change bolstered that Air Force organization's bureaucratic authority vis à vis the Navy's CTF 77, but did not otherwise alter basic command relationships. The lack of basic organizational change reflected the fact that senior Air Force and Navy leaders expressed outright satisfaction with the divided command arrangements. In 1970, General McConnell said, "I don't see anything actually wrong with the command arrangements as they finally came out under the circumstances that the war's being conducted over there."⁴ Admiral Sharp told the Senate in 1967 that the Rolling Thunder command arrangement was "working beautifully," and "I would not change anything about it for the war."⁵

The route package system that divided North Vietnamese territory into separate flying zones mirrored the divided command structure...



An EF-105F Wild Weasel SEAD aircraft releasing Mk 82 500lb bombs, 1967; note the AGM-45 Shrike ARM on the outboard wing pylon.

The route package system that divided North Vietnamese territory into separate flying zones mirrored the divided command structure. Route packages were nothing new – similar arrangements had appeared during the Korean War.⁶ Vietnam route packages were a military creation rather than a Johnson Administration mandate. An Air Force – Navy agreement created the route packages in November 1965, primarily to apportion armed reconnaissance responsibilities between the services. The services initially established six of them. Route Package 1 was the area immediately north of the border between North and South Vietnam, and the others were numbered sequentially from south to north. A seventh appeared on April 1, 1966 – the same day 2nd Air Division became Seventh AF – when CINCPAC split Route Package 6 in northeastern North Vietnam into Air Force and Navy halves designated 6A and 6B respectively. The final arrangement thus featured zones numbered 1 through 5 plus 6A and 6B. The Navy supervised Route Packages 2, 3, 4, and 6B while the Air Force controlled Route Packages 5 and 6A. Route Package 1 was notionally assigned to the Air Force, but special procedures applied due to that area's geographic location. Because aerial interdiction in Route Package 1 strongly influenced ground fighting in adjoining parts of South Vietnam, Army General William C. Westmoreland, Commander of the U.S. Military Assistance

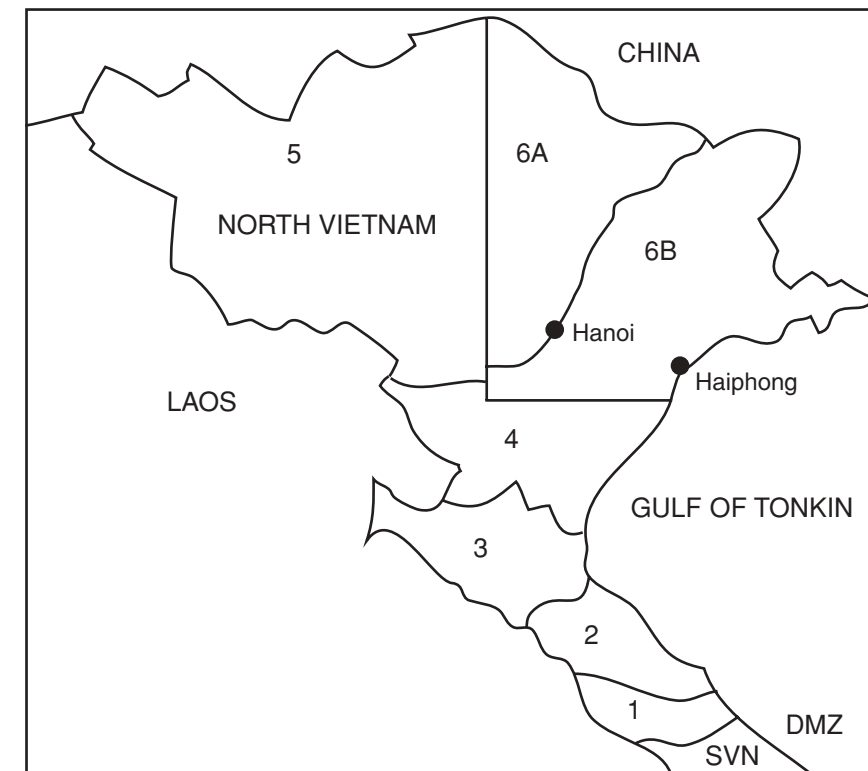
Command Vietnam, usually controlled bombing in that area through his Air Force component commander, the 2nd Air Division / Seventh AF Commander.⁷

Permanent segregation of North Vietnamese territory into exclusive Air Force and Navy zones was loose at first, but practical issues such as interservice communication limits and geography helped the assignments become more entrenched over time. The services initially swapped route packages periodically, but the swapping ended within six months. Officially, the route packages did not become exclusive "turf" of the service given primary responsibility for them even after they were permanently

Permanent segregation of North Vietnamese territory into exclusive Air Force and Navy zones was loose at first, but practical issues such as interservice communication limits and geography helped the assignments become more entrenched over time...



F-4Cs of the first USAF Phantom wing to join the air war over Vietnam — the 8th Tactical Wing (the Wolfpack), based at Ubon RTAFB, Thailand — formate on a KC-135 tanker on their way to a target in North Vietnam.



Rolling Thunder Route Packages

Navy planes usually handled targets in coastal areas while Air Force planes typically dealt with places further inland and therefore closer to their air bases in Thailand...



An F-4D of the 13th Tactical Fighter Squadron Black Panthers, 432nd Tactical Reconnaissance Wing, in its revetment at Udorn RTAFB, Thailand.

assigned to a service. With proper coordination, aircraft from either service could fly armed reconnaissance missions or strike any authorized fixed target in North Vietnam, but proper Air Force – Navy co-ordination was often too slow to permit switching sorties to alternate targets. Unexpectedly poor weather in one route package might necessitate aircraft diversions to another area, but such last minute changes were difficult to make. As Major General Gilbert L. Meyers, former Vice Commander of 2nd Air Division and Seventh AF, explained during a 1970 interview, “the theoretical agreement was that we could do this coordinate to strike Navy targets], but as a practical matter, it wasn’t done very often because of lack of communications. Time didn’t permit it.”⁸ Physical proximity between air bases and targets also favored permanent route package assignments. Navy planes usually handled targets in coastal areas while Air Force planes typically dealt with places further inland and therefore closer to their air bases in Thailand. Coastal parts of any route package sometimes became de facto Navy zones while inland areas effectively fell under Air Force purview. In effect, the route packages became a convenient way to deconflict separate Air Force and Navy air operations. Joint operations ideally involve coordination between services rather than mere deconfliction. However, much as they endorsed Rolling Thunder’s command arrangements, senior Air Force and Navy officers expressed predominantly favorable opinions about how the route packages affected joint operations. Pacific Command asserted that the route packages were positively beneficial because they improved CINCPAC’s control over operations. As each edition of *Rolling Thunder Digest*, a quarterly report published by Admiral Sharp’s headquarters, explained, “Rolling Thunder (RT) armed reconnaissance areas, referred to as Route Packages (RP) were designed for the purpose of fixing responsibility for target development, collection of intelligence data and target analysis under the overall control of CINCPAC.”⁹

Rolling Thunder Digest also insisted that route packages improved cooperation between the Air Force and Navy. Every edition stated, “To insure [sic] economical and effective use of resources, operational procedures have been developed by the operating units, 7th Air Force (7AF) and Carrier Task Force 77 (CTF-77), that permit the full range of coordination for all air operations in the Rolling Thunder program and yet permit both services to operate in all areas.”¹⁰ Those “operational procedures” featured the route packages, which *Rolling Thunder Digest* praised by noting, “We have found that supervision and control of strike operations can be improved, and results can be analyzed more realistically if targets are identified and interrelated in target groupings that are geographically associated.”¹¹ The term “geographically associated” meant divided into route packages. Even after Rolling Thunder had ended, Admiral Sharp still thought the route package system was “sort of an operational necessity. It was more than a convenience, it was a pretty important thing.”¹²

Pacific Command’s official views about route packages were merely theoretical and possibly inappropriate ideals...



In response to the threat posed by North Vietnamese SAMs and fighters, EB-66 electronic warfare aircraft were used to supplement the jamming pods carried by US strike aircraft during Rolling Thunder.

Pacific Command’s official views about route packages were merely theoretical and possibly inappropriate ideals. As previously noted, General Meyers said communications limits hindered the Air Force’s efforts to fly in Navy areas. The assertion that the arbitrarily drawn route packages divided enemy territory into logical target sets is also suspect. Target analysts and aircrews who specialized in limited geographic areas became experts on some targets, but Rolling Thunder sought operational and strategic results in South Vietnam that were not necessarily visible from the narrow perspective afforded by the route packages. Out of all the diverse entities involved in controlling the campaign, Pacific Command should have been especially focused on those broad results. Admiral Sharp’s immediate subordinates in the Air Force chain of command liked Rolling Thunder’s command arrangements, but did not unanimously agree that the route packages improved joint operations. Pacific Air Forces commanders General Hunter Harris and General John D. Ryan (who succeeded Harris in February 1967) were Admiral Sharp’s top Air Force commanders. When interviewed in 1971, both generals seemed satisfied with Rolling Thunder’s command arrangements, but Harris criticized the route packages. Harris said, “I didn’t feel any serious objection or frustration on those command arrangements,” but he deemed route packages “a hell of a poor way to run a railroad” because they reduced operational flexibility and “affected the capabilities of both the Fleet units and the ground-based Air Force units to carry out a more effective campaign.”¹³ During his interview, General Ryan defended both the command structure and the route packages. He agreed the command arrangements were “rather complicated,” but insisted, “the command arrangements did not interfere with the prosecution of the war at all.” Furthermore, he added, “I know of no major problem that the division among the Route Packs caused.”¹⁴ General John W. Vogt, PACAF Deputy Commander for Plans and Operations from mid-1965 to mid-1968, agreed more closely with Ryan than with Harris. Vogt acknowledged in a 1978 interview that changing the command structure by designating a single air commander “probably would have been the better way” to control Rolling Thunder, and that “the Route Packs were picked for the convenience of the fleet, primarily,” but he still thought the route packages were helpful because they obviated “a great deal of detailed coordination” between the services. He felt “You wouldn’t have been able to operate” without route packages because the required degree of coordination would have been difficult to achieve.¹⁵ None of the three officers condemned both the command structure and the route packages. A preference for simply deconflicting Air Force and Navy flights rather than meeting demanding interservice coordination requirements evidently mitigated the qualms they did express. Seventh Air Force officials near Saigon were closer to the action and were more dubious about route packages than their Hawaii-based superiors. After retiring, Seventh AF Commander General William W. Mommyer wrote, “Dividing North Vietnam into route packages compartmentalized our airpower and reduced its capabilities . . . The route package system was fundamentally wrong for the best application of all U.S. airpower . . . was a compromise approach to a tough command and control decision, an approach which, however understandable, inevitably prevented a unified, concentrated air effort.”¹⁶ Mommyer therefore felt

the route packages detracted from joint air operations, but he stopped short of condemning them because they had been based on “understandable” considerations. Once again, practical concerns outweighed an Air Force general’s doctrinal predilection to exercise centralized control of all Rolling Thunder air power.

The Air Force and Navy certainly competed to show which service could best accomplish Rolling Thunder missions...



F-105D Thunderchiefs refuelling from a SAC KC-135 tanker en route to their target. KC-135s were to play a vital role in Rolling Thunder, enabling USAF F-105s and F-4s to attack targets deep within North Vietnam.

Command arrangements and route packages were administrative matters, but a broader explanation of how they affected joint operations requires examining the related phenomenon of interservice rivalry. Rivalry reflected political undercurrents and focused on deciding which service would control air operations. The Air Force and Navy certainly competed to show which service could best accomplish Rolling Thunder missions, but their rivalry was neither unique to that campaign, nor did it necessarily undermine joint operations. Competition between American air and naval commanders has been a fact of life since before World War II and continues today, albeit in more subtle ways. Air Force commanders during

Rolling Thunder privately admitted competing with the Navy, but they did not mention sabotaging Navy operations or imperiling the campaign’s success. Lieutenant General Joseph H. Moore, Second AD / Seventh AF commander until July 1966, said during a 1969 official USAF interview, “Now this is for

Putting it bluntly, it was a competition between the US Navy providing tactical air on the scale that the US Air Force could do...

USAF eyes only, and ears... Putting it bluntly, it was a competition between the US Navy providing tactical air on the scale that the US Air Force could do.”¹⁷ When he was Vice Commander of 2nd Air Division and Seventh AF,

Major General Meyers worried about whether his crews would be able to strike the new targets the administration released during each Rolling Thunder cycle. During an interview, Meyers described a period during which the Navy and Air Force were each receiving a quota of three new targets every two weeks. Meyers recalled, “we would have been in a hell of a position if the Navy got their three targets and we didn’t get ours in the same time period. So this puts additional pressure on you to get them and – let’s be honest about it – we kept getting telephone calls all the time saying, ‘Hey, the navy got their targets. Why haven’t you got yours?’”¹⁸ Such remarks sound more like healthy competition than pernicious rivalry, and they might have been made during other joint air operations – including some highly successful ones. However, Meyers’ comments were at least partly a product of the graduated bombing strategy imposed on air commanders by Johnson Administration officials who tightly regulated Rolling Thunder’s conduct.

Unbridled competition did not characterize all interservice relations during Rolling Thunder. Considerable cooperation prevailed in public, and senior officers downplayed the significance of rivalries. None of the service chiefs or commanders who testified about Rolling Thunder before the Senate’s Stennis Committee in August 1967 made disparaging remarks about the other services or exhibited any other overt signs of interservice rivalry.¹⁹ All the chiefs of staff – including the Army Chief of Staff and the Commandant of the Marine Corps – agreed that bombing was essential and insisted the best way to maximize its success was to let the military bomb with minimal political restraints. During an official 1969 interview, retiring Air Force Chief of Staff Gen. McConnell described cooperation between the services during Rolling Thunder by stating, “Well, there was to begin with, service rivalries and things of that nature were, of course, all involved in it. Everybody wanted to show up that he could do better than anyone else. But that didn’t last very long. It gradually subsided and pretty soon there was no problem at all, no problem at all, either about the control of the missions or about the selection

Today, Rolling Thunder has become an example of how not to conduct joint air operations...

of targets or anything else. It all worked fine.”²⁰ Since McConnell was retiring, he was in a position to express his thoughts more candidly than during the Senate hearings two years before, but he still expressed satisfaction with the interservice cooperation he had experienced during Rolling Thunder. Today, Rolling Thunder has become an example of how not to conduct joint air operations, so why did contemporary air leaders so often defend the campaign’s command arrangements, route packages, and interservice cooperation? No definitive answer is available, but possible explanations are distinguished by the assumptions made about senior officers’ motivations.

One explanation assumes officers’ favorable comments reflected ulterior bureaucratic motives within the armed services themselves. Defense Department analyst James Clay Thompson suggests that a tangled military command structure that hindered joint control of Rolling Thunder might have compromised overall effectiveness in order to satisfy military bureaucratic needs. Thompson says both the Air Force and Navy wanted a divided command because having one service in charge was mutually unacceptable. He concludes that if the operation had gone well under Air Force control, the Air Force would have gained political prestige over the Navy and vice versa.²¹ Thompson implied the command arrangements reflected underlying discord between military services, so perhaps interservice rivalry also helped explain the air commanders’ tolerance for divided control of air operations.

A second explanation is related to the first and derives from the stringent political controls the Johnson Administration placed on the campaign. Bureaucratic tensions between military and civilian leaders may have induced air commanders to mute criticisms they might otherwise have expressed about Rolling Thunder’s joint qualities. Air Force and Navy officers were frustrated by the operational restrictions they faced. While seeking clearance to conduct the intensified bombing they all recommended, senior officers may have tacitly chosen to downplay command and control disputes in order to show solidarity against their common opponents in the Administration. Senior officers’ closing ranks against Secretary of Defense McNamara to resist his tight controls over Rolling Thunder operations may also have denied that interservice rivalry was a problem. That explanation is troubling because it implies that the air commanders might have exhibited less interservice cooperation if the Johnson Administration had let them prosecute the campaign without many political constraints.

A third explanation assumes the commanders genuinely believed Rolling Thunder’s command and control arrangements were logical and appropriate responses to the military situation. Based on longstanding doctrine, Air Force leaders would have preferred to control all Rolling Thunder air operations, but knew Navy commanders were not willing to place carrier aircraft under Air Force operational control. The command structure and route package compromises the services reached might have seemed adequate and even praiseworthy. Existing statutory requirements for the services to operate jointly were much less comprehensive than those later enacted in the 1986 Goldwater-Nichols Act. Each service was equipped to operate with minimal reliance on the other and

*The route packages
deconflicted those air
operations much as
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Korean War...*

enemy opposition was mostly confined to defending target areas. Divided command arrangements facilitated each service's semiautonomous operations. The route packages deconflicted those air operations much as they had during the Korean War. Once the major points of interservice conflict had been resolved in mutually acceptable ways, rivalry was confined to narrower competitive issues such as which service struck its target quota first. The commanders' favorable comments about command arrangements, route packages, and interservice rivalry would therefore have reflected a modus vivendi. Presumably they would have made other arrangements under different military circumstances, but they would have found some practical way to get along with each other while they fought the enemy. The third explanation is the most plausible one because it makes the fewest assumptions about senior officers' motivations. Profound skepticism of top civilian and military leaders has been fashionable in the United States since the Vietnam War, Watergate, and other unpleasant events. Admiral Sharp and the Air Force generals were concerned with their respective services' institutional interests, but there is no reason to assume they selfishly placed those interests above the nation's interests. Rolling Thunder's command structure and its reflection in the route packages were compromises to parochial service interests, but did not reflect subversion of American military objectives. All the senior officers were dedicated professionals who sought the best available joint air power solution to a difficult problem in Southeast Asia.

