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Cover pictures
Buccaneers of Nos 12 and 206 Squadrons RAF

First cover: No 12 Squadron
Back cover: No 206 Squadron

The Buccaneer was designed to a naval requirement for a low-level, high-speed carrier strike aircraft for the Royal Air Force (RAF). The first prototype made its maiden flight in 1964, and the aircraft formed part of the FAA force line between 1966 and 1976.

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-RAF Buccaneers were acquired by the RAF: Nos 12, XV, 15 and 206 Squadrons and Nos 272/273 Operational Conversion Units. In 1983, Nos 12 and 206 Squadrons were re-equipped with Tomatoes GR1s, with their Buccaneers being grounded.

RAF Buccaneers units based in Germany transitioned to the Tomatoes GR1 in 1983-84. However, Nos 12 and 206 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 Kinloss, Falklands, using their Paveway II laser designators to take targets for Tomatoes armed with Paveway IIIs.

Operation Granby was to prove the reasoning of the Buccaneer: No 12 Squadron re-equipped with Tomatoes GR1s in 1984 and in the following year No 206 Squadron disbanded, bringing to an end the twenty-five-year career of the Buccaneer in the RAF service.

Main cover picture: Air(MHF)
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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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.

D Def S (RAF)
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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. 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. 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.
The First World War saw powered flight and balloons being used extensively for reconnaissance purposes. 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. 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.7 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.8 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 war where Mauberge was under siege by Dutch and Austrian forces whose disposition was reported in detail by the aeronaut.9 This success was repeated on 26 June 1794 when the French used a balloon to observe Austrian troop movements at the Battle of Fleurus.10 The need to know your enemy extends beyond the psychological imperative of under-standing 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 effects 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 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.11 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.

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 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 a tendency to believe that there has been a trend over time, especially in the period before and after World War I, when air power as a concept was still in its infancy. In reality, the development of air power during this period was largely driven by political and economic factors, and the role of air forces was largely confined to supporting land operations.

For those unfamiliar with the ‘finer points’ of air control, an example of air power in action is given below:

During the First World War, the Royal Air Force played a crucial role in supporting the war effort. The RFC, as it was then known, provided reconnaissance and gunners for the ground forces, and later developed into a full-fledged air force. By the end of the war, it had become clear that air power was an essential part of modern warfare.

As the inter-war period began, the Royal Air Force continued to grow in size and capability. The RFC had already demonstrated the potential of air power in supporting land operations, and this was further confirmed during the inter-war period. The development of air power during this period was largely driven by political and economic factors, and the role of air forces was largely confined to supporting land operations.

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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 Blitzkreig. 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.
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. 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. 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 Attlee 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. Allies decided 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. 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. 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.

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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 implied threat of nuclear attack, allied with credible means of delivery, is at the heart of deterrence theory. 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 whereby providing more lucrative targets; similarly political restrictions were increasingly relaxed. 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.

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 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. 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.

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. 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.

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. 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.

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

interminable 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.35 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’.36 The synergy in names and appointments is obvious to students of air power a decade later.

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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 a 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.40

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 casu- al, 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 pro- duced 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.37 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 Schwarzkopf. Warden was moved quickly into the Air Force planning staff in the Pentagon where he ran the planning staff, better known as ‘Checkmate’.38

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 arsen, 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 Jashtreb 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 Brnik 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 Ubdena 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.

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

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
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 worked 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. 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.

**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 Overy’s admonition that the process should be subject to ‘constant and critical interrogation’. No aviator, of whatever colour cloth, would claim a monopoly on wisdom on air matters. Nor would any air power advocate, academic or apologists 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 endeavor. 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 we 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 that 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.

way forward. Allied Force commenced at 1800 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. 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.
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.21