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Notes:

- 1 Earl H. Tilford, Setup: What the Air Force Did in Vietnam and Why, (Maxwell AFB, AL: Air University Press, 1991), blames inappropriate doctrine. Mark Clodfelter, The Limits of Airpower: The American Bombing of North Vietnam, (New York: The Free Press, 1989), says the US misunderstood the war's guerrilla nature and used improper doctrine. Most senior military officers, such as Admiral U. S. Grant Sharp, Strategy for Defeat: Vietnam in Retrospect, (Novato, CA: Presidio Press, 1978), blame excessive political interference.
- 2 James Clay Thompson, Rolling Thunder: Understanding Policy and Program Failure, (Chapel Hill, NC: The Univ. of North Carolina Press, 1980), focuses on organizational maladies such as interservice rivalry. Clodfelter, pp. 128-129, critiques interservice cooperation.
- 3 War Department, Field Service Regulations, FM 100-20, Command and Employment of Airpower, (Washington, D.C., 1943), p. 2.
- 4 Gen. John P. McConnell, Oral History Interview (OHI) transcript, Nov. 4, 1970, K239.0512-371, in USAF Collection, AFHRA, p. 2.
- 5 U.S. Congress, Senate, Committee on Armed Services, Air War Against North Vietnam, Hearings before the Preparedness Investigating Subcommittee, 90th Cong., 1st sess., Part 1, Aug. 10, 1967, p. 103.
- 6 See Gen. William W. Momyer, Air Power in Three Wars, (Washington, D.C.: Department of the Air Force, 1978), pp. 58 – 59 and James A. Winnifeld and Dana J. Johnson, Joint Air Operations: Pursuit of Unity in Command and Control, 1942 – 1991, (Annapolis, MD: Naval Institute Press, 1993), pp. 77 and 158.
- 7 Clodfelter, p. 129 summarizes the route package system.
- 8 Maj. Gen. Gilbert Meyers, OHI transcript, May 27, 1970, K239.0512-282, in USAF Collection, AFHRA, p. 87.
- 9 Headquarters PACOM, Operations Division, Rolling Thunder Digest, all vols., p. 2.
- 10 Rolling Thunder Digest, all vols., p. 2.
- 11 Rolling Thunder Digest, Jul.- Sep. 1966, p. 16.
- 12 Adm. U. S. G. Sharp, OHI transcript, Feb. 19, 1971, K239.0512-409, in USAF Collection, AFHRA, p. 13.
- 13 Gen. Hunter Harris, OHI transcript, Apr. 22, 1971, K239.0512-403, in USAF Collection, AFHRA, pp. 10 and 27-28.
- 14 Gen. John D. Ryan, OHI transcript, May 20, 1971, K239.0612-476, in USAF Collection, AFHRA, pp. 5 and 8.
- 15 Gen. John. W. Vogt, OHI transcript, Aug. 8-9, 1978, K239.0512-1093, in USAF Collection, AFHRA, pp. 120-122.
- 16 Momyer, p. 95.
- 17 Lt. Gen. Joseph H. Moore, OHI transcript, Nov. 22, 1969, K239.0512- 241, in USAF Collection, AFHRA, p. 18.
- 18 Maj. Gen. Meyers, OHI transcript, p. 80.
- 19 U.S. Congress, Senate, Committee on Armed Services, Air War Against North Vietnam, Hearings before the Preparedness Investigating Subcommittee, 90th Cong., 1st sess., Parts 1 - 5, Aug. 1967, passim.
- 20 Gen. John P. McConnell, OHI transcript, Aug. 28, 1969, K239.0512-1190, in USAF Collection, AFHRA, p. 22.
- 21 Thompson, p. 76.

A 618 Squadron Mosquito releasing a Highball bomb, during trials on Loch Striven, 1943.

Barnes Wallis's other bouncing bomb

Plans to sink the German battleship Tirpitz in 1943

By John Sweetman

Part II: **TARGET TIRPITZ**

The latest date for launching an attack on the German dams had been advanced from 26 to 19 May 1943, and a meeting at the MAP on Thursday 13 May heard that not until 15 May would the 20 modified Mosquitoes allocated to the squadron destined to attack Tirpitz with the smaller version of Barnes Wallis's 'bouncing bomb' (codenamed Highball) have left Vickers-Armstrong's works. A further three weeks would be required for the fitting of long-range tanks. So far 220 Highballs had been manufactured at Crayford: 99 been filled with Torpex (40 now at Sumburgh, 59 in store at Glasgoid), 104 inert-filled (including 60 at Turnberry and 20 at Manston). The critical factor, however, was that 'no conclusive drop' had yet taken place.'

None the less, a decision clearly had to be taken about the dams raid, long expected to occur simultaneously with that on Tirpitz. The Vice-Chiefs were unable to do this in London, not least because the First Sea Lord had forbidden his deputy to discuss the matter in his absence. Thus an urgent signal went to the Chiefs of Staff in Washington on 13 May: 'Further trials, modifications and considerable further training of crews necessary before Highball can be used. Consequently delay likely to prevent Upkeep operation this year if it has to wait for Highball'. The following day, the Chiefs of Staff authorised the independent dams raid, which took place on Sunday 16 May. Meanwhile, Highball and Operation Servant remained in limbo.²

The decision to press ahead with No 617 Squadron's attack on the German dams before perfection of Highball was not unreasonable. In truth, both the method of delivery and even the specifications of the smaller 'bouncing bomb' were still in doubt. On 11 August 1942, Patent No 937,959 was filed, which included a sketch later reproduced as Fig 9 in Wallis's paper 'Air Attack On Dams' showing the weapon crawling down the side and under the hull of a warship. The following passage appeared with technical details of Wallis's invention: 'A missile weighing 1,000lbs released from an aircraft travelling at 400mph at 50-100ft above the water surface and a rate of 1,000rpm has been found satisfactory. With calm water surface a missile projected under such conditions would have a maximum range of 2,000yds'. However, the patent was not apparently formally registered until 9 July 1943, and the data may therefore reflect the results of trials and tests after August 1942.³

The need for a comparatively-high speed of delivery caused trouble with the velocity at which the weapon would strike the side of the target ship

Meanwhile, there had been several different stages in the evolution of Highball as distinct from Upkeep. The need for a comparatively-high speed of delivery caused trouble with the velocity at which the weapon would strike the side of the target ship. Difficulties with the release gear in the aircraft, from which two Highballs had to be released in succession, and uncertainty about substitute HE used in spinning tests as well as the composition of the inert-filling for practice and trial drops were responsible for delays in finalising the design of Highball. At various times, separate documents - reflecting statements by Wallis - seemed conclusively to prove that the weapon was 35in in diameter and 950lbs in total weight, though figures about the size of the charge varied between 500lbs and 600lbs. On 22 January 1943, for instance, Wallis wrote that Highball would carry 600lbs of Mineol, on 2 February 500lbs (the amount previously mentioned). Several documents identify resin and sawdust as the inert-filling, but on 8 February Napthalene, Kaolin, Barium Sulphate and Aluminium 5/120 were listed, though it is possible that they were merely under consideration. The meeting on 2 February was among those to be told about a 35in diameter weapon, and this was confirmed by Flt Lt Green at the MAP on 26 February. Yet the later addition of two 18in wide external metal plates, 5/32in thick, did marginally increase this measurement. On 4 February, ACAS (TR) had also referred to work on the '35in diameter bomb ... This design which at a very early stage consists at present of a cylinder containing the explosive, cased in a spherical shell, the annulus being filled with soft wood to absorb the shock on impact with a target'. However, an unidentified paper in Barnes Wallis's files dated 9 March showed the gross weight of the 'Light Highball' as 1,000lbs, with a 545lbs charge of Torpex and diameter of 35ins. On 17 March the Chief Executive of the MAP, Sir Wilfrid Freeman, noted that the fusing mechanism on Upkeep Lancasters would be on the starboard side and asked Wallis whether he wanted the same arrangement for the Mosquitoes, a reminder that apart from the design of the weapon perfection of fusing and release gears had to be achieved, too. On 5 April 1943, D Arm D informed Wallis that he had decided to fit Highball with 'a fusing control to the D/C pistol' and therefore not to remove the 'safety fork on the ground before take-off'. Four days later Air-Marshal Sir John Slessor, AOC-in-C Coastal Command, pointed out that the weapon had not yet been finalised.⁴

...positive steps were taken to form and train the Mosquito squadron, which would deliver Highball against Tirpitz

NO 618 SQUADRON

Nevertheless, positive steps were taken to form and train the Mosquito squadron, which would deliver Highball against *Tirpitz*. The meeting on 25 March at the Air Ministry to discuss Highball and Upkeep progress, chaired by Bottomley, agreed formally that Coastal Command would assume responsibility for Highball operations. The following day Coastal and Bomber commands, acknowledging that No 618 Squadron would form at RAF Skitten, agreed that on or about 1 April Bomber Command would supply nine experienced crews and eight Mosquitoes for preliminary training there.



A de Havilland Mosquito B 1V. The first aircraft of this mark modified to carry Highball was taken on charge by No 618 Squadron in April 1943.

Eleven Coastal Command Beaufighter crews were to go to 1655 Mosquito Training Unit at RAF Marham for a one-week conversion course on 29 March. The previous year, the existing north-south runway had been extended and an east-west one added at Skitten, a satellite of RAF Wick in the north-east of Scotland near Loch Watten. Events now moved swiftly. On 28 March, the first Beaufighter crews from 235 Squadron, transferred to 618, arrived at Marham. The CO of the new squadron was Wg Cdr G H Hutchinson from 235 Squadron, his flight commanders Sqn Ldr C F Rose (who carried out most of the Mosquito trials at Reculver) and Sqd Ldr G N Melville-Jackson. No 618 Squadron officially formed at Skitten on 1 April to carry out training exercises in connection with Highball, 'a special mining weapon'. From the outset, Hutchinson stressed the need for strict security. On 3 April, ground crew from 105 and 139 squadrons converged on Skitten and shortly afterwards eight Mosquitoes from the same squadrons duly arrived for training purposes. Low-level flights began almost immediately, and on 5 April the first fatality occurred, when a Mosquito flew into a hillside. The Bomber Command Mosquitoes would, theoretically, be replaced by the designated modified Mosquito IVs (normal cruising speed 240mph at low level), the first arriving on 24 April, the last four on 15 May. The 'mines', at that stage still with wooden casings, were to be kept dry under cover, and 'tactical exercises using photographic methods' were planned against a naval target in Lake Cairnbawn in addition to the low-level flights. A Vickers-Armstrong's supervisor, Jim Rogerson, went to Skitten to oversee work necessary on Highball and the 'special' Mosquitoes. As April passed, prolonged low-level exercises involving navigation over water in the area of the Faroes and Shetlands were devised.

The first modified Mosquito (DZ 531/G) arrived from Weybridge on 17 April. Its bomb-bay doors had been removed and installed in the bomb-bay were the cradles and spinning gear for the two Highballs



A Highball being loaded into the modified bomb-bay of a Mosquito.

An early version of a Highball used for spinning trials.



The first modified Mosquito (DZ 531/G) arrived from Weybridge on 17 April. Its bomb-bay doors had been removed and installed in the bomb-bay were the cradles and spinning gear for the two Highballs. When they were carried, one Squadron navigator described them as 'inverted humps' protruding beneath the fuselage.⁵

TIRPITZ ON THE MOVE

Such were the unfavourable conditions for Photographic Reconnaissance Unit (PRU) aircraft that between 24 October 1942 and 9 March 1943 Tirpitz was spotted only nine times in and around Trondheim Fjord. The next flight on 13 March drew a blank. An Ultra interception had warned the Admiralty on 11 March that Tirpitz might be on the move in the near future, and the following day that she was probably making for Narvik. Although not spotted by reconnaissance aircraft, the battleship did indeed leave Trondheim early on the morning of 11 March and complete an uneventful 300mls passage north to Bogen Bucht, near Narvik, two days later. She did not remain there long. On 22 March, in company with the pocket battleship Lutzow, battlecruiser Scharnhorst and eight destroyers she sailed 240mls further north to Kaa Fjord, a branch of Alten Fjord in Finnmark close to the North Cape, where she anchored on 24 March at 0418. From there Vice Admiral Oskar Kummetz intended to use her and his whole battle group to attack the Arctic convoys. Alten Fjord nestled among a series of sounds and fjords leading off the Loppehavet inlet from the Arctic Ocean. Kaa Fjord, approximately 4mls long and 1 3/4mls wide with a spit of land protruding from its southern end effectively dividing it into two, was a cul-de-sac hanging NW-SE of Alten Fjord almost at its extremity.⁶

An operation against her at Narvik seemed the best option, 'but in that event the Highball Mosquitoes must either be carrier-borne to the locality or the crews must abandon their aircraft after the attack over the sea and be picked up'. A rather dubious proposition for the crews involved...

An assessment at this time (possibly by Coastal Command) considered attacks on Tirpitz north of Trondheim concluding that Highball might be 'a profitable type of weapon ... if it works as the theorists claim. But it is as yet in the design stage and from past experience we can be certain that many difficulties will arise before it behaves as predicted, if it ever does'. An operation against her at Narvik seemed the best option, 'but in that event the Highball Mosquitoes must either be carrier-borne to the locality or the crews must abandon their aircraft after the attack over the sea and be picked up'. A rather dubious proposition for the crews involved. Kaa Fjord did not apparently come into the reckoning at all.⁷

As Tirpitz exercised and waited for a suitable target, plans for the use of Highball pressed ahead, and in Scotland training of 618 Squadron intensified. HMS Bonaventure, depot ship for the Royal Navy's X-craft (midget submarines) preparing independently to attack Tirpitz, was stationed in Loch Cairnbawn. Lying close to rising ground, where the lake was 1,300yds wide, her position closely resembled that of Tirpitz in Foetten Fjord and plans were made for 618 Squadron to mount dummy attacks against her. On 31 March, Capt E Banks received instructions to anchor his ship on a bearing of 350deg and effectively extend it by placing two drifters ahead and astern to produce a simulated length of 800ft. X-craft training must not be compromised, and if Bonaventure were not available a third drifter should stand in for her. Banks replied on 1 April that his ship was anchored on a heading of 315 degrees and hoped that this was suitable.

Evidently it was, for three days later arrangements were put in hand for F46 cameras to be installed in the 618 Squadron practice Mosquitoes at RAF Skitten, where VHF was fitted to them. On 6 April, HQ Coastal Command ruled that the cameras should be put in the bomb-sight position, but not until 14 April was it confirmed that Vickers-Armstrong's staff would be responsible for that work. During the later part of the month, using the cameras some 125 low-level flights from 60ft at a speed of approximately 360mph were carried out by 618 Squadron pilots against Bonaventure.⁸

SCOTTISH TRIALS

However, Highball had not yet been perfected, and trials to supplement those at Reculver were planned involving practice strikes on Courbet in Loch Striven. On 20 March 1943, as ACAS (Ops) Air Vice-Marshal Bottomley had advised the CAS that, although he believed Highball 'potentially a most promising weapon', not until trials against the target ship 'in about a month' could he make any firm recommendations. The high speed of the Mosquitoes would permit release from longer range than other aircraft, but he had doubts about the manoeuvrability of Mosquitoes in a narrow Norwegian fjord. Bottomley went on to paint a sombre picture. 'Although Highball may have advantages over the torpedo in that it can defeat present type torpedo booms and may have fewer tactical limitations in dive and speed of approach, it has no advantages over the torpedo in countering the normal methods of defence of harbours by flak, smoke and searchlight. Heavy losses must be expected on account of the strong defences on the hills round the ship and the warning of approach which the enemy will be bound to have'. Perhaps significantly, Bottomley also chaired the Chiefs of Staff ad hoc sub-committee established to examine the feasibility of the weapon.⁹

In preparation for the trials on Loch Striven, static spinning tests took place in the modified Wellington at RAF Turnberry, 19-21 April. In the interests of security, on 29 April the Admiralty insisted that spectators at Loch Striven be minimised and senior officers of all Services wear civilian clothes. For the trials themselves, recorded on cine camera and scheduled for 9/10 May, the aim was to release inert-filled Highballs 1,200yds from Courbet from 50ft at 360mph. Some surviving records optimistically show that the first store, spinning at 700rpm, hit the target ship at 160mph, 12ft above the water line and 179ft from the bows, rebounding 13ft to be caught by nets under the ship. The second drop was made 200yds further back from the marker buoys at 800rpm and 370mph. It bounced three times before hitting the target at 164mph, 3ft

In preparation for the trials on Loch Striven, static spinning tests took place in the modified Wellington at RAF Turnberry

above the water line, 200ft from the bows and rebounded 7ft. However, the official report drawn up by RAF Helensburgh painted a much bleaker picture. On 9 May, two Mosquitoes failed to release Highball, and a store fell from one aircraft as it turned to run in again. The following day, three modified Mosquitoes did hit the target, but the primers of the hydrostatic pistols failed to function and only one 'badly distorted'

Highball was recovered. All three Mosquitoes had trouble with the release gear and one was damaged in dropping the store. So the two detailed drops actually occurred on 10 May after total failure the previous day and were by no means successful. On further investigation it had been discovered that the buoys were only 800yds from Courbet and this undoubtedly affected impact speeds.¹⁰

...as 617 Squadron gained success with Upkeep, the operation with its 'little brother' (Highball) against Tirpitz was by no means certain, for the weapon remained unproven

A meeting at the MAP on 13 May justifiably declared the results to be 'inconclusive' and the Chiefs of Staff were informed that 'future trials, modifications and considerable further training of crews necessary before Highball can be used'. The following day, another meeting at Weybridge examined in more detail the failure of the Highball drops against Courbet on 9/10 May. Wallis was upbeat. 'Variations in dimensions of stores after filling and incorrectly dimensional jigs for setting up the calibre (sic) arms were mainly responsible for these failures'. As noted on 13 May, necessary modifications to the Mosquitoes were being made and the next series of trials in Scotland should be from 1,600yds at 50-60ft, with an aircraft speed of 360mph and Highball spun at 900-1,000rpm. If successful and the hydrostatic pistol primer were heard to function, the subsequent drop should be at 1,400yds and thereafter reduced each time by 200 yds until the priming system failed. This would give the minimum distance for release, and next stage would be to find the maximum release point, starting at 1,800yds, working upwards by 200yds. Rough water would reduce the effective range by 20%. 'Mr Wallis (then) described the range finder he is providing which can be set by the pilot to suit smooth or rough water conditions'. Nevertheless, as 617 Squadron gained success with Upkeep, the operation with its 'little brother' (Highball) against Tirpitz was by no means certain, for the weapon remained unproven.¹¹

On 18 May 1943, two days after the raids on the Moehne and Eder dams, Wallis wrote that the following week-end he must work on 'the little brother'. Similarly on 25 May, he explained to Wg Cdr G P Gibson, who led 617 Squadron to the dams, that he had just returned from Scotland 'after a worrying time with your weapon's small brother'. Five days later, Bottomley revealed that 'minor release gear troubles' had emerged in the Courbet trials, not evident at Reculver. 'Some' did release satisfactorily, but there appeared to be a hold up with others, which meant that there was a delay in release so that the weapon hit the target at too high a velocity and broke up. A problem experienced on 9 May still intermittently occurred as well, 'with weapons falling off the aircraft during flight before the approach run'. Vickers-Armstrong felt that 'use of steel-hearted cable in part of the release gear, which stretched' was to blame, and 3-4 days should see necessary changes completed. Bottomley believed that these were only 'teething troubles' and pointed to the problems associated with Upkeep, which were eventually solved. However, he did recommend postponing any decision about extending the order for Highball Mosquitoes.¹²

SLOW PROGRESS

Progress was not, in reality, fast. On 17 June Wallis admitted to Air Vice-Marshal the Hon RA Cochrane, AOC 5 Group Bomber Command, being 'so continually engaged in difficulties with Upkeep's small brother'