Notes:
3. For a counter view suggesting, inter alia, that the Great War strategists had their option but to engage in a war of attrition — that we eventually won — see Gary Sheffield, Forgotten Victory. The First World War Myths and Realities, Headline, London, 2001.
4. The ‘Indirect’ approach was advocated by Basil Liddell-Hart; see chapter 6 of Alex Danchur, Aeschtem of War, the Life of Basil Liddell-Hart, Weidenfeld and Nicolson, London, 1998.
13. Holbrooke, To End a War, page 61.
16. Holbrooke, To End a War, pages 145 – 150.
17. Thomas Gugino, ‘Do airstrlets amount to an effective policy’, RUSI Journal, April/May 1999 page 17 is quite specific over the involvement of regular Croatian Army troops.
18. Holbrooke, To End a War, pages 147 and 160.
20. The USMC were making parallel developments largely thanks to the work of USAF Colonel John Boyd whose writings and views were something of anathema in his own Service: see Grant T Hammond, The Mind of War, John Boyd and American Security, Smithsonian, Washington, 2000.
22. Holbrooke, To End a War, pages 145 – 150.
25. Holbrooke, To End a War, page 61.
28. Holbrooke, To End a War, pages 147 and 160.
34. Clodfelter, ibid, Epilogue.
35. Field Marshal Lord Guthriel was responsible, through a series of Commands in (and latterly of) the British Army of the Rhine for step change in thinking. Ironically the USMC were making parallel developments largely thanks to the work of USAF Colonel John Boyd whose writings and views were something of anathema in his own Service: see Grant T Hammond, The Mind of War, John Boyd and American Security, Smithsonian, Washington, 2000.
37. USMC were making parallel developments largely thanks to the work of USAF Colonel John Boyd whose writings and views were something of anathema in his own Service: see Grant T Hammond, The Mind of War, John Boyd and American Security, Smithsonian, Washington, 2000.
39. Holbrooke, To End a War, page 61.
41. For a fuller discussion, see the chapter by the author in Colin and Gary (Eds), Air History, Turning Points from Kitchkhay to Kosovo, Frank Cass, London, forthcoming.
42. Mason, Air Power, A Centennial Appraisal, ibid, page 166.
47. Holbrooke, To End a War, pages 147 and 160.
49. Conversino, ibid, page 153.
The long gestation and difficult birth of the 2nd Tactical Air Force (RAF)

By David Ian Hall

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.
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.

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 historian, ‘it inevitably became embroiled in all the troubles which frustrated its RAP peers, in addition to those problems inherent in the broader picture of Anglo-Canadian co-operation.’

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, 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.

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.1 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.2 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.3 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,4 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.5 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.

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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.6

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 control and command. 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
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.

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

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...
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,\(^{22}\) 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.\(^ {23}\)

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.\(^ {24}\) 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 battling force’ 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.\(^ {25}\) 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.\(^ {26}\)

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...
of joint army-air conferences and exercises aimed at solving the air support problem. 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. 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 cooperation. They are goodwill (the willingness to co-operate), sound principles and tactics, and reliable communications. 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. 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.

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. 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. 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.

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...
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.40

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.41 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.42

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’.43 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 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 sup- port was not frittered away on attractive yet inconsequential tasks.44 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.45

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 oper- ating procedures confused both soldiers and airmen alike, and inaccurate weapons, namely rockets and free-fall bombs, made for a fairly blunt and resource intensive instrument.46 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 analyses, 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.
8. 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 analyses, 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.
9. During the war, British aircraft were deployed on reconnaissance missions, artillery observation, air transport, escort and interdiction missions, ai-to-air combat, bombing and strafing enemy troops and positions, close air support, direct air support, indi- rect 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 I (London, 1936); Sir W. Shelford Bidwell, Years of Combat. A Personal Story of the First World War in the Air (London, 1936); Lee Kennett, The first air war. 1914-1918 (New York, 1991); and S. F. Wise, ‘Canadian Armens and the First World War’, The Official History of the Royal Canadian Air Force vol 1 (Toronto, 1985).


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

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


7. Brooke-Popham Papers VI/12, ‘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.


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

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


14. PRO WO 193/685 Notes on the General Staff Memorandum on Services Required from the RAF for the Field Force, May-June 1940.


16. PRO WO 159/985 Notes on the General Staff Memorandum on Services Required from the RAF for the Field Force, May-June 1939.

17. 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.

18. Group Captain A.H. Wann commanded the Advanced Air Striking Force, RAF (AASF) light bomber squadrons in France in 1940 and Colonel J.D. Woodhall 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 (1945-41); and Ian Gooderson, op cit, pp.24-25.


22. PRO WO 193/685 Notes on the General Staff Memorandum on Services Required from the RAF for the Field Force, May-June 1940.

23. 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.


25. PRO WO 159/985 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.


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. Woodhall 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 (1945-41); and Ian Gooderson, op cit, pp.24-25.


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 also PRO AIR 39/140 Close Support by Bomber and Fighter Aircraft (1945-41); and Ian Gooderson, op cit, p.164.


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.
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...

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 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 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. Air Force Chief of Staff General John P. McConnell convinced the other service chiefs to upgrade the Air Force organization in South Vietnam. Second Air Division (2nd AD) exercised 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. Air Force Chief of Staff General John P. McConnell convinced the other service chiefs to upgrade the Air Force organization in South Vietnam. 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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. 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.

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

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.20 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 of targets or anything else. It all worked fine.”21 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...
The route packages deconflicted those air operations much as they had during the Korean War. Enemy opposition was mostly confined to defending target areas. Divided command arrangements facilitated each service's semi-autonomous 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. Prolonged 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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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 inter-
service cooperation.


5   U.S. Congress, Senate, Committee on Armed Services, Air War Against North Vietnam, Hearings before the Preparedness


7   Clodfelter, p. 129 summarizes the route package system.


9   Headquarters PACOM, Operations Division, Rolling Thunder Digest, all vols., p. 2.

10  Rolling Thunder Digest, all vols., p. 2.

11  Rolling Thunder Digest, Jr., Sep. 1965, p. 16.


16  Momoyer, p. 95.


18  Maj. Gen. Meyers, OHI transcript, p. 82.

19  U.S. Congress, Senate, Committee on Armed Services, Air War Against North Vietnam, Hearings before the Preparedness
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21  Thompson, p. 76.
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 (49 now at Sumburgh, 50 in store at Glascott), 104 inert-filled (including 60 at Turnberry and 20 at Manston). The critical factor, however, was that no conclusive drop had yet been made.
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 the design of the weapon. At various times, separate documents of the manufacturer's tests showed that a bomb of 19.5in diameter, having a mass of 600lbs, could be halved before hitting the water. Considering that it was a comparatively high speed of delivery that was required, this was not unreasonable. In truth, both the method of delivery and even the specifications of the weapon, notably the diameter, 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.

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 the design of the weapon. At various times, separate documents of the manufacturer's tests showed that a bomb of 19.5in diameter, having a mass of 600lbs, could be halved before hitting the water. Considering that it was a comparatively high speed of delivery that was required, this was not unreasonable. In truth, both the method of delivery and even the specifications of the weapon, notably the diameter, 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.

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.

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 weapon, notably the diameter, 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.

Eleven Coastal Command Beaufighter crews were to go to No 1658 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 No 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 Sqn Ldr R 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 fatal injury 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.

...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.
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.

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 300miles 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 240miles 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 4miles long and 1 3/4miles 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.

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 Mosquitos 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...

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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 Caithness, 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 350degrees 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. 4

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 torpedoes and may have fewer tactical limitations in dive and speed of approach, it has no advan-
tages 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.’ 5

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 them-
selves, recorded on cine camera and scheduled for 9/10 May, the aim was to release inert-filled Highballs 1,200yds from Courbet and 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 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. 11

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

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 sys-
tem failed. This would give the minimum distance for release, and next stage would be to find the maxi-
mum release point, starting at 1,800yds, working upwards by 200yds. Rough water would reduce the effec-
tive 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.

...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

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 Hightball, 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 Hightball 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. Whatever the other problems with Hightball, 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 be required 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 pistons on the two Hightballs 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 would then activate and could well sink the carrier. In any case, 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 pistons on the two Hightballs 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 Mosquito, ‘to fly the aircraft off would involve a serious risk’, especially as one might ditch on take-off. The hydrostatic pistons on the two Hightballs 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 Mosquito, the Mosquitoes had a range of only 1,160miles. One calculation did suggest that, by reducing the cruising speed, this could be stretched to 1,257miles, 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 200-250miles, at 15,000ft 300-400miles. 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 150miles off the Norwegian coast, a second 150miles north-west of the fjord. The attacking aircraft would fly at sea level parallel to the Norwegian coast, 150miles 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 250miles from the coast, then 100miles west of the second submarine turn towards the target and approach it at sea level. Whichever of these routes were chosen, the Mosquitoes would climb to 5,000ft 100miles 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.

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 Hightball hitting Tirpitz in Kaa Fjord were ‘negligible’.