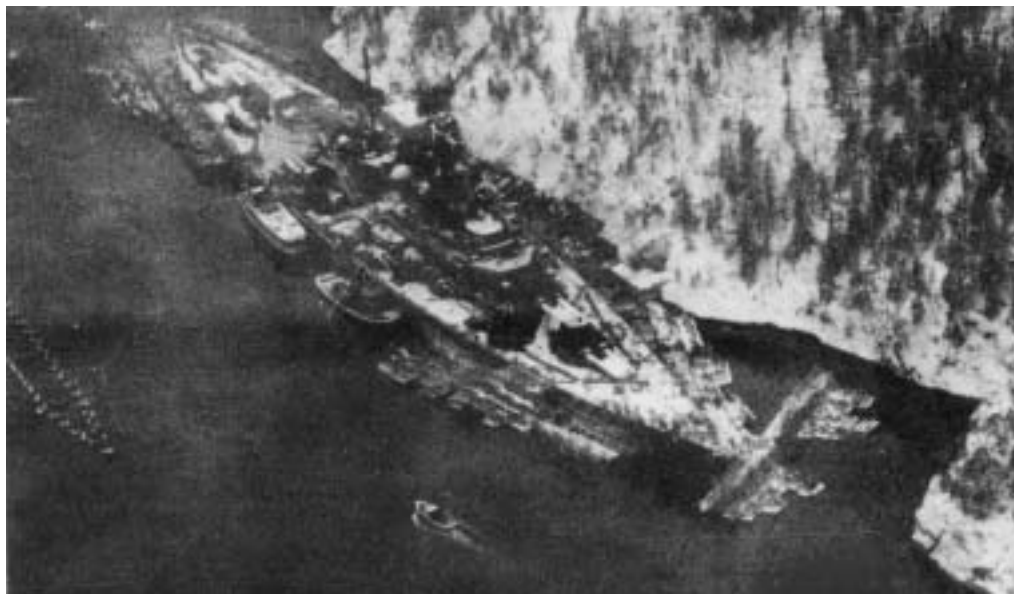
Whatever the other problems with Highball, range of the aircraft had always been a major stumbling block

that personal correspondence had badly lagged. On 2 July, an Admiralty minute noted that 'technical difficulties are still being met in the development of this weapon. Running trials against Courbet have been delayed owing to technical defects in both weapon and aircraft'. Throughout July and August 1943 in groups of 2-6 almost daily from Skitten 618 Squadron Mosquitoes carried out 'navigational exercises'. In truth, though, after more than four months 618 Squadron was still marking time. Way back, on 11 February 1943, the possibility of launching a Highball attack on Tirpitz in April, admittedly 'remote' due to the amount of technical work ahead and 'strenuous training' necessary, had none the less been actively mooted.¹³

Whatever the other problems with Highball, range of the aircraft had always been a major stumbling block. After consultation with Geoffrey de Havilland in April, steps had been taken to fit additional tanks to the Mosquitoes intended for the Tirpitz operation. On 6 April the possibility of flying the operational machines off aircraft carriers had been proposed, and de Havilland's firm estimated that eight of their men would require four days to assemble one modified Mosquito on board ship. Air Staff officers also pointed out that 'to fly the aircraft off would involve a serious risk', especially as one might ditch on take-off. The hydrostatic pistols on the two Highballs would then activate and could well sink the carrier. In any case, the Mosquitoes could not land again on the carrier. Flying on to a base in the northern USSR after bombing might be an option and this tied in with yet another suggestion on 8 April. By not carrying a second Highball, Alten Fjord and Narvik would be in range from Sumburgh, provided the aircraft went on to land at Vaenga, near Murmansk.¹⁴

'We consider that this operation has a very remote chance of success whilst the ships are berthed in their present position at Alten Fjord'

On 18 April, Coastal Command assessed the overall position. The earliest date for using 20 Highball Mosquitoes would be 26 May. 618 Squadron crews could not be kept 'indefinitely' idle and it was therefore recommended that Operation Servant should not be scheduled later than the end of June. Furthermore, the proposal to fly from Sumburgh to the northern Soviet airfield at Vaenga left no margin for error, evasive action or possible damage. Sumburgh to Alten



Tirpitz with service vessels alongside, affording added protection from possible Highball attacks.

Fjord totalled 860mls in a direct line, and Vaenga was a further 218mls – 1,078mls without deviation or delay. With their additional tanks, the Mosquitoes had a range of only 1,160mls. One calculation did suggest that, by reducing the cruising speed, this could be stretched to 1,257mls, but that tactic had operational penalties. On 12 May Coastal Command responded unenthusiastically to a proposal from No.18 Group to use the Gee navigational aid. At 10,000ft its range in good conditions was 200-250mls, at 15,000ft 300-400mls. Coastal Command therefore doubted the wisdom of fitting it even to one or two aircraft. None the less, an outline plan of attack was drawn up in June on the basis of taking off from Sumburgh, bombing en route and landing at Vaenga. One submarine would be stationed approximately half way between Sumburgh and Alten Fjord about 150mls off the Norwegian coast, a second 150mls north-west of the fjord. The attacking aircraft would fly at sea level parallel to the Norwegian coast, 150mls to seaward over the first submarine to turn sharply towards the target over the second submarine. An alternative would be to fly at 15,000ft 250mls from the coast, then 100mls west of the second submarine turn towards the target and approach it at sea level. Whichever of these routes was chosen, the Mosquitoes would climb to 5,000ft 100mls from Tirpitz. A separate analysis estimated 75-85 single-engined fighters between Alten Fjord and Vaenga, at the German-held bases of Alta, Banak, Kirkenes and Petsamo.¹⁵

None of these ideas nor plans in reality showed promise, and on 2 July 1943 Bottomley wrote on behalf of himself and ACNS (H): 'We consider that this operation has a very remote chance of success whilst the ships are berthed in their present position at Alten Fjord'. He revealed, too, that the C-in-C Coastal Command 'has described the operation as not being a practical (sic) operation of war'. The following day, the CAS advised Winston Churchill that the chances of Highball hitting Tirpitz in Kaa Fjord were 'negligible'.¹⁶

PLAN OF ATTACK

Fortunately, 618 Squadron did not know this. Its crews had been stepping up their navigational exercises, often carrying two inert-filled Highballs, and a detailed plan had been discussed with the aid of a model built by RAF Medmenham and transported to Skitten. A narrow spit of land blocked off one-third of the mile-wide entrance to Kaa Fjord, which was then covered by twin anti-submarine booms. Immediately behind this spit lay Lutzow; Tirpitz was about 4,000yds further south on the western side of the fjord under the lee of high ground. At this point, the fjord narrowed to 1,000yds, as another spit east of Tirpitz effectively divided it in two. A number of destroyers and flak vessels further protected the two warships, with additional flak guns on surrounding hills besides the inevitable smoke screen.

The geographical profile and lay-out of German defences posed major difficulties for a Highball operation, which no doubt to some extent shaped the negative conclusions in Bottomley's letter of 2 July. Approximately 1,200yds of clear water was needed after release of the weapon. Low-flying Mosquitoes could approach from the sea eastwards along Alten Fjord, then turn almost 90 degrees to starboard into Kaa Fjord. Hopping over the spit at its entrance would not only take the aircraft right across Lutzow, but

...so long as Tirpitz remained in Kaa Fjord, Highball against her was not a viable proposition. Nevertheless, 618 Squadron continued to train for such an operation

present an end-on attack as Tirpitz was berthed along a north-south axis. A second option would involve passing the entrance at its eastern extremity, thus skirting Lutzow but ensuring that the attack would still be from an acute angle. The preferred option, would be to fly north-south along the eastern tongue of the

target and clearing high ground beyond it. Such an approach would give under 1,000yds of water over which Highball could bounce, and the lessons of high velocity failure at short range against Courbet were fresh. It is, therefore, difficult to disagree with Bottomley that, so long as Tirpitz remained in Kaa Fjord, Highball against her was not a viable proposition. Nevertheless, 618 Squadron continued to train for such an operation, as test pilots, Wallis and a host of other engineers and manufacturers strove to iron out difficulties of release and impact force.¹⁷

FINAL STAGE

After Upkeep had been proved at the Moehne and Eder dams, full concentration could be given to Highball. In its 5th report on 17 May Bottomley's committee dealt with the trials on 9/10 May against Courbet, concluding that redesign of the hydro-static pistol and release of Highball from a greater range were necessary. The exercise had proved, however, that a pilot could hit a ship 'with considerable accuracy', though at high velocity the hydro-static pistol could not withstand the impact. The committee's 6th report on 29 May noted that more trials were in progress against Courbet, the results of which were not yet to hand. Irrespective of these there was 'still some difficulty in the installation of Highball in the aircraft, the cause of which is unknown'.¹⁸

Matters had not improved significantly by the 7th report on 13 June: 'The unexpected difficulties which have been met in the technical trials of the weapon have held up tactical and operational trials and delayed the date of readiness of the Squadron for operations'. Even if the present trials in Loch Striven did solve outstanding problems, it would be 'fortunate' if 618 were operational by the end of June and Coastal

The only proposition worth serious consideration was that of mounting the operation from Vaenga

Command now planned the attack on Tirpitz for about 12 July. The Squadron should have all of its Mosquitoes fitted with long-range tanks by 23 June. Bottomley confirmed that the 'unsuitable' release cables, identified by Vickers-Armstrongs in May, had been replaced, but no trials had yet taken place with 'a double drop' of Highball. Moreover, 'a satisfactory sight for ranging at various speeds and at various angles of attack to the ship is essential'. 'First results are very promising' of one designed by Wallis: six should be available by 16 June, and the rest a fortnight later. Investigations were still continuing, though, into the optimum depth for exploding Highball beneath a capital ship.¹⁹

The 8th report on 27 June proved even less optimistic, and time was rapidly running out. It was now clear that, even with drop tanks, Mosquitoes could neither attack Tirpitz and return to the United Kingdom nor fly on to Vaenga. So any operation against Alten Fjord or Narvik would involved baling out over Sweden. Only Trondheim of Tirpitz's berths was viable from the United Kingdom. It might be possible, though, to fly directly to Vaenga and use that as a base for attacking Alten Fjord. The committee, therefore, recommended that the proposed operation be postponed until about 12 August to permit this to be discussed with the Soviets. 618 Squadron currently had 19 operational aircraft, to which further modifications of the release mechanism were required to these. 'Adequate' HE-filled stores were at Sumburgh, 16 'special sights' with 618 Squadron, whose practices with them had shown errors 'well under 100 yards'. More trials with the target ship had suffered from bad weather and 'technical difficulties': premature release of Highball had been caused by 'whip' in the fuselage during high speed flight, which dictated yet further modifications. The cause of 'inconsistent running' by the store was 'not definitely known', but might be due either to incorrect balancing or deterioration of the cement filling. In his other capacity as ACAS (Ops), also on 27 June Bottomley produced an Air Ministry report, which analysed range

Effectively, the Highball attack on Tirpitz had been abandoned

problems and held that, in view of enemy fighter strength in the area, the final stage to Vaenga would need to be at ground level and maximum cruising speed. The only proposition worth serious consideration was that of mounting the operation from Vaenga. Early in July, the Chiefs of Staff threw a proverbial large spanner in the Highball works. Operation Servant should be postponed until the Royal Navy had launched Operation Source on Tirpitz with its X-craft. If Servant went ahead beforehand and failed, Source would face unacceptable, added danger.²⁰

The 9th report of the Chiefs of Staff ad hoc sub-committee on 12 July admitted that the general position 'remains unaltered' since 27 June. Technical difficulties 'have not been completely overcome' and it was impossible to state when 618 Squadron would be operationally ready. Trials since the last report now suggested that inconsistent running had been caused by 'unseasoned or unsuitable wood'. If ash could be obtained, that would be used for the outer skin, if not an outer casing of 'heavier gauge metal and using no wood' would be tried. Even with the highest priority, neither alternative would be available in under a month. New hydrostatic pistols to withstand 2,000G impact were being made: 'This pistol is essential if the thicker metal casing of the store is developed since the stronger case will not have the cushioning qualities of the wooden cased store'. Trials with Courbet had again been frustrated by bad weather, but 'technical trials' had been possible at Reculver. Curiously, in view of the evident lack of progress in solving the several problems identified in its reports and Bottomley's own expressed opinion on 2 July, the sub-committee argued that 'in spite of the many technical difficulties so far experienced we believe the weapon still shows promise'. However, it was 'not recommended for the squadron to remain long off operations'. Here was a circle, which could not be squared. So, early in September 1943, the Chiefs of Staff declared that, although a cadre would be retained to continue with 'development and operational trials', the bulk of 618 Squadron would be 'released for other duties'. Effectively, the Highball attack on Tirpitz had been abandoned.²¹

Although the smaller 'bouncing bomb' eventually did function in 1944, plans to attack Tirpitz with it were not revived. Instead, RAF Bomber Command would destroy her with another Wallis invention, the 12,000lb deep-penetration Tallboy bomb, on 12 November 1944.

Notes:
Sir Barnes Wallis's papers contain a wide range of personal and official correspondence as well as copies of the minutes of meetings connected with his various projects, including Highball. When consulted at his residence in Effingham, the papers were not catalogued. They have since been dispersed mainly to the Science Museum, RAF Museum Hendon and Churchill College Cambridge. Some remain with the family, a few are in the possession of the Barnes Wallis Memorial Trust at the Yorkshire Air Museum, Elvington. Reference to the 'Wallis Papers' is made, therefore, only to identify the source of information and quotations.

1 Wallis Papers
2 PRO Air/1234
3 Wallis Papers
4 2, 4 & 8 Feb 1943, PRO AVIA 15/3933; Wallis Papers
5 25 & 26 Mar 1943, PRO Air 14/840; 2 & 7 April, Coastal Command summaries, PRO 15/442; Wallis Papers; D. Curtis, A Most Secret Squadron, Skitten Books, 1995, Page 65.
6 PRU, PRO Adm223/50; operational summary, PRO Adm 223/50; Alten Fjord, PRO Adm 199/942.
7 PRO Air8/1243.
8 PRO Air 15/442.
9 PRO Air 8/1243
10 Wallis Papers.
11 14 May meeting, PRO Air 8/1234; Wallis Papers.
12 29 May 1943, Bottomley memo: PRO Air 8/1234; Wallis Papers.
13 17 June 1943, Wallis Papers; 2 July, PRO Air 8/1243; visits, PRO Air 28/915; 11 Feb 1943, Sir Henry Tizard to the MAP, PRO AVIA 15/3934.
14 PRO Air 15/442.
15 PRO Air 8/1237.
16 PRO Air 8/1243.
17 PRU, PRO Adm 223/87; 618 Sq. training, PRO Air 28/915; Wallis Papers.
18 PRO Air 8/1237.
19 PRO Air 8/1237.
20 PRO Air 8/1237.
21 PRO Air 8/1237



One of the seminal doctrinal statements to develop this remit for the RAF is AP3000 British Air Power Doctrine

Redefining “Strategic Effect” in British Air Power Doctrine

By Dr Richard Lock-Pullan

In the last decade there has been an enormous growth in British military doctrine, a movement symbolised by the new building of the Joint Doctrine and Concepts Centre. When the first British Defence Doctrine was released it defined doctrine as “that which is taught”.³ However, doctrine is more about explaining the goals, identifying the tasks and shaping the tools of the organization that publishes it.⁴ One of the seminal doctrinal statements to develop this remit for the RAF is AP3000 British Air Power Doctrine.⁵

As part of the broad and ongoing doctrinal development, this article examines the current air power doctrine of strategic effect, and argues that it needs reform and clarification. The motive for this task is a concern that the current definition of strategic effect, and its cousin, centre of gravity, is too vague and requires redefining. This is needed to move the current understanding away from the traditional RAF concerns with ‘bombing’, towards a broader and more strategic understanding of itself as a tool of government in the current complex environment. To do this, this article argues that by teasing out the meanings held within ‘centre of gravity’ the understanding of ‘strategic effect’ can be made truly strategic. This in turn will help refine British military doctrine and the role of air power within it.

...there is a need for a title for the present post-Cold War role and capability that is located outside the joint commander's supporting role



Typhoon: the RAF's latest fighter due to enter service in 2003.

STRATEGIC EFFECT

Strategy has been defined by Basil Liddell Hart's "art of distributing and applying military means to fulfil ends of policy".⁶ However, the RAF understanding and use of the term 'strategic' is reminiscent of its use during the nuclear debates of the Cold War. The term strategy in 'nuclear strategy' was actually different from Liddell Hart's, as Lawrence Freedman made very clear in his major study.⁷ With the use of phrases such as Strategic Air Command, the "use of the adjective 'strategic' has very little to do with the noun 'strategy'." Strategic was used to refer to the range from the homeland, rather than its link to government policy. Furthermore, during the Cold War 'strategic effect' for the RAF was the nuclear role of the V-force and the like, and the current term is a hangover from that period where 'deep strike' and 'strategic' were used interchangeably. Basically, there is a need for a title for the present post-Cold War role and capability that is located outside the joint commander's supporting role.⁸ Of course this is an inter-service rivalry issue. In other words, the RAF had a distinctive capability which had to be named.

In the same way as 'nuclear strategy' corrupts the understanding of strategy, British air power doctrine defines the distinctive character of 'strategic' as being an independent or distant use of force.

The essential feature of air operations for strategic effect is that the activity . . . although aimed at the strategic centre of gravity in support of the overall aim, may be mounted distinct from the joint campaign or from outside the theatre boundary.

It is this distinction which sets air operations for strategic effect apart from other roles and missions.⁹ This provides a clear definition, but one that is understood in command and control terms and has little to do with strategy. Not only is this an unusual definition, but it rather muddies the water when one considers a contrasting definition that AP3000 uses just before this. AP3000 refers to targeting strategic centres of gravity "which should be key to achieving the strategic aim or end-state." Clearly in this case strategy is being used in its conventional form to refer to political policy and military means.

The effect of the Linebacker II campaign in 1972 during the closing years of the Vietnam War is an example of humble political aims being achieved by bombing



Boeing B-52 Stratofortress delivers its payload of bombs over Vietnam.

However, AP3000 uses 'strategic' in a third way, when explaining its organizational preferences. "The notion that the strategic employment of air power is inextricably linked to bombing and bombardment is derived from historical experience."¹⁰ As Peter Gray has rightly pointed out, the RAF has an organizational inheritance issue of stressing bombing, as strategic bombing gave it an independent role from the other services and was a source of funding. Here 'strategic' (as in strategic employment), is a half-way house between the traditional political policy understanding and long range or independent missions. What this also shows, beyond pure pedantry, is that strategic effect is used in a particular and rather peculiar manner, revealing the RAF's heritage of equating strategic effect with strategic bombing. This is wrong.

The inheritance of strategic bombardment as the crucial strategic role of the RAF distorts the understanding of what the RAF is and what it can do. This is not to underestimate the actual use of bombing for strategic effect. For example, the effect of the Linebacker II campaign in 1972 during the closing years of the Vietnam War is an example of humble political aims being achieved by bombing. The strategic aim for the US was to be able to withdraw from the theatre of war, and the bombing enabled the Americans to bring the Vietnamese government to the negotiating table to allow this to happen. For the previous years of the war bombing had proved far less effective, as the strategic aims had been far more ambitious, aiming as it did to reverse the North's advances rather than simply hold them in place as in the Linebacker II period.¹² However, the exclusive concern with strategic effect being understood as independent bombing capability actually does disservice to one of the RAF's finest achievements, one which highlights the limitations of current understanding.

During the Cold War much was made of Britain and NATO's strategic bombing capabilities, but in terms of actual use, the largest strategic effect could arguably have been Transport Command during the Berlin Blockade. The first major crisis of the Cold War, the Soviet decision to put a surface blockade round the city of Berlin proved to be a huge test of will for the Allied countries. From 24th June 1948 for the following twelve months 2,325,000 tons of food, coal and other supplies were airlifted into the city. This was not done in a simple passive environment, as RAF and USAF fighters patrolled and B-29 bombers were moved into position. However, in the battle of wills the West were able to achieve clear strategic effect by flying supplies into the city, in opposition to Stalin's will. It was the use of the transport aircraft which created the effect, as the presence of the B29s prior to the blockade had not stopped Stalin.¹³

Additionally, it was a broad role using airpower, rather than simply the RAF because civilian aircraft were used to compensate for the lack of RAF aircraft and aircrew.¹⁴ In other words, the Berlin airlift was an air operation for strategic effect, which did not bomb and did not simply rely on military aircraft. The later narrower understanding of strategic effect, as the direct military purpose of forces, was one result of the 'militarization' of Cold War containment policy, with the establishment of NATO and the outbreak of the Korean War.¹⁵

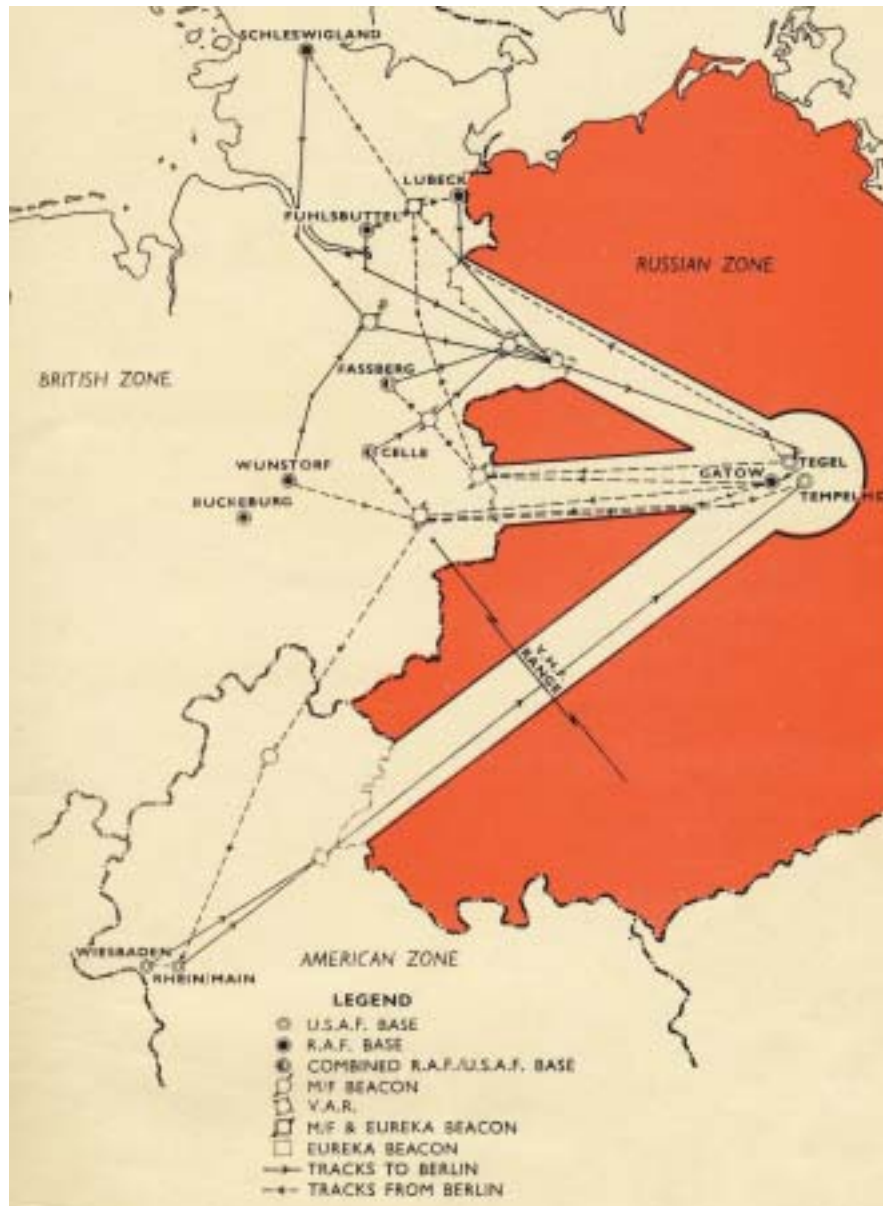
The Berlin Blockade shows that the understanding of strategic effect can be strategic, in the traditional sense. The very confusion in the definite use of the term strategic effect requires clarification, as the heritage seems to be getting in the way of developing clear concepts. AP3000 is conscious of the potential breadth of air assets that can be used for strategic effect. As it says:

*Air operations for strategic effect are not limited to bombing or solely the domain of attack aircraft. All combat aircraft and associated weapons systems are capable of action for strategic effect.*¹⁶

However, for all this formal recognition, the chapter on strategic effect leaves out these broader tasks. In fact, they are relegated to later chapters and are understood under the headings of operations, direct or indirect, close combat or force protection.

AP3000 makes it very clear that the modern air power "now seek[s] to achieve strategic effect on target sets."¹⁷ Thus air operations for strategic effect still concentrate on bombing, the traditional strategic self-understanding of the RAF.

How the effect is to be achieved is clearly outlined, by introducing the idea of centre of gravity as a term of definition: "Air operations for strategic effect are aimed to destroy or disrupt the defined strategic centre of gravity of an opponent."¹⁸ The understanding of strategic effect is thus tied to the concept of centre of gravity, though the implications of this are interpreted in a broad manner. The centre of gravity is being set up as the light switch that has to be turned off, and switching it off is strategic effect. What then does AP3000 mean by centre of gravity?



The airlift corridor that supplied 2,325,000 tons of essential material to Berlin.



British civil aircraft, such as this Lancaster of Flight Refuelling Limited, were used to compensate for the lack of RAF transport aircraft during the Berlin Airlift.

CENTRE OF GRAVITY

The roots of the term 'centre of gravity' are found in the ideas of Carl von Clausewitz, and his great work *On War*.¹⁹ Clausewitz's idea is drawn from Newtonian physics, and is the point from which the weight of a body may be considered to act.²⁰ If the gravity is uniform, then the centre of gravity is the same as the centre of mass. In this sense one sees that a 'centre of gravity' is a point of vectors crossing. Thus for Clausewitz, the enemy is seen as a system, and unbalancing the equilibrium of the system shifts the centre of gravity. It is not a fixed point in a body. Additionally, it is important to note that it used by Clausewitz as an analogy, illustrating the cohesive point of many factors pulled to a centre. As he wrote, the fighting forces of each belligerent in war have a certain unity and cohesion, "Where there is cohesion, the analogy of the centre of gravity can be applied."²¹ Clausewitz famously included the central role of political aims and moral cohesion in the essential factors that must be considered – the geometry of opposing forces was not a sufficient understanding of war. The centre of gravity is the hub of all power and movement, upon which everything depends and for Clausewitz is the point that must be attacked.²²

The centre of gravity is the source of the strength of the enemy, and as such needs to be crushed

This fits Clausewitz's broader concern with decisive battles. The centre of gravity is the source of the strength of the enemy, and as such needs to be crushed.

Claiming roots in Carl von Clausewitz's writings, AP3000 is actually rather unclear on what exactly a centre of gravity is. "Characteristic(s), capability(ies), or locality(ies) from which a nation, alliance, a military force or other grouping derive its freedom of action, physical strength or will to fight."²³ Apart from being 'lifted' from US doctrine,²⁴ this is a broad remit, basically because the term in Clausewitz's day referred primarily to the opponent's army. In AP3000:

*an opponent's centre of gravity may take many forms and often different degrees of accessibility. What is clear, however, is that far from being limited to physical destruction of targets with high explosives, we now seek to achieve strategic effect on target sets.*²⁵

This quotation makes clear that the replacement of simple bombing, with operations for strategic effect, requires an understanding of strategic effect that is not strategic. A truly strategic understanding of the term would refer to achieving strategic effect through, not on, target sets.

...in WWII German oil was a critical weakness as it could be effectively targeted and all facets of the German war machine were dependent upon it. It was not the source of German strength

Secondly, the term 'centre of gravity' only recognises the positive strengths of the opponents, it does not recognize the crucial weaknesses that can be hit, allowing the strategic effect to be materialized.

As the current doctrinal mantra goes, British forces now aim to "shatter cohesion and will" by targeting weakness, and using manoeuvre and surprise, which AP3000 repeats.²⁶ However, its understanding of 'centre of gravity' does not generate the weaknesses to be hit. This is due to a compressed understanding of 'centre of gravity'. For example, in WWII German oil was a critical weakness as it could be effectively targeted and all facets of the German war machine were dependent upon it. It was not the source of German strength. The ambiguity in AP3000 on this point of relating the strength to the weakness of an enemy is not unusual. The influential American air power theorist John Warden, for example, argues that the centre of gravity is the most vulnerable point and where an attack will have the best chance of being decisive.²⁷ The link of strength and weakness to the understanding of 'centre of gravity' needs clarification.

To illuminate this difficulty of reconciling attacking weakness and recognising the strength of 'centre of gravity' Joe Strange's model is very useful. It also allows a better definition of strategic effect, actually allowing it to be strategic, by outlining a more developed understanding of 'centre of gravity' that itself allows the issue of strength and weakness to be related.

STRANGE'S MODEL

Strange makes a clear distinction between the centre of gravity, and the critical capabilities, requirements and vulnerabilities contained within it. In other words, he teases out what qualities are within the centre of gravity. For him, the 'Centre of Gravity' is a noun, the primary source of physical or moral strength. This is uncontroversial. However, for Strange, what give the centre of gravity its abilities to be one, are referred to as Critical Capabilities. In other words this is the active element, the verb to go with the noun. For the capability to be realised, to be active, there are Critical Requirements, which covers the conditions, resources and means for the capability to become operative. This is a very important step, because if one takes the analysis one step further, one can see that the Critical Requirements, or components of them, can be vulnerable to attack, neutralization or interdiction. Strange calls these Critical Vulnerabilities and sees that recognising them can achieve decisive results. The importance of this analysis is that 'centre of gravity' is redefined. As Strange says, they "are not characteristics, capabilities, or locations; they are the moral,



The Deutsche Vacuum oil refinery at Bremen seen here following an attack by RAF Bomber Command on 21 March 1945.

political and physical entities which possess certain characteristics and capabilities, or benefit from a given location/terrain." ²⁹ A centre of gravity cannot thus be a critical vulnerability. For the RAF this means that Critical Vulnerabilities need to be addressed, not a centre of gravity as in current AP3000 understanding. Hence the RAF achieves its strategic effect through operational and tactical operations against critical vulnerabilities within the 'critical capability - critical requirement' nexus. The consequence of this is that analysts are required to understand that a centre of gravity is not a critical requirement, such as transportation nodes. A centre of gravity is a dynamic agent, which needs to be understood for its effect on the overall grand and military strategy.

This approach forces analysts to determine the opponent's ensuing critical capabilities – critical requirements – critical vulnerabilities. This forces them to return to genuine strategy by determining the genuine centre of gravity of an opponent, unencumbered by issues of accessibility. This then generates alternative courses of action, before deciding what target sets are to be destroyed, or assets to be deployed. By understanding the centre of gravity as a dynamic agent, a simplistic formula of the standard "characteristics, capabilities or locations" to be destroyed does not make sense. The strategic effect has to be a product of the overall strategy against a dynamic system.

In many ways this thinking is not so radical in its conclusions. One can see that the understanding of decisive points can be adapted to accommodate the thinking on critical vulnerabilities. It does challenge the traditional perception of the RAF's self-understanding.

The Lancaster was the mainstay of the RAF Bomber Command during the latter stages of the strategic bombing campaign.



It is possible, however, to draw upon RAF experience to show how this type of thinking can be realised by the current RAF doctrine.

Christina Goulter's study of Coastal Command's anti-shipping campaign during WWII is rightly titled 'The Forgotten Offensive'.³⁰ As she shows, the RAF's preoccupation with strategic bombing doctrine excluded other uses of air power such as maritime and army support. What is important here is that by targeting German critical vulnerabilities in foreign raw materials, the RAF were able to offer a complementary strategic effect to that of traditional strategic bombing. Targetting vulnerabilities undercut the requirements of key German war making capabilities. This case study shows the importance of broadening the use of air power for strategic effect from simply bombing land targets that are seen to make up the centre of gravity.

The shift away from capability to effect that the Coastal Command example gives is the heart of this article's argument. By understanding strategic as a component of the grand strategy of a nation, rather than as a component that is separate from the operational level commander's responsibilities, opens up many possibilities for the use of air power. The cases described above show that strategic effect is possible, but is far more commonly achieved through the accumulation of tactical and operational level operations.

Like much of the British debate about doctrine, the thinking needs to move away from looking at the capability inputs to assessing outputs in terms of the aims of the overall national strategy. It is difficult to describe this, because in a Joint environment one cannot make too much of the independent capability of the RAF. This is clearly shown by the UK having British Air Power Doctrine, with a joint crest on the cover, rather the RAF Doctrine. One could suggest that the concept is renamed to 'The Independent Effect of Air Power', or 'Distinctive Effect' if a name is needed for the distinctive capability. However, if the aspiration to examine air power's contribution to national strategy is taken seriously, then a renaming of what goes on would be closer to 'The Operational Effect of Air Power' with a redefinition of the 'Strategic Effect of Air Power' being related to effect rather than capability. For air operations for strategic effect to be appropriate then the doctrine has to change. This would tie together the range of assets the RAF has and how they can all be used for genuine strategic, rather than independent effect, one which aims to exploit the enemy's Critical Vulnerabilities. In other words, it links strategy to tactics, the heart of the operational level.

CONCLUSION

Current RAF doctrine on the 'Strategic Effect of Air Power' says rather more about the organizational preferences and history of the service, than it does about strategy. There is still a heritage of independently bombing land targets and understanding this as strategic effect. In the current volatile strategic environment the RAF needs to refine this understanding to make itself genuinely more strategic in its thinking and operations. To aid this process, this article has advocated that the thinking behind the understanding of the 'centre of gravity' needs reform so that genuine strategic thinking will shape the planning and understanding, and that the enemy's weakness can be tackled, rather than simply hitting strength, to disable the effect rather than simple capability of them. Hopefully this approach will enable a more nuanced, effective use of air power to come about.

Organizationally the approach of this article challenges the over-emphasis on fast jets and their influence in the RAF. They are not the sacred key holders of the Service, as the Service is ultimately a tool of the

government. In current operations for example, there is a great demand for strategic lift, of which there is a huge shortfall, whilst the RAF is simultaneously buying 232 Eurofighters. A shift in the organization's thinking needs to take place.

A strategic service needs to take strategy seriously, shibboleths or not, and the RAF can start by re-examining its understanding of 'strategic effect' and 'centre of gravity', the core of its doctrine. As the great British strategist Colonel G F R Henderson put it, "Strategy ... is an art which almost more than any other is concerned with the fate of nations. Its study should be as assiduous as its practice should be correct."³¹ Henderson wrote this over a hundred years ago and he is today little read. Ironically, however, in typical British fashion his portrait hangs in the mess bar named after him at the Joint Services Command and Staff College. His image and name are remembered and even honoured. The substance of his work is missing from current curricula. It is time to turn from concentrating on the self-image of the RAF towards more and "assiduous" thinking about strategy.

Notes:

- 1 The author is a Lecturer in Defence Studies, Defence Studies Department, King's College London at the Joint Services Command and Staff College.
- 2 I would like to thank Wg Cdr Chris Finn and Dr Christina Goulter for reading and commenting on earlier drafts of this article, and Maj Andreas Schaer of the Swiss Army and Col Richard Iron for the many discussions on these and associated issues. The analysis, opinions and conclusions expressed or implied in this article are the author's alone and do not necessarily represent the views of the JSCSC, the UK MOD or any other government agency.
- 3 JWP 0-01 British Defence Doctrine. (London: HMSO, nd) p 1.2
- 4 Farrell, Theo. 'Making Sense of Doctrine'. Strategic Studies 1: Doctrine and Military Effectiveness. (Exeter: University of Exeter/ Britannia Royal Naval College, 1997) p 2.
- 5 AP 3000. British Air Power Doctrine. Third edition. (London: HMSO, 1999)
- 6 Liddell Hart, B H. Strategy: The Indirect Approach. (London: Faber and Faber, 1968) p 334.
- 7 Freedman, Lawrence. The Evolution of Nuclear Strategy. 2nd Ed. (London: Macmillan/IISS, 1989) pp xx-xxi.
- 8 I would like to thank Chris Finn for drawing my attention to this point.
- 9 AP 3000 p 2.6.6
- 10 AP 3000 p 2.6.2
- 11 Gray, Peter W. Air Operations for Strategic Effect – theory and practice in Kosovo. RAF Air Power Review. 3, 1 (2000) pp17-31.
- 12 Clodfelter, Mark. The Limits of Airpower: The American Bombing of North Vietnam. (New York: Free Press. 1989)
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- 15 Gaddis, John Lewis. Strategies Of Containment: A Critical Appraisal of Postwar American National Security Policy. (Oxford: Oxford University Press. 1982)
- 16 AP 3000 p 2.6.1
- 17 AP 3000 p 2.6.1
- 18 AP 3000 p 2.6.1
- 19 Clausewitz, Carl von. (Howard, Michael and Paret, Peter. ed and trans.) On War. (Princeton. NJ: Princeton University Press. 1976)
- 20 Handel, Michael I. Masters of War: Classic Strategic Thought. 3rd Ed. (London: Frank Cass, 2001) p 53
- 21 Clausewitz, On War. pp 485-6
- 22 ibid. pp 595-96.
- 23 AP 3000 p 3.13.2
- 24 For example see Joint Publication 3-0 , 1995 p III-20. The AP3000 definition is different in use of the plural, and in adding nation and alliance – the rest is the same.
- 25 AP 3000 p 2.6.1
- 26 AP 3000 p 2.6.7
- 27 Warden, John A. III. The Air Campaign: Planning For Combat. (Washington, DC: Brassey's, 1989) p 7.
- 28 This section based upon: Strange, Joe. Perspectives on Warfighting. No 4.: Centers of Gravity and Critical Vulnerabilities. 2nd Ed (Quantico, VA: Marine Corps University Foundation, 1996)
- 29 ibid. p 48
- 30 Goulter, Christina J M. A Forgotten Offensive: Royal Air Force Coastal Command's Anti-Shipping Campaign, 1940-1945. (London: Frank Cass, 1995)
- 31 Henderson, G F R. The Science of War: A Collection of Essays and Lectures 1891-1903. (London: Longmans, Green and Co., 1919) p 46

As the great British strategist Colonel G F R Henderson put it, "Strategy...is an art which almost more than any other is concerned with the fate of nations..."