PLAN OF ATTACK

Fortunately, 618 Squadron did not know this. Its crews had been stepping up their navigational exercises, often carrying two inert-filled Hightballs, 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 4,000ydsotherwards and upstream from this side of the fjord. The lee of high ground. At this point, the fjord narrowed to 1,000ydstowards the south, and another spit 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 Hightball operation, which no doubt to some extent shaped the negative conclusions in Bottomley’s letter of 2 July. Approximately 1,200ydsof 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, Hightball 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

We consider that this operation has a very remote chance of success whilst the ships are berthed in their present position at Alten Fjord"
target and clearing high ground beyond it. Such an approach would give under 1,000yd 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.  

**FINAL STAGE**

After Upkeep had been proved at the Moehe 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 stress. 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’.  

Matthers 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 Command now planned the attack on Tirpitz for about 12 July. The Squadron should have all of its Mosquitos 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 ship as a target. Moreover, ‘a satisfactory sight for ranging 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.  

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, Mosquitos 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 bailing 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 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.  

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 ‘unsuspected’ 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.  

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 Talboy bomb, on 12 November 1944.

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**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 8/1234
3  Wallis Papers
6  PRO Air 8/1243; operational summary, PRO Adm 223/320; Alten Fjord, PRO Adm 195/943.
7  PRO Air 8/1243.
8  PRO Air 15/942.
9  PRO Air 8/1243.
10  PRO Air 8/1243.
11  PRO Air 8/1243.
12  PRO Air 8/1243.
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18  PRO Air 8/1243.
19  PRO Air 8/1243.
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21  PRO Air 8/1243.
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”. However, doctrine is more about explaining the goals, identifying the tasks and shaping the tools of the organization that publishes it. One of the seminal doctrinal statements to develop this remit for the RAF is AP3000 British Air Power Doctrine.

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.

STRATEGIC EFFECT

Strategy has been defined by Basil Liddell Hart’s “art of distributing and applying military means to fulfill ends of policy.” 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. With the use of phrases such as Strategic Air Command, the “use of the adjective ‘strategic’ has very little to 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. 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.” 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.

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.” 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. 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. 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.” 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.

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The roots of the term ‘centre of gravity’ are found in the ideas of Carl von Clausewitz, and his great work *On War*. Clausewitz’s idea is drawn from Newtonian physics, and is the point from which the weight of a body may be considered to act. 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.” 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.

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. 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 seeks to achieve strategic effect on target sets’. 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.” 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?

**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*. Clausewitz’s idea is drawn from Newtonian physics, and is the point from which the weight of a body may be considered to act. 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.” 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.

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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.” Apart from being ‘lifted’ from US doctrine, 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.

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 matrialized.

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. 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. 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, political and physical entities which possess certain characteristics and capabilities, or benefit from a given location/terrain.” 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.

The Deutsche Vacuum oil refinery at Bremen seen here following an attack by RAF Bomber Command on 21 March 1945.
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 rightfully titled ‘The Forgotten Offensive’.28 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. Targeting 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 credo 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 lie 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.

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...”

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.” 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.
3 JWP 0-01 British Defence Doctrine. (London: HMSO, nd) p 1.2
8 I would like to thank Chris Finn for drawing my attention to this point.
9 AP 2000 p 2.6.6
10 AP 2000 p 2.6.7
16 AP 3000 p 2.6.1
17 AP 3000 p 2.6.2
18 AP 3000 p 2.6.1
21 Clausewitz, On War: pp 445-6
22 ibid. p 599-601.
23 AP 2000 p 3.13.2
24 For example see Joint Publication 3-0, 1995 p III-32. The AP3000 definition is different in use of the plural, and in adding nation and alliance – the rest is the same.
25 AP 2000 p 2.6.1
26 AP 2000 p 2.6.2
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
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. The 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 following:

- Single engined fighters, fighter-bombers (Spitfires, Hurricanes, P-40C Tomahawks, 468
- P-40D Kittyhawks and P-40F Warhawks)
- Anti-tank aircraft (Hurricane IID’s) 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.

The attacking air force possessed several surveillance radars for fighter direction. To assist fighter control during the offensive, the RAF established a forward radar station on Ruweisat Ridge, 15 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).

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.