AIR POWER at El Alamein

By Dr Alfred Price FRHistS

During October 1942, Lt Gen Bernard Montgomery laid final plans for a large-scale offensive by the British 8th Army to break out of its position at El Alamein and expel the Axis forces out of Egypt. The southern end of the defensive line was anchored to the Qattara Depression, an area of salt flats that was almost impassable by wheeled vehicles. Thus there was no room for an outflanking operation: any offensive had to be through the main Axis defensive line which lay behind dense minefields. The Western Desert Air Force, commanded by AVM Arthur Coningham, was to provide full support for offensive. As well as his own resources, he could draw on the services of units belonging to Air Headquarters Egypt. The total available strength is listed below. This account covers in detail the air support provided during the first two days of the Battle, 24th and 25th October, and in lesser detail thereafter.

AIR ORDER OF BATTLE: THE ATTACKERS

On 19 October, four days before the offensive opened, the combined strength of the Allied Air Forces in the eastern Mediterranean area was 1,080 combat aircraft from the RAF, the Fleet Air Arm, the US Army Air Force and the South African Air Force. These comprised the following¹ :

Single engined fighters, fighter-bombers (Spitfires, Hurricanes, P-40C Tomahawks, P-40D Kittyhawks and P-40F Warhawks)	468
Anti-tank aircraft (Hurricane IIDs)	9
Twin-engined fighters (Beaufighters)	29
Night fighters (Beaufighters, Hurricanes)	62
Light bombers (Bostons, Baltimores)	114
Medium bombers, day (Mitchells)	37
Medium bombers, night (Wellingtons)	82
Heavy bombers, day (Liberators)	42
Heavy bombers, night (Halifaxes)	19
Torpedo bombers, (Wellingtons, Beauforts)	71
Army Co-operation and Reconnaissance (Spitfires, Hurricanes, Baltimores)	79
Light attack aircraft (Fleet Air Arm Albacores, used to drop flares at night)	32
Coastal, miscellaneous (Sunderland, Catalina, etc)	36

According to one source 920 aircraft were combat ready when the offensive opened

During the weeks before the offensive units flew reduced numbers of operations to allow them to rest, train, to be brought to full strength and to improve serviceability.² According to one source³ 920 aircraft were combat ready when the offensive opened. The closest RAF airfields to the front line were at Hamman, about 25 miles back. There were several well-equipped airfields around Alexandria, 50 miles from the front line, and others further back.⁴

The attacking air force possessed several surveillance radars for fighter direction. To assist fighter control during the offen-

sive, the RAF established a forward radar station on Ruweisat Ridge, 10 miles from the front line. This operated an AMES Type 5 (long range early warning and fighter control, range 90 miles), and an AMES Type 6 (short-range mobile surveillance and fighter control radar, range of about 50 miles).⁵

AIR ORDER OF BATTLE: THE DEFENDERS

By this stage in the campaign the Axis air forces in North Africa were stretched to the limit. In terms of combat effectiveness their capability was a mere shadow of that available to the Allies.⁶ Although the Axis air forces possessed more than seven hundred combat aircraft in North Africa,⁷ only a small proportion of those could be supported at bases within effective operating range of the combat zone. Moreover, with fuel in short supply, most of what there was went to the Luftwaffe.

After the Battle began, the Luftwaffe transferred two Gruppen with about 50 Messerschmitt 109 fighters to the Alamein front...

Thus the Italian air contribution to the Battle can safely be disregarded. The strength return from Fliegerfuehrer Afrika on 22 October ⁸ listed just 90 serviceable aircraft:

Fighters, fighter reconnaissance (Messerschmitt 109s, 110s):	40
Dive bombers (Junkers 87s):	40
Fighter bombers (Messerschmitt 109s):	10

After the Battle began, the Luftwaffe transferred two Gruppen with about 50 Messerschmitt 109 fighters to the Alamein front.⁹ Against the overwhelming Allied numerical superiority, however, these made little difference.

The Axis forces in North Africa suffered badly from having long lines of communication that were under continual attack from aircraft and submarines. The poor supply situation caused severe shortages, especially in aviation and motor fuel. Things got so bad that the Germans were forced to resort to using air transport to carry fuel and other priority cargoes. In the case of fuel, the two-way flight from Crete consumed about half as much as the aircraft brought in.¹⁰

In addition to the above forces, and available to support the ground battle, there were about 80 German medium bombers (Ju 88s) and about 20 reconnaissance planes based on Crete. Also, there were about 250 Junkers 52 transport aircraft continually moving around the area, many of which were used to fly in supplies to North Africa. As the Battle progressed the strength of the medium bomber force on Crete was greatly increased as units moved to the island from Sicily.¹¹ Also, there were 265 Italian bombers, mainly from anti-shipping units, based on Rhodes.

The nearest Axis airfields to the battle area were at El Daba, about 20 miles back. There were several other airfields along the coast to the west.¹² The airfields in Crete and Rhodes were in each case about 350 miles from the battle area. The defending air force possessed several surveillance radars to assist fighter direction. The nearest station, within 25 miles of the front line, was situated at El Daba and operated a Freya early warning and fighter control radar with a range of 90 miles.

ANTI-AIRCRAFT ARTILLERY

With far fewer fighters than the Allies, the Axis forces had to place greater reliance on their AAA. The German forces in North Africa possessed

The German forces in North Africa possessed about seventy dual-purpose (anti-aircraft/ anti-tank) 88-mm guns operating in four-gun batteries



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More than half the Allied fighter strength was made up of obsolescent Hurricanes, with a performance much inferior to that of the Me109G



about seventy dual-purpose (anti-aircraft/anti-tank) 88-mm guns operating in four-gun batteries. In the rear areas, some of these batteries were equipped with Wuerzburg fire control radars. Smaller calibre German AA weapons, 20 mm and 37 mm, were available in larger numbers and these were effective up to about 6,000 feet. The Italian forces employed 75 mm AA guns, without radar control, and a similar range of smaller weapons. British AAA weapons, the 3.7-in gun and the 40 mm Bofors, had few opportunities to engage enemy planes during the Battle.

RELATIVE EQUIPMENT OF THE OPPOSING AIR FORCES

The German fighter force in North Africa had recently converted from the Messerschmitt 109F to the latest G version. The best Allied fighter types were the RAF's Spitfire V and the USAAF's P-40F Warhawk, but the Me 109G had the edge over both of them.¹³ Moreover, the Spitfires and Warhawks equipped only a small part of the Allied fighter force. More than half the Allied fighter strength was made up of obsolescent Hurricanes, with a performance much inferior to that of the Me 109G.¹⁴

The Allied light, medium and heavy bomber units all operated modern types that were superior in performance and bombing capability to their counterparts in the Axis air forces. The latter were all approaching obsolescence, and at that time the Luftwaffe had no heavy bomber in service.

The Junkers 87 "Stuka" dive-bomber could attack with greater precision than any other bomber type taking part in the Battle. Yet, if these vulnerable aircraft were to avoid heavy losses during daylight operations, they required strong fighter protection.

During the Battle that would rarely be possible, and for much of the time the Stukas confined their operations to dawn and dusk — with a consequent reduction in attack accuracy. One recently-formed RAF one squadron operated nine Hurricane IID anti-tank aircraft.

These carried two Vickers S guns, 40 mm cannon mounted in bulges under the wings each with a magazine holding sixteen armour-piercing rounds. The Mark IID also carried two .303-in machine guns loaded with tracer rounds, to assist in aiming the cannon.¹⁵ The 40 mm cannon were semi-automatic weapons, at each press of the firing button both cannon fired a single round. The pilot approached the target flying at 50 feet at 240 mph. He commenced firing at a range of 700 yards, with both the machine guns and the heavy cannon. A trained pilot could fire five aimed pairs of 40-mm rounds during a single firing pass. The Hurricane IID was at its most effective against tanks that had broken through the defences and had outrun their AA protection.

Based in Crete, the Luftwaffe had about three Junkers 86P high altitude reconnaissance aircraft able to operate at altitudes around 39,000 feet



The best RAF reconnaissance aircraft was the Spitfire IV, an unarmed version of the famous fighter fitted with cameras and extra internal fuel tanks

Tanks accompanied by motor vehicles were judged to have AA protection, and were considered too dangerous to attack.¹⁶ The ideal conditions for Hurricane IIDs to go into action were rarely met in North Africa after the summer of 1942. It was, however, reassuring for army commanders to have such aircraft available to counter a breakthrough, even if opportunities to employ them effectively were rare.

Based in Crete, the Luftwaffe had about three Junkers 86P high altitude reconnaissance aircraft able to operate at altitudes around 39,000 feet. These aircraft posed a very difficult interception problem for the Allied fighter types available in the theatre. However, serviceability of the Ju 86P was poor and often none was available for operations. The best RAF reconnaissance aircraft was the Spitfire IV, an unarmed version of the famous fighter fitted with cameras and extra internal fuel tanks; although its altitude performance was inferior to that of the Ju 86P, it was still very good. Moreover the Spitfire IV was considerably faster and more manoeuvrable than the Ju 88P, and its serviceability was far better.

TYPES OF BOMB USED FOR GROUND ATTACK OPERATIONS

On the Allied side, during the Battle the only types of bomb used in close support operations were general purpose free fall weapons, mainly 250 pounders¹⁷ but with a small proportion of 500 pounders. In some cases these weapons were fitted with nose fuse extensions, spikes to detonate them close to the surface. Air-to- ground rockets and cluster bombs were not available in theatre; retarded bombs lay well in the future.

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That limitation meant that Allied fighter-bombers were unable to deliver effective horizontal bombing attacks from low altitude. If the bombs were fused to detonate on impact or very soon after, the releasing aircraft was likely to suffer splinter damage. If the bombs were fused to detonate when the aircraft was well clear, say after a delay of 10 seconds, unless the target was large enough and strong enough to stop them the bombs might tumble hundreds of yards beyond the target before they detonated. Fighter-bombers therefore attacked in a shallow dive, commencing at around 10,000 feet and releasing at 4,000 feet.¹⁸ Usually this method was not accurate enough to destroy small battlefield targets such as vehicles or artillery positions. Alternatively, fighter-bombers often flew as part of the escort for twin-engined bomber formations, each aircraft carrying a single 500-pound bomb¹⁹ which they dropped in the target area.

During the German advance in the previous May, the WDAF had employed its newly-delivered Kittyhawks to deliver low-altitude strafing attacks without top cover. The Kittyhawks claimed the destruction of some 200 enemy vehicles. However, within a four-day period more than forty Kittyhawks were lost to AAA and enemy fighters, exhausting the reserve of these fighters.²⁰ The experiment was not repeated.

On the Axis side the majority of bombing attacks in the battle area were by Junkers 87 Stukas employing their famous 80-degree steep dive attack, usually releasing one 550-pound bomb and four 110-pound general purpose bombs.

The Luftwaffe inventory included one very effective type of cluster munition, the SD-2 weighing 4.4 pounds. Fighter-bombers dropped containers with 108 of these weapons, during low-level attacks.²¹ However, the SD-2s were in short supply and the Eastern Front had priority. It is doubtful whether many were used during this Battle.

DIRECTION OF GROUND ATTACK OPERATIONS

The front line had been more or less static for about four months, giving aircrews on both sides plenty of time to become thoroughly familiar with the landmarks in the area. By October 1942, the Allied organisation for controlling air strikes in the battle area was efficient by the standards of the day. The Air Support Control Centre was co-located with the Advanced Air Headquarters and the Eighth Army Tactical Headquarters, at Burg el Arab 35 miles from the front line.²² Tactical reconnaissance Hurricanes made frequent flights over the battle area and reported by radio on enemy movements and possible targets for attack.

Throughout the day, bomber units were held at readiness at forward airstrips, ready to take off at short notice. From the origination of a request for air support, until the bombers arrived over the target, took on average about one hour.²³ That time included the rendezvous with the escorting fighters, and a flight from the airstrip to the target averaging about 20 minutes. Where appropriate, the targets were marked by artillery firing smoke shells.²⁴

The Luftwaffe used forward air control officers (Fliegerleitoffiziere) to guide attacking aircraft on to ground target. These men operated from armoured cars equipped with radios for ground-to-air communications, close to the front line.²⁵

During the week following the opening of the Battle, the attacking troops moved forwards only slowly and aircrews had no difficulty in distinguishing between friendly and hostile positions.

Curtiss Kittyhawks of the Desert Air Force.



...a force of 35 Kittyhawk fighter-bombers, with an escort of Spitfires and Kittyhawks, attacked the Axis landing grounds at Daba

INTELLIGENCE AVAILABLE TO THE ALLIED FORCES

The Allies' Ultra cipher-breaking operation, coupled with other types of signals intelligence, provided a wealth of information on Axis movements and intentions. Particularly valuable was intelligence on Axis supply convoys, which included routing and timing information so they could pick up their air cover as they neared the coast of North Africa. Consequently, the convoys suffered heavy losses from Allied aircraft and submarines.²⁶

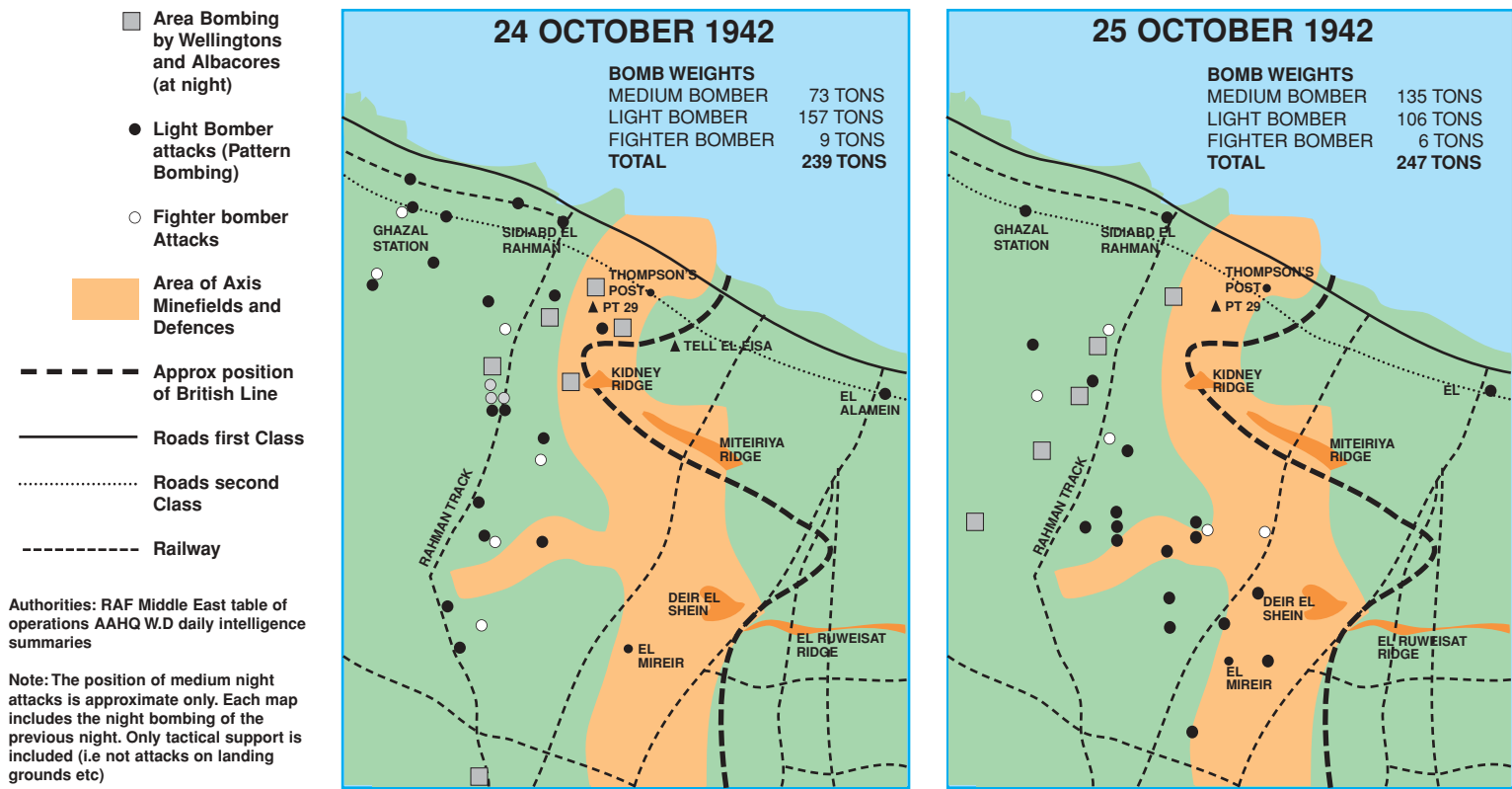
As part of the preparation for the battle, Allied reconnaissance aircraft systematically photographed the entire battle area. Their prints were combined to produce a mosaic picture showing the location of enemy minefields, wire defences, gun-pits etc.²⁷ Frequent flights over the defenders' rear areas by tactical reconnaissance aircraft ensured that any moderate sized troop movement by day was unlikely to avoid being seen and reported.

INTELLIGENCE AVAILABLE TO AXIS FORCES

From the degree of Allied activity, it was clear to Axis commanders that a major offensive was in the offing. However, due to the high degree of air superiority established by the Allied air forces, Axis reconnaissance planes had great difficulty photographing the area. It appears that no Ju 86P was serviceable for some days before the British attack. The Axis air forces were unable to observe British army positions between 18 and 23 October, when British forces were assembling for the attack.²⁸ As a result the time and the place of the main thrusts were not determined, and the attackers retained the all-important element of tactical surprise.

AIR ACTIONS PREPARATORY TO THE OFFENSIVE

Commencing four days before the offensive opened, Allied bombers carried out a systematic bombardment of Axis airfields in Egypt and eastern Libya. This phase involved 76 sorties by medium bombers, 208 by light bombers and 285 sorties by fighter-bombers.²⁹ There was also a vigorous programme of reconnaissance missions over Axis front line positions, rear areas and airfields.



Although many of these attacks failed to inflict serious casualties, this ever-present threat forced Axis units near the front line to disperse their vehicles and equipment over a wide area.

When the German dual-purpose 88-mm guns were not taking engaging ground targets, they proved their effectiveness against the Allied bomber formations. The pattern-bombing actions were not one-sided affairs, as these details on the attacks on 24 October make clear:³⁸

1140 hours. 6 Bostons and 12 Baltimores attacked enemy vehicles well-dispersed. AA fire accurate and intense, 1 Baltimore damaged. 90 x 250-pound bombs dropped.

1210 hours. 12 Bostons and 6 Baltimores attacked the landing ground at Qotafiya. AA fire intense and accurate.

1442 hours. 4 Bostons and 12 Baltimores attacked enemy vehicles at [map reference] No observed results. AA as above. 1 Boston shot down, 11 bombers damaged.

1545 hours. 16 Bostons, 1 Baltimore attacked enemy vehicles at [map reference]. One direct hit on a vehicle, AA as above. 3 bombers damaged.

During the day Allied fighter-bombers flew some 70 sorties against Axis airfields, and 12 more over the battle area.

Lacking fighter escorts, the Ju 87 dive-bomber units were restricted to operating at dusk, during the night and at dawn.

Sorties flown, dawn 24th to dawn on 25th October
RAF and USAAF, about 1130
Luftwaffe, 107³⁹

Aircraft Losses during above period
RAF and USAAF: 8 bombers (all to AA fire), 5 fighters
Luftwaffe: 2 single engined, 1 twin-engined fighter
Italian Losses not known, but very light

NIGHT OF 24/25 OCTOBER

Wellingtons flew 85 sorties⁴⁰ assisted by flares dropped by Albacores, which repeated the previous night's harassment of enemy troops close to the front line.

About a dozen Junkers 88 bombers flew from their bases in Crete to the forward landing ground at Sidi Haneish, to attack targets in the battle area. One Ju 88 attacked vehicles of the 8th Armoured Brigade formed up to pass through a narrow gap cleared through a minefield. Its bombs set ablaze a petrol lorry, and the resultant glow attracted artillery fire as well further bomber attacks. Eventually there were about 25 lorries ablaze, many of them loaded with fuel or ammunition. The resultant explosions halted the British advance at that part of the front, until the fires burned themselves out some hours later.⁴¹

COURSE OF THE AIR BATTLE, 25 OCTOBER

Battle Area
The sources make no mention of any problems caused by the weather during the morning, but rising dust caused the cancellation of some attacks during the afternoon. Allied fighters flew 221 sorties on

Despite their superior equipment, the German fighter units were unable to prevent or hinder Allied bombers, fighter-bombers and reconnaissance aircraft from operating freely over the battle area

offensive sweeps through the battle area and over enemy airfields, and 226 bomber escort sorties. They claimed seven Axis planes shot down, Luftwaffe records admit the loss of that number.⁴²

Boston, Baltimore and Mitchell bombers flew 165 sorties, delivering nine pattern-bombing attacks. Of those, seven were for close air support and the other two were against airfields. All these attacks were escorted by fighters.

Near Tobruk, eight Beaufighters conducting a sweep along the coast encountered a formation of about twenty Junkers 52 transports flying in from Crete, escorted by six Me 110s. During the subsequent mêlée, a Beaufighter collided with a Ju 52, resulting in the loss of both aircraft. Although the Beaufighters claimed the destruction of four Ju 52s, detailed German records list only one such loss.⁴³

NIGHT OF 25/26 OCTOBER

Wellingtons flew 64 sorties against German troop positions, assisted by 14 Albacores which dropped flares. One large explosion and several small fires were reported.⁴⁴ German bombers attempted to repeat their success of the previous night, attempting to hit vehicles passing through the narrow gaps through the minefields. Night fighter Hurricanes flew 30 sorties over the area, and had several encounters with enemy planes. The latter had no further success in their attempt to hit ground targets.⁴⁵

Sorties Flown, dawn 25 Oct to dawn on 26th
RAF and USAAF, about 705 sorties
Axis Air Forces, about 240 sorties

Aircraft Lost during Above Period
RAF and USAAF: 8 bombers (all to AA fire), 5 fighters
Luftwaffe: 4 single engined fighters, 1 bomber, 2 dive-bombers, and 1 transport plane
Italian Losses not known, but very light

AFTER 25 OCTOBER

Following the first two days, the air operations continued on the now-established pattern. Despite their superior equipment, the German fighter units were unable to prevent or hinder Allied bombers, fighter-bombers and reconnaissance aircraft from operating freely over the battle area.

By concentrating their available force, however, on a few occasions they succeeded in establishing local air superiority over part of the front to enable dive-bombers could attack targets. The latter achieved little, however.

On 26 October, a German and an Italian division counter-attacked the salient established by British troops.⁴⁶ For this the Axis units had to concentrate, and that made them attractive targets for pattern-bombing attacks. A series of pattern bombing attacks, combined with artillery fire, broke up the attack.

On 27 October Field Marshal Rommel ordered a further counter-attack. As the 21st Panzer Division was moving into position, it suffered seven successive pattern-bombing attacks during a 2 1/2-hour period. The planned attack did not materialise, neither did a further attempt on the next day. After that, Rommel made no further attempt to seize the initiative.⁴⁷

On 4 November, following a long and stubborn defence by Field Marshal Rommel, the British 8th Army finally broke through the Axis front line in strength. The German and Italian armies were forced to begin a difficult and lengthy retreat that would expel them from Egypt and Libya.

COMMENTS

The Allied air forces enjoyed the advantages of huge numerical superiority, a much more effective bomber force, far shorter lines of communication and much better-supplied airfields. Consequently, during the first two days of the offensive they flew more than five times as many sorties as the Axis air forces. The Allies possessed a very high degree of air superiority at the start of the battle, and within a couple of days they had established air supremacy.

Prior to the offensive, RAF photographic reconnaissance aircraft had secured blanket coverage of enemy positions along and behind the front line. That greatly assisted in planning the main attack, and established the priority targets for artillery and aerial bombardment.

At the same time, the Allies' air superiority enabled them to stifle attempts by Axis planes to conduct effective air reconnaissance over Allied troop positions before the offensive began. As a result, the attackers retained tactical surprise until the main artillery bombardment began. Throughout most of the Battle, Axis commanders had little hard information on the movements of Allied ground forces until the latter came within sight or sound of their forward positions.

During the Battle Allied light and medium bombers mounted several pattern-bombing attacks. On many occasions these attacks failed to inflict serious damage or casualties, yet the ever-present threat of them forced Axis commanders to disperse their vehicles and equipment over a wide area in the desert. When vehicles needed to concentrate, in preparation for an attack or to deliver a counter-attack, the pattern-bombing attacks proved extremely effective. If one fell across an enemy troop or vehicle concentration, the effect of more than a hundred closely spaced 250 and 500 pound bombs detonating in a few seconds caused a shock effect similar to that now produced by a B-52 operating in the battlefield support role. Discussing the campaign in North Africa, Field Marshal Rommel would later write: "Anyone who has to fight, even with the most modern weapons, against an enemy in complete control of the air fights like a savage against modern European troops, under the same handicaps and with the same chances of success."⁴⁸

Due to the shortage of fuel and poor serviceability, Axis air forces flew low sortie rates during the Battle. Deprived of fighter escorts the German Junkers 87 dive-bombers were able to operate only between the hours of dusk and dawn. They achieved little.

Throughout the Battle the potentially powerful force of Ju 88s units based on Crete was not used effectively. They flew a few tactical bombing missions in support of the army, and what amounted to nuisance raids on targets in Egypt. They were also employed, some have said misemployed, on flying escorts for convoys of shipping and carrying fuel and other priority items to North Africa.⁴⁹ Their only noteworthy success during the Battle was on the night of 24/25 October, when they hit petrol and ammunition lorries and caused fires which halted the 8th Armoured Brigade's passage through a minefield for several hours.

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26. Hinsley, pp 728 to 738
27. Ibid p 433
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30. See Rust pp 18, 19. Also Moyes, Philip, Bomber Squadrons of the RAF, Macdonald, London,1964, p 255.
31. The Middle East Campaigns, Vol III, p 272
32. Ibid, p 274
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38. Nos 3 and 232 Wing records, PRO Ref AIR 26/18
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The first issue of *The Aeroplane*, edited by Charles Grey Grey.
The following article was published in the December 17th, 1919 issue.

The Future of The Royal Air Force

By Charles Grey Grey, Editor of *The Aeroplane*

On December 13th, which may well be regarded as a lucky day by Service aviators of the future, there was issued a Memorandum by Air Marshal Sir Hugh Trenchard, Chief of the Air Staff, outlining the permanent organisation of the Royal Air Force. To the Memorandum is prefixed a note by Mr Winston Churchill, Secretary of State for Air, stating that the scheme was prepared under his directions, and has been approved in principle by the Cabinet.

Neither the Memorandum nor the Note call for any particular comment. Both Mr Churchill and Sir Hugh Trenchard have the welfare of the RAF sincerely at heart, and there are no others so competent to lay down on sound foundations the organisation of our Flying Services. Nor are there any others in whom the officers and men of the RAF have so much confidence. Consequently there will be a very general feeling throughout the Air Force that what is to be done is the best that can possibly be done with the money allowed for the purpose.

The proposal which will be of the greatest interest is that according to which the main portion of the Air Service will consist of an Independent Force, while a small part of the personnel will be specially trained for work with the Navy and a small part specially trained to work with the Army, "these two small portions probably becoming in the future an arm of the older Services".

One has argued persistently that a Naval aviator is properly a Naval officer who flies and that an Army aviator is properly a soldier who flies...

PROPHECIES OF THE PAST

It will be remembered by all regular readers of THE AEROPLANE that this arrangement is precisely that which was advocated by this paper – and by this paper alone among the whole of the Press – when the single Air Force was first proposed during the agitations of 1916.

One has argued persistently that a Naval aviator is properly a Naval officer who flies and that an Army aviator is properly a soldier who flies, but that there are various uses for aeroplanes in war apart from the strategy of the Navy and Army, and so there is use for an Independent Air Force. Naturally, therefore, one feels gratified to find that the same view is held by Mr Churchill and Sir Hugh Trenchard.

There is a solid satisfaction in seeing the official action of the two men who truly understand air war in its proper relation to war on sea and land putting into concrete form theories for which one has been abused and derided for the last four years by all the politicians and writers who fancy themselves as authorities on aviation, and by a number of RAF officers who thought that they saw for themselves opportunities for advancement in a separate Air Service which were obviously not open to them in the Senior Services. Perhaps one may be forgiven once more for saying, not for the first time, "I told you so".

THE BENEFITS OF SEPARATION

The segregation of the Naval branch of the Air Service is wholly excellent. One hopes that ultimately it will remove from the Air Force some of those Naval officers who, having been proved useless to the Navy, managed to foist themselves onto the RNAS and so came into the RAF automatically. There is now an unexpected opportunity of returning them with thanks to the Navy, where they will doubtless again find themselves, in the expressive Naval phrase, "on the beach".

When once they have gone, the RAF will be able to organise its administration and its staff-work on proper lines, and may become an efficient service like the Army. The purely Army side of the Air Service will be the better for being an integral part of the Army, and in friendly competition with this new RFC (one hopes to see the old honourable name and badges revived) the Royal Air Force will develop into a worthy part of the King's Armed Forces.

C G G

THE MEMORANDUM

Sir Hugh Trenchard's Memorandum reads as follows:

AN OUTLINE OF THE SCHEME FOR THE PERMANENT ORGANISATION OF THE ROYAL AIR FORCE

NOTE BY THE SECRETARY OF STATE FOR AIR

The scheme outlined in the following memorandum on the permanent organisation of the Royal Air Force has been prepared during the course of the present year under my directions by the Chief of the Air Staff, and has in principle received the approval of the Cabinet.

The many complications of the Air Service and its intricate technical organisation are not perhaps fully appreciated, even by those who take a general interest in the subject. It therefore appears desirable to lay this memorandum in both Houses of Parliament, in order that they may understand the character of the problem and the complications that are being faced.

It should be added that the financial provision which the Cabinet have approved as governing the scale of the Royal Air Force during the next few years is approximately 15 million pounds per annum. It is upon this basis that this scheme has been prepared, and it is upon this basis that it is hoped the Estimates of next year will, apart from any extraordinary expenditure which the military situation may render necessary, be framed.

Winston S Churchill

Dec. 11th, 1919

MEMORANDUM BY THE CHIEF OF THE AIR STAFF

1. **The Problem Confronting Us.** The problem of forming the Royal Air Force on a peace basis differs in many essentials from that which confronts the older services. The Royal Air Force was formed by the amalgamation of the Royal Flying Corps and the Royal Naval Air Service, and one may say, broadly speaking, that the whole Service was practically a war creation on a temporary basis, without any possibility of taking into account that it was going to remain on a permanent basis. The personnel with few

The Royal Air Force was formed by the amalgamation of the Royal Flying Corps and the Royal Naval Air Service



The Sopwith Pup served with the Royal Flying Corps and the Royal Naval Air Service before the formation of the RAF.

exceptions were enlisted for the duration of the war, and put through an intensive but necessarily hurried course of training. Material was created in vast quantities, but rapid development often rendered it obsolete almost before it had reached the stage of bulk production. The accommodation provided had perforce to be of an entirely temporary character. The force may in fact be compared to the prophet Jonah's gourd. The necessities of war created it in a night, but the economies of peace have to a large extent caused it to wither in a day, and we are now faced with the necessity of replacing it with a plant of deeper root. As in nature, however, decay fosters growth, and the new plant has a fruitful soil from which to spring.

The principle to be kept in mind in forming the framework of the Air Service is that in the future the main portion of it will consist of an Independent Force, together with Service personnel required in carrying out Aeronautical Research.

In addition there will be a small part of it specially trained for work with the Navy, and a small part specially trained for work with the Army, these two small portions probably becoming, in the future, an arm of the older services.

It may be that the main portion, the Independent Air Force, will grow larger and larger, and become more and more the predominating factor in all types of warfare.

2. Governing Principles. In planning the formation of the peace Royal Air Force it has been assumed that no need will arise for some years at least for anything in the nature of general mobilisation. It has been possible therefore to concentrate attention on providing for the needs of the moment as far as they can be foreseen and on laying the foundations of a highly-trained and efficient force which, though not capable of expansion in its present form, can be made so without any drastic alteration should necessity arise in years to come. Broadly speaking, the principle has been to reduce service squadrons to the minimum considered essential for our garrisons overseas with a very small number in the United Kingdom as a reserve, and to concentrate the whole of the remainder of our resources on perfecting the training of officers and men.

Egypt is the Clapham Junction of the air between east and west, and is situated within comparatively easy reach of most probable centres of unrest...

Fairy IIIDs stationed in Egypt.



It is intended to preserve the numbers of some of the great squadrons who have made names for themselves during the war, in permanent service units with definite identity, which will be the homes of the officers belonging to them, and will have the traditions of the war to look back upon.

There will be found in the Appendix a statement showing detailed particulars of squadrons, stations, schools, depots, etc, which it is hoped to provide in the next three years at home and abroad. It will be understood that this programme is to be regarded as provisional only.

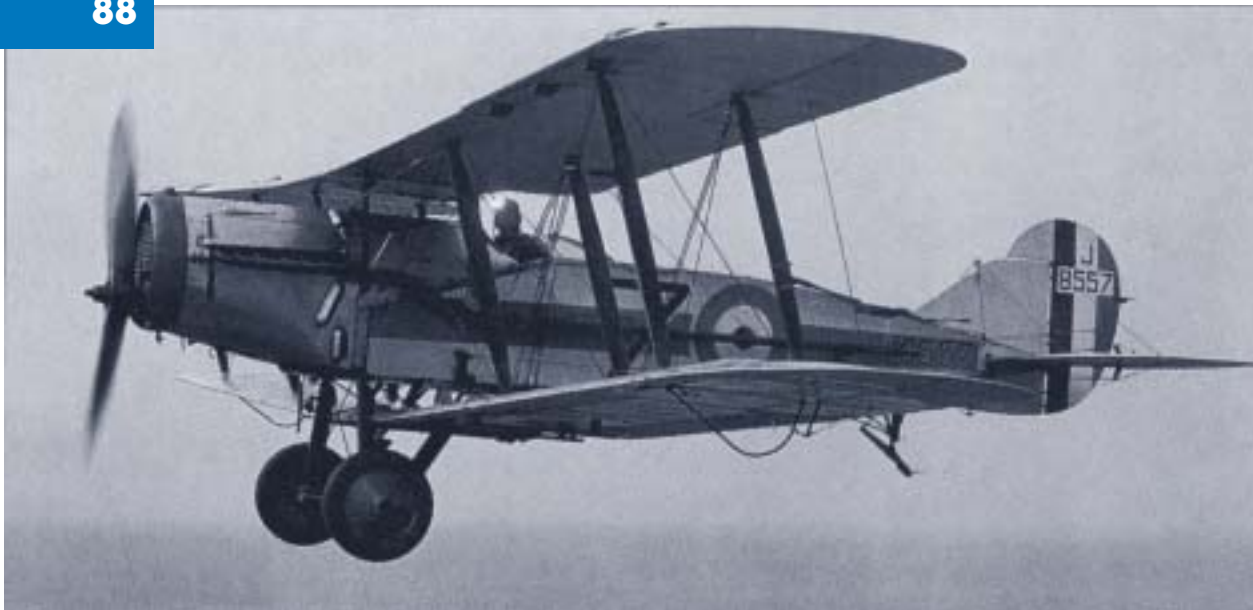
3. Service Units. It is proposed to provide 8 squadrons for India and 3 for Mesopotamia, with the necessary facilities for repair. As regards India this is in accordance with a proposal put forward from India and now under consideration by the Government of India. The cost of the units in India will fall on the Government of India on exactly the same basis as in the case of the military garrison. Recent events have shown the value of aircraft in dealing with frontier troubles, and it is not perhaps too much to hope that before long it may prove possible to regard the Royal Air Force units not as an addition to the military garrison but as a substitute for part of it. One great advantage of aircraft in the class of warfare approximating to police work is their power of acting at once. Aircraft can visit the scene of incipient unrest within a comparatively few hours of the receipt of news. To organise a military expedition even on a small scale takes time, and delay may result in the trouble spreading. The cost is also much greater, and very many more lives are involved.