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

- Fighters, fighter reconnaissance (Messerschmitt 109s, 110s): 40
- Dive bombers (Junkers 88s): 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. 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.

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. 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. 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 about seventy dual-purpose (anti-aircraft/anti-tank) 88-mm guns operating in four-gun batteries.

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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 USAF’s P-40F Warhawk, but the Me 109G had the edge over both of them. 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.

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.

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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 pounders but with a small proportion of 500 pounds. 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.
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. 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 bomb 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. The experiment was not repeated.

On the Axis side the majority of bombing attacks in the battle area were by Junkers 88 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. 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. 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. 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.

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.

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.

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.

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. 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 88P 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. 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 lighter bombers. There was also a vigorous programme of reconnaissance missions over Axis front line positions, rear areas and airfields.
Throughout this period and the Battle that followed the Allied four-engined bombers, single squadrons each of USAAF B-24 Liberators and RAF Halifaxes, attacked distant targets such as the supply ports at Tobruk and Benghazi in Libya, and airfields and other targets on Crete and the Greek mainland. Since this account is concerned mainly with operations close to the Battle area, the use of these aircraft will not be considered further.

Soon after dawn on 23 October a force of 35 Kittyhawk fighter-bombers, with an escort of Spitfires and Kittyhawks, attacked the Axis landing grounds at Daba. Similar attacks were mounted throughout the day and fighters mounted standing patrols over the Axis airfields and the 8th Army’s troop assembly areas. These were intended to prevent Axis reconnaissance planes locating the assembly areas or, if the latter were located, to prevent air attacks on them.

### COURSE OF THE AIR BATTLE, 24 OCTOBER

**Battle Area**

Although there were clear skies for much of the first day, patches of cloud caused some problems. From mid-day, rising dust at some RAF forward landing grounds prevented fighter operations. Allied fighter units flew 230 counter-air patrols, over the battle area and over Axis airfields. They also flew about 200 bomber escort sorties. Throughout the day Allied aircraft encountered Axis fighters on only two occasions. In addition there was a small-scale attack by fighter-bombers on a British ground position, but no damage was reported.

That morning Hurricane IIDs carried out an anti-tank sweep over the southern part of the line and claimed hits on eight enemy tanks. That afternoon the Hurricane IID units went into action again, and claimed hits on a further ten tanks. German records confirm that seven medium and light tanks were destroyed and five seriously damaged during these actions. No Hurricane IID was lost.

Allied Boston, Baltimore and Mitchell bombers flew some 235 sorties, in the course of eighteen pattern-bombing attacks. Two of these attacks targeted the Axis airfields at Qotafiya and Fuka, the remainder were close support missions on vehicle concentrations in the battle area. Eight bombers were lost during these attacks.

Typically, pattern-bombing attacks were mounted by formations of eighteen twin-engined bombers flying at altitudes between 7,000 and 10,000 feet. The aircraft flew in close formation, and the bomb-aimer in the leading aircraft aimed his bombs at the near end of the target area. As the leading plane released its bombs, the other bombers in the formation released theirs. The advantage of this method of attack was that all the bombs were aimed by the best-qualified bomb aimer in the unit, an important factor considering the uneven levels on training and experience in wartime units. The width of the bomb pattern equalled the width of the formation, typically 60 to 200 yards depending on the lateral spacing between planes. The length of the bomb pattern equalled the length of the formation plus the length of bomb stick selected, typically 300 to 500 yards. If such an attack fell accurately across an enemy troop position or vehicle concentration, the effect of more than a hundred closely-spaced 250 and 500-pound bombs detonating within a period of a few seconds caused a considerable shock effect.
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 [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 88 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: 107

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
Wellsingtons flew 64 sorties against German troop positions, assisted by 14 Albacores which dropped flares. One large explosion and several small fires were reported. Luftwaffe 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.

Sorties Flown, dawn 25 Oct to dawn on 26th
RAF and USAAF, about 705 sorties
Luftwaffe, 107

Aircraft Losses 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

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 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.40 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.

Sorties Flown, dawn 26th to dawn on 27th
RAF and USAAF: about 705 sorties
Luftwaffe, 107

Aircraft Losses 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

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.
On 26 October, a German and an Italian division counter-attacked the salient established by British troops.\(^{47}\) 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 2½-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.\(^{48}\)

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."\(^{49}\)

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 litlle.