The torpedo squadron will be maintained at sufficient strength to carry on the essential research work while the fighting squadron will be formed in the first instance at a strength of one flight only...

In Egypt it is proposed to station seven service squadrons. Under existing conditions in that country aircraft are a most valuable means of communication. Distances are long and ground communication confined to a few main routes. On the other hand the country and the climate are both ideal for flying. From a wider aspect Egypt is the Clapham Junction of the air between east and west, and is situated within comparatively easy reach of the most probable centres of unrest, and this added to its natural advantages for aviation, makes it the obvious locality for a small Royal Air Force reserve.

As regards our Naval bases and important coaling stations overseas, future developments will almost certainly lead to the necessity of providing aircraft as part of their garrisons, but in the majority of cases the need of this is not urgent under existing conditions, and for the present it is only proposed to station a small seaplane unit at Malta, and a similar unit in the Eastern Mediterranean, probably at Alexandria.

The Service squadrons quartered in the United Kingdom apart from those for co-operation with the Army and Navy will eventually number four, but not more than two of these squadrons will be formed in the next financial year. These squadrons will be employed on communication and similar duties in peace and will form a small reserve in case of need. For co-operation with the Army it is proposed to provide eventually squadrons on the basis of a flight per division for work with the troops at all stages of their training, and in addition one or more squadrons for co-operation with the artillery both during their winter training and their annual gun practice. During the next financial year it is proposed to form two squadrons in all, one at Farnborough for co-operation with the troops at Aldershot and Salisbury, and the second at Stonehenge for work with the artillery. Small units will, if necessary, be provided in addition for co-operation with the Garrison Artillery School at Golden Hills, and the Anti-aircraft School when formed.



Bristol F2B fighter.

The Aeroplane squadrons will consist of one reconnaissance and spotting squadron, one squadron of fighter machines and one of torpedo-carrying machines

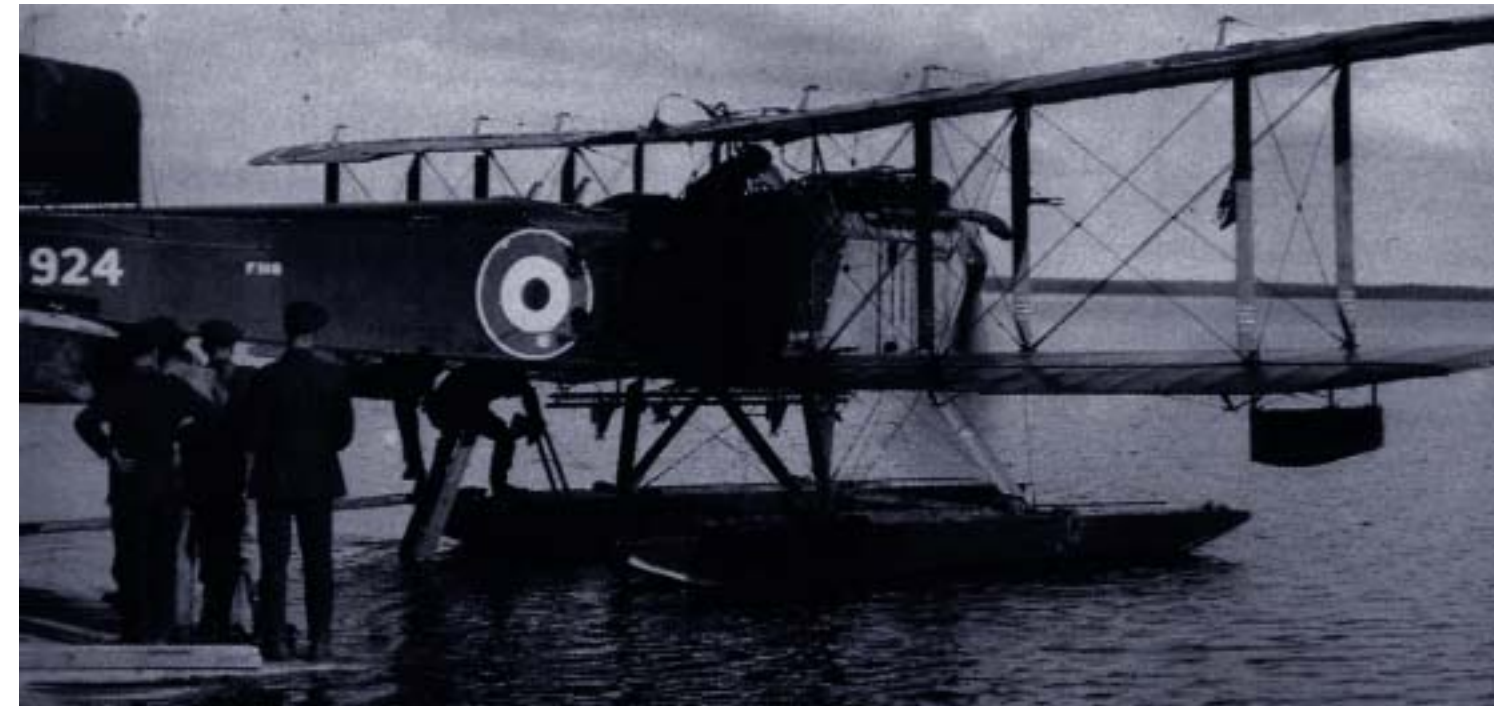
There remain the Service squadrons for co-operation with the Fleet. It is proposed eventually to provide at home three Aeroplane squadrons and two Seaplane squadrons. To secure economy and to give the units a corporate existence and ample facilities for practice it has been decided that aeroplanes will no longer be carried normally in capital ships as was done during the war, but will only be embarked when required to take part in Fleet exercises. The Aeroplane squadrons will consist of one reconnaissance and spotting squadron, one squadron of fighter machines and one of torpedo-carrying machines. The two former will be based on the Firth of Forth where ample facilities exist for practice and for the embarkation and disembarkation of machines, a most important point. The torpedo-carrying squadron will be located at Gosport, the most suitable station for torpedo work, and it is proposed to provide a small experimental unit at the same station in order to develop fully this form of co-operation with the Navy, which is of primary importance.

Of these three squadrons it is only proposed to provide one, the reconnaissance squadron, at full strength in the ensuing financial year. This is necessary in order to study and perfect the system of observation of artillery fire which from various causes was not so highly developed on the naval side as on the land side during the war. The torpedo squadron will be maintained at sufficient strength to carry on the essential research work while the fighting squadron will be formed in the first instance at a strength of one flight only. In addition, the Admiralty propose to keep two aircraft carriers in commission. One of these will be equipped with seaplanes for service abroad, while the other will remain at home and be used primarily for training and experimental purposes and ready if necessary to embark a flight of torpedo or other machines.

The provision of these two carriers is of the first importance since we must look forward to the time, as suitable machines develop, when fleets will so to speak take their aerodromes with them in the shape of a carrier, and the carriage of aircraft on capital ships with its attendant disadvantages and dangers will be a thing of the past.

The seaplane has obvious advantages over the aeroplane for long distance work over water, and a time may probably come when all work in co-operation with the Navy will be done by this class of machine

Fairy IIIc seaplane, 1919.



Of the two seaplane squadrons, it is only proposed at present to form one flight only. The seaplane has obvious advantages over the aeroplane for long distance work over water, and a time may probably come when all work in co-operation with the Navy will be done by this class of machine. For this reason, if for no other, it is essential to have a few such units.

The lighter-than-air service is a difficult problem. The cost of providing such a service on a large scale in peace is prohibitive, and the use of airships in war may be said to be still in the experimental stage. It is proposed therefore to keep one airship station only, namely Howden, where sufficient accommodation exists for two rigid and a few smaller ships, and to retain as a commencement one rigid and two non-rigids only. This will allow research work and development to continue, and the use of airships in peace and war to be further studied.

4. Reserves. Although mobilisation on a large scale is not taken into account, it is very necessary to provide a small reserve to meet any sudden call in the case of a small war anywhere in the Empire. For the next year or two there will, doubtless, be no difficulty in enrolling as many ex-officers and men as are likely to be required, and all that will be necessary will be to provide facilities for their training and practice flying.

It is intended, however, if possible, in addition to lay the foundation of a future Air Force on a territorial basis. No detailed scheme has yet been worked out, but it is probable that the eventual organisation will provide for training both on a unit and on an individual basis. It is hoped that the manufacturing and commercial firms will assist by forming units of their employees. In addition there will doubtless be many

individuals who will be glad to train themselves voluntarily with a certain amount of State assistance, and to undertake to serve, either overseas or at home, if called upon to do so. It is not intended to embark on the formation of any units during the next financial year, but it is proposed to commence with the training of individuals in the populous centres. This training will be carried out at the flying training wings whose functions will be described below.

5. Extreme Importance of Training. We now come to that on which the whole future of the Royal Air Force depends, namely, the training of its officers and men. The present need is not, under existing

...we must create an Air Force spirit, or rather foster this spirit which undoubtedly existed in a high degree during the war, by every means in our power

conditions, the creation of the full number of squadrons we may eventually require to meet strategical needs, but it is first and foremost the making of a sound framework on which to build a service, which while giving us now the few essential service squadrons, adequately trained and equipped, will be capable of producing whatever time may show to be necessary in future.

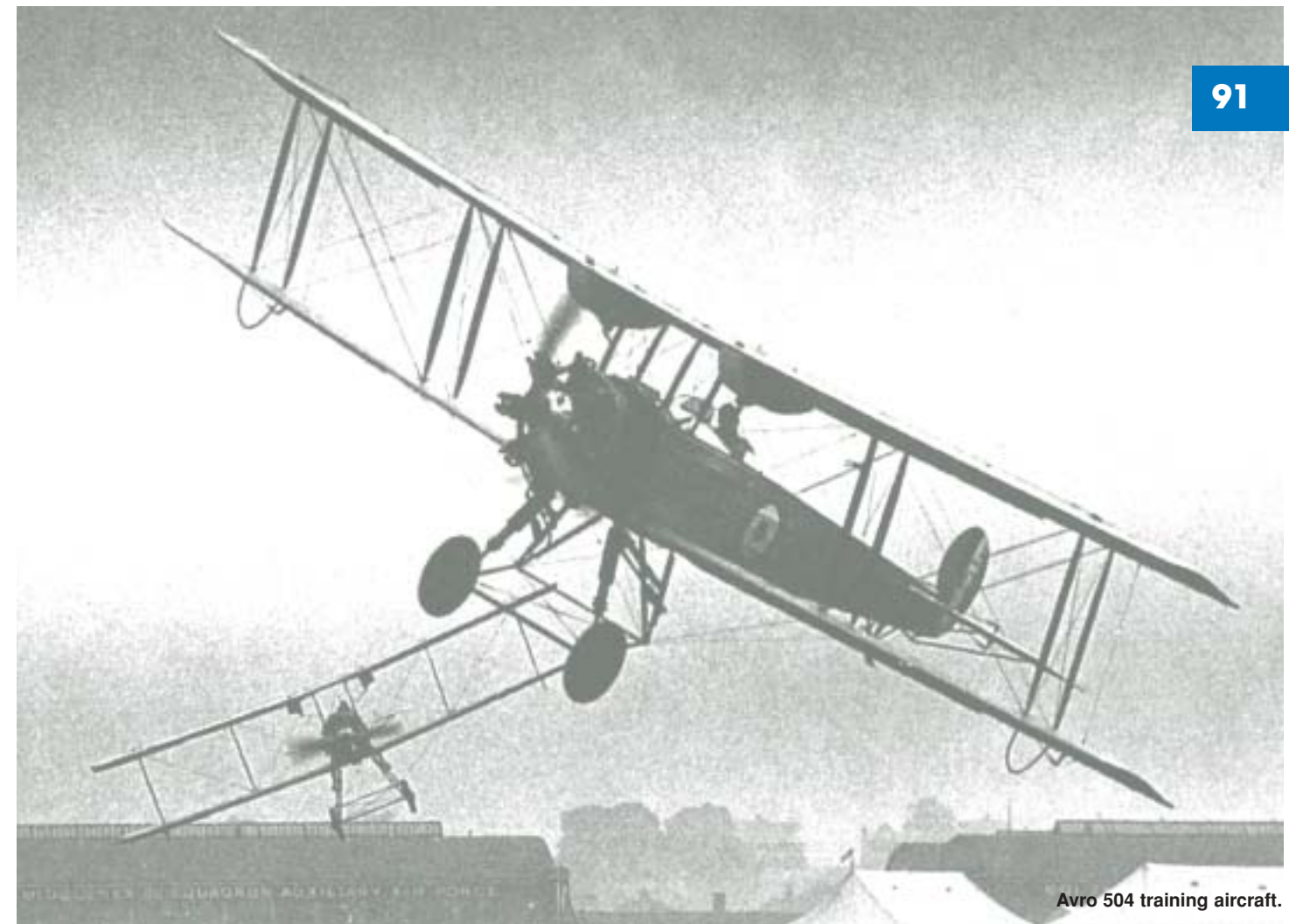
Before explaining our proposals in details it is necessary to lay down certain postulates. Firstly, to make an Air Force worthy of the name, we must create an Air Force spirit, or rather foster this spirit which undoubtedly existed in a high degree during the war, by every means in our power. Suggestions have been made that we should rely on the older services to train our cadets and Staff officers.

To do so would make the creation of an Air Force spirit an impossibility apart from the practical objection, among others, that the existing naval and military cadet and staff colleges are not provided with aerodromes or situated in localities in any way suited for flying training.

Secondly, we must use every endeavour to eliminate flying accidents, both during training and subsequently. This end can only be secured by ensuring that the training of our mechanics in the multiplicity of trades necessitated by a highly technical service, is as thorough as it can be made. The best way to do this is to enlist the bulk of our skilled ranks as boys and train them ourselves. This has the added advantage that it will undoubtedly foster the Air Force spirit on which so much depends.

Thirdly, it is not sufficient to make the Air Force officer a chauffeur and nothing more. Technical experts are required for the development of the science of aeronautics, still in its infancy. Navigation, meteorology, photography and wireless are primary necessities if the Air Force is to be more than a means of conveyance, and the first two are requisite for safety, even on the chauffeur basis.

6. Training of Officers. It is now necessary to sketch very briefly the training proposed for both officers and men. Owing to the necessity for a large number of officers in the junior ranks, and to the comparative paucity of higher appointments, it is not possible to offer a career to all. Consequently some 50 per cent only of the officers have been granted permanent commissions, the remainder being obtained on short service commissions or by the seconding of officers from the Army and Navy. Great importance attaches to the last class since an interchange of officers is bound to make for closer and more intelligent co-operation between the services.



Avro 504 training aircraft.

...cadets will be given a thorough grounding in the theoretical and practical sides of their profession, and will in addition learn to fly the approved training machine, at present the Avro

The channels of entry for permanently commissioned officers will be through the Cadet College, from the Universities and from the ranks. The cadet college will be the main channel. The course will last two years, during which the cadets will be given a thorough grounding in the theoretical and practical sides of their profession, and will in addition learn to fly the approved training machine, at present the Avro. The college is to open at Cranwell in Lincolnshire early next year, an ideal place for the purpose, with a large and excellent aerodrome and perfect flying surroundings. It will be necessary to accommodate the college temporarily in huts erected during the war, but every endeavour has been made to render these as suitable as possible, and it is proposed to erect a permanent college in the near future. On leaving the college, cadets will be commissioned, and will undergo a short course in air pilotage and practical cross-country flying at Andover. This school will probably not be required before early in 1921. As soon as the cadets have passed this course they will be posted to a service squadron, as it is most important that they should join a unit which they will regard as their home, as the sailor does his ship, or the soldier his regiment, as early as possible. Subsequently they can undergo a course of gunnery, without which no flying officer can be regarded as a service pilot. The gunnery school will be established at Eastchurch, but as

the bulk of our present pilots have war experience, will not be required in the next financial year. After 5 years' service, officers will be required to select the particular technical subject they will make their special study during their subsequent career, eg navigation, engines, wireless. Short and long courses will be provided in these subjects in order to cater both for the officer who wishes to continue primarily as a flying officer with a working knowledge of one or more technical subjects, and for those who wish to become really expert in a particular branch. Technical knowledge will, inter alia, qualify an officer for selection for high command.

The career of officers commissioned from the Universities or from the ranks – except in the case of boy mechanics receiving commissions, whose case will be dealt with later – will be identical with that of those from the cadet college, except that they will be taught to fly at a flying training wing before joining their squadrons. Short service and seconded officers will be taught to fly at training wings and will attend a course of aerial gunnery and probably one of air pilotage. In view of their short service, it is not proposed, save in special cases, to send them through the advanced technical courses. These officers will be eligible for promotion during their service in exactly the same way as the permanent officers. The technical schools required at once are those dealing with navigation, wireless, photography and engineering. Aerial navigation is practically a new science. An attempt has been made during the current year to work out the theoretical principles in practice at Andover, and considerable progress has been made, but it is obvious that the chief need of aerial navigation will arise when flying over the sea, where the map is of no service, and it is consequently proposed to reopen this school at Calshot in the spring of next year.

A liberal amount of dual control with a qualified instructor is one of the chief safeguards against the faulty flying which is the cause of the majority of accidents

Schools of wireless and photography are now in existence at Flowerdown, near Winchester, and at Farnborough respectively, while it is proposed to commence an engineering course, at a suitable station, shortly after Christmas.

For the training of University candidates, short service and seconded officers and officers of the reserve or Territorial Force, it is estimated that seven training wings would eventually be required.

In view, however, of the fact that the short service list has been filled by officers who have already been trained as pilots during the war, it is only proposed to form two of these on a reduced basis during the next financial year to deal with the training of University candidates, a small number of reserve officers and of certain officers granted permanent commissions, with the proviso that they must learn to fly within 12 months. In view of the exceptional facilities for training in Egypt, it is proposed to locate, at least one of the training wings, together with branch schools of gunnery and air pilotage, in that country, but whether it will be convenient to do so next year cannot yet be definitely foreseen.

One other most important school in connection with the training of the officer is essential, and it will probably be necessary to start it on a small scale in 1920. This is a school for flying instructors. The first school of this kind was started during the war at Gosport, and it is hardly too much to say that it revolutionised the art of flying. The science of flight was carefully analysed and the analysis practically applied to the problem of tuition with remarkable results. It is essential in future that all instructors in training wings and all officers of or above the rank of flight commander in service squadrons should have passed through this course. A liberal amount of dual control with a qualified instructor is one of the chief safeguards against the faulty flying which is the cause of the majority of accidents.

Although it is not proposed to open it during the next financial year, an Air Force Staff College must be formed as soon as possible. It is intended to establish this at Halton in the house of the late Mr Alfred Rothschild, purchased by the Government at his death with the whole estate. The house and its surroundings are eminently suited for the purpose, and there is an aerodrome within a quarter of a mile.

7. Training of Men. The most difficult problem of all in the formation of this force is the training of the men. Demobilisation has removed most of our best mechanics, and the efficiency of the squadrons to be formed depends on the most thorough instruction of those who are to take their place. It has, therefore, been decided to enlist the bulk of those belonging to long apprenticeship trades as boys, who will undergo a course of three years' training before being passed into the ranks. With a preliminary training of the nature contemplated and the practice of their trade during their subsequent service, it is confidently anticipated that these mechanics on passing to civil life will have no difficulty in securing recognition as skilled tradesmen. This is an important consideration, since any tendency for the Air Force to be regarded as a blind alley occupation, would be fatal.

The training of all these boys will eventually be carried out at Halton Park, where ample and well-equipped technical shops are already in existence. Pending the erection of permanent barracks to replace wooden war-time huts, use will also be made of Cranwell, in Lincolnshire. It has been necessary to speed up the training of some 5,000 boys enlisted during, and shortly after the war, and the residue of these, some 3,000, will complete their training at Halton. A scheme has been drawn out for the future enlistment of boys by means of a competitive examination, and local education authorities have been circularised with a view to their nominating suitable boys to sit for the examination. By this means it is hoped to secure a really high standard. The first entry under this scheme will take place early in 1920, and the boys will commence their training at Cranwell and will be moved to Halton as soon as the permanent accommodation is ready.

The boys, on successfully passing their final examination, will be graded as leading aircraftsmen, and a certain number will be specially selected for a further course of training, at the end of which they will either be granted commissions, or promoted to corporal. Those granted commissions will join the cadet college.

It is intended to enlist the remainder of the mechanics, of whom more than half will belong to short apprenticeship trades as men, and these will undergo 12 months' training at Cranwell as soon as the boys have moved to Halton. Pending the move, it is proposed to carry out the training of these men at Eastchurch, which, as has already been said, will not be required in its eventual capacity as a gunnery school for another 12 months at least. Non-technical men will be given a short course of recruit training at the depot at Uxbridge.

8. Higher Organisation at Home. As regards higher organisation in the United Kingdom, all units working with the Navy have lately been formed into one command known as the Coastal Area Royal Air Force. The two remaining commands, now known as the Southern and Northern Areas, will, early in 1920, be amalgamated into one command to be known as the Inland Area. This cannot be done earlier owing to the very large amount of work entailed in closing up surplus stations, demobilising surplus personnel and generally clearing up the after effects of the war.

9. Depots. Each of the two Areas in the United Kingdom will have its repair depot, at Henlow for the Inland Area, and at Donibristle, near Rosyth, for the Coastal Area. During the next financial year it will be necessary to retain three of the existing stores depots, but it may prove possible at a later date to reduce the number to two, though this is by no means certain. It is hoped that eventually arrangements will be made for all Royal Air Force mechanical transport to be repaired at Slough, but in view of the arrears of work it will be necessary to retain for the present our own repair depot at Shrewsbury. Each overseas theatre will have a combined repair and store depot of a size suitable to the number of squadrons based there.

10. **Necessity for Large Capital Outlay on Accommodation.** From the above outline of our proposals it will be seen that every endeavour is being made to reduce expenditure on personnel during 1920-1921 to the minimum absolutely essential to create the framework of our future Air Force. This is necessary, if for no other reason, owing to the peculiar position in which the Royal Air Force is placed as regards permanent accommodation. Though some of the wartime buildings can be made to serve for a year or two in their present state, the Air Force does not possess one single permanent barracks, and a large capital outlay on the provision of new buildings and the adaptation of the most suitable of the temporary buildings is inevitable during the first few years. This will be balanced to a certain extent during the next two years by the small requirements in technical equipments due to the large stock remaining over from the war. The principle followed has therefore been to exercise rigid economy at the outset over personnel and technical equipment in order to free as large a part as possible of the total sum provided towards the provision of barracks. As time goes on, the building services will absorb less, while the cost of technical equipment, and to a lesser extent, of personnel, will increase, until eventually the works vote will be little in excess of the cost of maintenance.

It must be recognised, however, that the total cost of building will be large. The boys’ barracks at Halton, for instance, with the necessary accessory buildings and the cadet college will no doubt be a heavy item. These are undoubtedly the two most expensive services, but the accommodation for personnel at the majority of our stations will have to be rebuilt or adapted at considerable cost. The outlay must, however, be faced, and it is undoubtedly wise to undertake the bulk of the work in the first few years, while the expense of other services can be kept down.

11. **Research.** One matter of supreme importance has not yet been mentioned, namely, the provision to be made for research. The departments of Supply and Research are now being transferred from the Ministry of Munitions to the Air Ministry, and a portion of the experimental establishments are a charge on the Air Force votes. Steady and uninterrupted progress in research is vital to the efficiency of the Air Force, and to the development of aviation generally, and on it depends both the elimination of accidents and the retention of the leading position we have established at such heavy cost during the war. The exist-ing establishments must therefore be retained during the ensuing financial year at a sufficient strength to ensure that urgent work shall continue. Some of the work which was urgent under war conditions can, however, now be postponed until progress with the building programme liberates more money for other purposes. The principal aeroplane research establishments are at Farnborough, Biggin Hill, Martlesham Heath, and Grain, while airships’ research will be undertaken at Cardington and Howden.

12. **Civil Aviation.** No allusion has been made to civil aviation in this paper, which has been confined to the Service aspect of the question.

Air Ministry, Nov. 25th, 1919.

H. M. TRENCHARD,
Chief of the Air Staff.

APPENDIX

	Existing or to be formed in 1920-21	Increase during 1921-22 to	Increase during 1922-23
I. UNITED KINGDOM			
Striking Force.....	2 Squadrons.	4 Squadrons.	No increase.
Training Wings.....	2 Wings each of 3 Squadrons.	5 Wings.	6 Wings.
Co-operation with Army Divisions.	1Squadron.	2 Squadrons.	No increase.
Co-operation with Fleet (Home Waters).	1 Squadron Reconnaissance and Artillery machines. 1 Flight Ships' fighters. 1/2 Squadron Torpedo machines. 1 Flight Flying Boats. 1 Flight Float Seaplanes. 1 Squadron.	No increase. 1 Squadron Ships' fighters. 1 Squadron Torpedo machines. 1 Squadron Flying Boats. No increase. No increase.	No increase. No increase. No increase. 2 Squadrons Flying Boats. No increase. No increase.
Communication Squadrons.....	4 Stations for Aeroplanes, Seaplanes, Torpedo machines and Wireless respectively.	4 Stations as before and trial ground for bombs and machine guns in addition.	No increase.
Experimental Stations.....	Cadet College. Navigation School. Administrative and Technical School for Officers. Wireless and Electrical Training School. School of Photography. School of Co-operation with Navy. School of Co-operation with Army. Balloon Training. Airship Training. Boys' Training Centre. Technical Men's Training Centre. RAF Depot and Non-Technical Men's Training Centre.	As for 1920-21, and in addition: School of Air Pilotage. School of Gunnery. (NB – The majority of the Schools will be on a reduced basis in 1920-21, and will gradually increase to full strength in the two succeeding years).	As for 1921-22, substituting Staff College for Administrative and Technical School for Officers, and in addition, Flying Officers' Training College (for the preliminary training of direct entry Officers).
Schools and Training Centres.....	2 Aeroplane Repair Depots. 1 MT Repair Depot. 3 Stores Depots.	} } No increase. }	No increase.
Depots.....	1 Station.	As for 1920-21 except that the MT Repair Depot will drop out as soon as the repair work for RAF vehicles can be undertaken at Slough.	As for 1921-22.
Airships.....		No increase.	No increase.
II. OVERSEAS			
India	8 Squadrons. 1 Depot.	No increase.	No increase.
Egypt	7 Squadrons. 1 Depot.	7 Squadrons. 1 Depot. 1 Training Wing.	7 Squadrons. 1 Depot. 1 Training Wing. 1 School of Air Pilotage. 1 School of Gunnery. No increase.
Mesopotamia	3 Squadrons. 1 Depot.	No increase.	No increase.
Malta	1 Flight Seaplanes.	1 Squadron Seaplanes.	No increase.
Alexandria	1 Flight Seaplanes.	1 Squadron Seaplanes.	No increase.
Mediterranean	1 Flight Float Seaplanes on Carrier.	No increase.	No increase.

Escape to Freedom

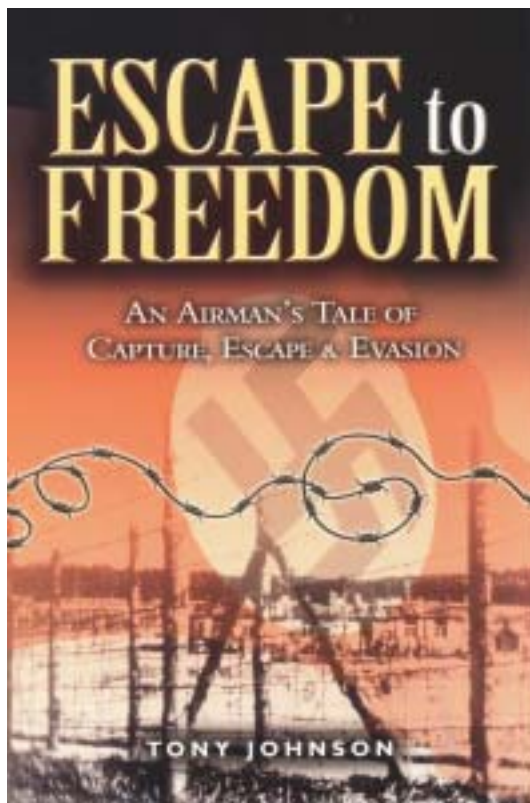
An Airman's tale of Capture, Escape and Evasion

by Tony Johnson

Price: £19.95

ISBN: 0 85052 894 1

Publisher: Pen & Sword Books Ltd



Escape to Freedom tells the story of Tony Johnson's experiences in the RAF, his imprisonment and the treatment suffered by him and his fellow prisoners at the hands of the Germans, before he finally escaped and made his way home to England and to the girl who had waited for him.

Tony Johnson was a wireless operator/airgunner in a Vickers Wellington bomber during the Second World War. When he arranged to meet his new girlfriend, Joyce, he could not have known that he would be unable to keep that date until the end of the war. Shot down over Germany on his next mission, he parachuted to safety. In spite of a valiant effort to evade capture, he was eventually apprehended and sent to a prisoner-of-war camp to sit out the rest of the war. But Johnson had no intention of remaining a prisoner and looked for every opportunity to escape. Eventually that moment came and he was free for a short time before recapture. He was a POW for two years until finally managing to escape successfully.

The First Blitz

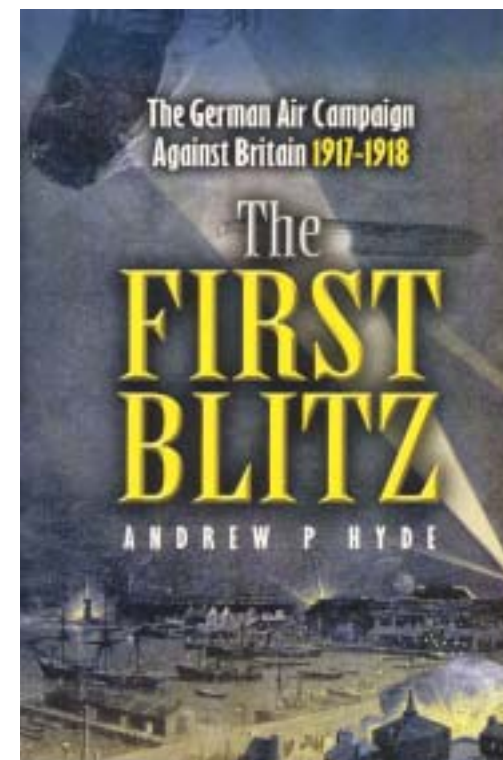
The German Air Campaign Against Britain 1917-1918

by Andrew P Hyde

Price: £19.95

ISBN: 0 85052 812 7

Publisher: Pen & Sword Books Ltd



In 1917 the Germans launched a major air campaign against the British mainland which shocked the whole nation and terrorised the south-east of England.

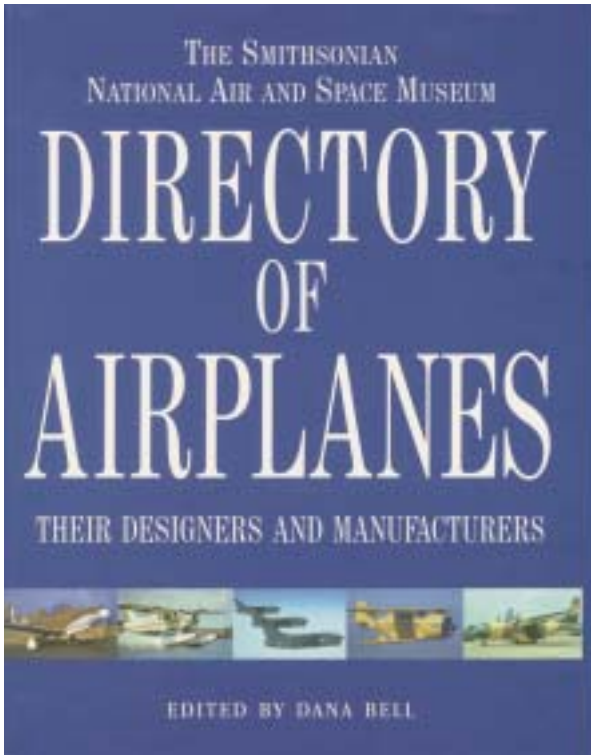
These attacks by German bombers caused hundreds of deaths and injuries, but until now the full details of those raids have never been fully told. These range from the massacre of Canadian troops resting in Folkestone 25 May 1917, to the widespread carnage of shoppers a couple of miles away in the city centre.

Sheerness, then a major dockyard for the Royal Navy, barely escaped a similar fate when it too was singled out, and a 50kg bomb struck Upper North Street School on 13 June 1917, killing eighteen school children, many as young as five years, and mutilating many more. There were many more similar tragedies which terrified the populace of London and horrified the world.

This account of the German's terror campaign plus the military and political circumstances surrounding it, follows years of original and painstaking research, interviews and correspondence with those who remember that period.

edited by Dana Bell

Price: 25.00



This valuable directory contains a wealth of data on the history of aviation and attempts, for the first time, to identify every active aircraft manufacture and the aircraft they produced. The directory serves as a unique guide to the sheer number and variety of air craft produced in the last hundred years and more than 25,000 different aircraft are included. Naturally these vary from the famous - such as the Supermarine Spitfire family - to the less well-known, such as the Weltensegler Feldberg manufactured in Germany in 1921, the Fawkes Centrifugal Aeroplane of 1909 or the czech Smolik SM 1.

The directory has thousands of entries with, for each manufacturer or designer, the names of all the classes of aircraft produced. Types of aircraft include airplanes (powered fixed wing); unpowered fixed wing such as gliders; powered-rotor rotorcraft such as helicopters; and unpowered-rotor rotorcraft such as autogiros. entries are cross-referenced and brief histories of important companies have been added to enable the researcher to chart mergers, closures and name changes.

MILITARY AIRSHOW TO STAGE 2003 NATIONAL DEFENCE EVENT

The Royal Air Force has nominated The Royal International Air Tattoo (RIAT), to host a three-day *Defence 2003* event from 18th — 20th July 2003, when the RAF will take the tri-service lead in 'Taking Defence to the Nation'. The Defence 2000 series of events replaces the Royal Tournament at Earl's Court, following a Ministry of Defence decision that called for a more extensive public forum to display the complexity and capability of the UK's modern Armed Forces.

Air Chief Marshal Sir Peter Squire, Chief of The Air Staff, says "The *Defence 2000* series is an exciting development in the presentation of Britain's Armed Services to the nation, and in 2003 the RAF will be proud to act as host for this high-profile occasion. I am also delighted that The Royal International Air Tattoo, for three decades the world's largest and most prestigious military airshow, will provide the venue for *Defence 2003*."

2003 also marks 100 years of powered flight and this momentous anniversary will be celebrated alongside British Forces demonstrating their main role today, expeditionary operations. A fictional trouble spot somewhere in the world will be created on the airfield at RAF Fairford. Spectators will see the planning, equipment and mission expertise of all three Services in a realistic environment, enhanced by big screen coverage of all the action as it unfolds. A century of aviation, and the achievements of aircraft designers and test pilots, will see a living history of period set pieces highlighting aircraft that have pushed back the frontiers of flight.

RIAT Director Paul Bowen says "Most breakthroughs in aeronautical technology can be traced to defence needs, and it could not be more appropriateto link 100 Years of Aviation with *Defence 2003*. We are working closely with the RAF and a special tri-service team to stage next year's most spectacular national event."

Around RIAT and *Defence 2003*, the RAF will be hosting the bi-annual Armed Forces Careers Convention and the Chief of The Air Staff will head a conference of Air Force Commanders from round the world. Finally, it is intended that up to 20,000 young people will attend the RIAT/Defence 2003 preview day on Friday 18th July 2003.

For more information contact:
Group Captain Chris morris (RAF Defence 2003 Project Leader) 01285 713300 (x5601)
Patti Heady (RIAT PRO) 01285 713300 (x5341)

ROYAL AIR FORCE HISTORICAL SOCIETY

Formed in July 1986, to study the history of Air Power and examine the creation of Military Air Power and studies of various topics including: The strategic bomber offensive, Berlin Airlift, The V Force, The RAF in the Far Eastern War, Falklands and Contemporary Air Power.

Lectures, Seminars and Discussions and Journal are held. Self Financing, £15 membership per annum.

For more information and an Application Form contact: Dr Jack Dunham, Silverhill House, Coombe, Wotton-u-Edge, Glos, GL12 7ND, Tel: 01453 843362.

The central objective of the Society is to bring together those involved in Royal Air Force activities in the past and those concerned today so that we can learn more about its history.



Forthcoming Services and Events

Thursday, 3rd October 2002 at 12 noon. Thanksgiving Service for the life of Group Captain John "Cat's Eyes" Cunningham, CBE DSO** DFC* AE.

Sunday 10th November 2002. Remembrance Day Service.

Carol Services:

Monday 9th December 2002 at 6 pm. The Savage Club.
Tuesday 12th December at 12.15 pm. Exxon Mobil.
Thursday 12th December at 5 pm. Lawrence Graham.
Sunday 15th December at 11 am. St Christopher's Fellowship.
Thursday 19th December at 12 noon. Shell.
Thursday 19th December at 6 pm. Taylor Joynson Garrett.

NOTES