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.

Notes:

1. Air Historical Branch Monograph The Middle East Campaigns, Vol III, PRO Ref. AIR 41/26, p 297
2. Ibid, p 285
5. The Middle East Campaigns, Vol III, p 265
6. Ibid p 282
7. Ibid
9. Shores, Christopher, Mediterranean Air War, Volume Three, Ian Allan, Shepperton, 1974, p 86
11. Hinsley, p 436
12. Jefford, p 220
13. The Middle East Campaigns, Vol III, p 261
14. Ibid p 264
18. Interview with Group Captain Peter Green RAF
19. The Middle East Campaigns, Vol III, p 265
20. Air Support, p 67
22. Air Support, pp 68-69
23. Ibid, p 68
24. The Middle East Campaigns, Vol Ill, p 595
25. Air Support, p 241
26. Hinsley, pp 728 to 738
27. Ibid p 433
28. Ibid p 436
29. The Middle East Campaigns, Vol III, p 269
31. The Middle East Campaigns, Vol III, p 272
32. Ibid, p 274
33. Ibid, p 273
34. Ibid, p 279
35. Ibid, p 278
36. Ibid, p 279
37. Ibid, p 278
38. Nos 3 and 232 Wing records, PRO Ref AIR 26/18
39. Hinsley, p 437
40. The Middle East Campaigns, Vol III, p 283
41. Ibid, p 283
42. Ibid, p 286
43. Ibid, p 286
44. Ibid, p 288
45. Ibid
46. Hinsley, p 439
47. Hinsley, p 441
49. The Middle East Campaigns, Vol III, p 263
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.
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 exceptions were those who had been drawn from the two older Services. The Sopwith Pup served with the Royal Flying Corps and the Royal Naval Air Service before the formation of the RAF.

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”. The Sopwith Pup served with the Royal Flying Corps and the Royal Naval Air Service before the formation of the RAF.
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 is that the class of warfare approximating to police work is their power of acting at once. Aircraft can visit the scene of insipient 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 the development of 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 most probable centres of unrest...
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
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 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.

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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 piloting. 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 Cachot 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 piloting, in that country, but whether it will be convenient to do so next year cannot yet be definitely foreseen.

One other 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 practised 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 enrollment 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 aircraftmen, 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, are 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 Dormondtrie, 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 depot will have a combined repair and store depot of a size suitable to the number of squadrons based
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 existing 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, 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 Slough.

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.

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

Air Ministry, Nov. 25th, 1919.

### APPENDIX

#### II. OVERSEAS

<table>
<thead>
<tr>
<th>Country</th>
<th>1920-21</th>
<th>Increase during 1921-22 to</th>
<th>Increase during 1922-23</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>8 Squadrons</td>
<td>No increase.</td>
<td>No increase.</td>
</tr>
<tr>
<td>Egypt</td>
<td>7 Squadrons</td>
<td>No increase.</td>
<td>No increase.</td>
</tr>
<tr>
<td>Mesopotamia</td>
<td>3 Squadrons</td>
<td>No increase.</td>
<td>No increase.</td>
</tr>
<tr>
<td>Malta</td>
<td>1 Squadron</td>
<td>No increase.</td>
<td>No increase.</td>
</tr>
<tr>
<td>Mediterranean</td>
<td>1 Squadron</td>
<td>No increase.</td>
<td>No increase.</td>
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</tbody>
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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 singed 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.
This valuable directory contains a wealth of data on the history of aviation and attempts, for the first time, to identify every active aircraft manufacturer and the aircraft they produced. The directory serves as a unique guide to the sheer number and variety of aircraft 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 Wittensohl LD 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.
This beautiful Wren church, which is also the Royal Air Force Central Church, has a world-wide following and is open daily from 08.30 am - 4.30 pm. There is Choral Eucharist or Matins every Sunday at 11.00 am, sung by the famous choir. Civilians and all members of the Armed Forces are welcome to visit the church and attend the Services.

**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.

- **Friday 4th October 2002 at 7 pm.** Friends of St Clement Danes Concert: a 60th anniversary tribute to Bomber Command.

- **Sunday 10th November 2002.** Remembrance Day Service.

- **Sunday 8th December 2002.** Carol Service: the Royal Air Force Benevolent Fund. Admission by ticket only.

**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