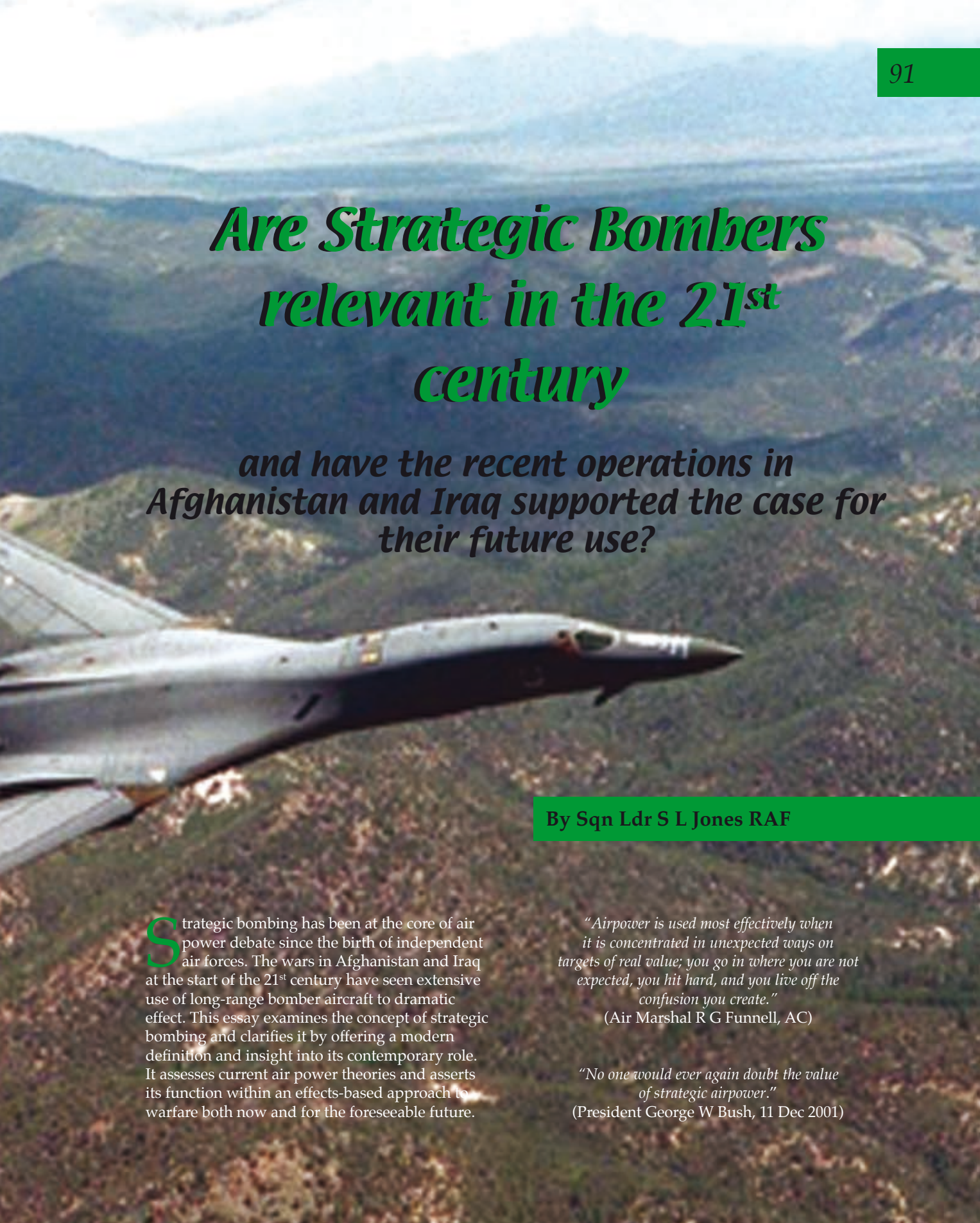

Are Strategic Bombers relevant in the 21st century

and have the recent operations in Afghanistan and Iraq supported the case for their future use?

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Strategic bombing has been at the core of air power debate since the birth of independent air forces. The wars in Afghanistan and Iraq at the start of the 21st century have seen extensive use of long-range bomber aircraft to dramatic effect. This essay examines the concept of strategic bombing and clarifies it by offering a modern definition and insight into its contemporary role. It assesses current air power theories and asserts its function within an effects-based approach to warfare both now and for the foreseeable future.

"Airpower is used most effectively when it is concentrated in unexpected ways on targets of real value; you go in where you are not expected, you hit hard, and you live off the confusion you create."
(Air Marshal R G Funnell, AC)

"No one would ever again doubt the value of strategic airpower."
(President George W Bush, 11 Dec 2001)

On 8 April 2003, within 12 minutes of receiving targeting orders, a B-1B Lancer dropped munitions on a restaurant in Mansour, western Baghdad, in an attempt to kill Saddam Hussein and his sons.[1] The accuracy of delivery, coupled with timely intelligence that led to a remarkably brief 'sensor to shooter' gap,[2] provided the military with the opportunity to achieve the desired 'strategic effect' of decapitating the Iraqi regime and thus attempting to hasten the successful conclusion of Operation IRAQI FREEDOM (OIF) — had Saddam been in the building at the time of weapon impact. The activity outlined above represents a relatively new air power capability yet is fundamentally linked to the earliest visions of how to best exploit air power's potential. Driven by doctrinal and tactical development, which have been influenced by changes in global security and political will and enabled by a combination of technological advances and associated equipment upgrades, particularly in the delivery of precision of munitions, 'strategic bombers' have become a highly prized asset in the United States' inventory. The extensive use of these aircraft in Kosovo in 1999 and more recently against Al Qaeda and the Taliban in Afghanistan in 2001-2002 and subsequently Sadam Hussein's Iraqi regime in 2003 establishes their relevance to any study of modern air power.

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Coincidentally, the enduring nature of the strategic bombing debate is well illustrated by its historical foundations in the Royal Air Force's (RAF) use of air power to police Iraq in the 1920s. It was at this time that the RAF was justifying its existence as a separate arm of the military by using the effect of its independent strategic bomber force to contain tribal uprisings. This study, however, must focus on the United States Air Force (USAF) because of its near monopoly on the key air platforms that are associated with strategic bombing, namely the B-52, B-1B and B-2[3] and its significance as the originator of the key contemporary air theories that have developed during the last two decades of the 20th century.

This essay will contribute to the clarification of the debate and generate an alternative classification to replace the term 'strategic bomber'. In the first section, definitions associated with strategic bombing are developed in order to then assess the significance of this role of air power. The themes that fall out of this progressive discussion refer to historical examples and require a brief discussion on broader, classic theories of warfare. The second section demonstrates the direct linkage between strategic bombing and its effect across the levels of warfare, reviews contemporary air power theories and explains why air platforms are becoming increasingly difficult to classify by role. Section three will assess the link between Effects-Based Operations (EBO) theory and the utility of long-range, long-loiter bomber platforms to its application. With the foundations established for an analysis of current employment of these aircraft, their successful utilization in recent operations will be demonstrated and some concerns over their use will be revealed in section four. The enduring difficulty of measuring bomber effectiveness is touched on several times but will be the focus of the penultimate, fifth section. Finally, the introduction of new technologies, the current global security situation and other means of achieving similar effects to current B-bombers are important considerations that will be analysed in section six. The essay will conclude that the ubiquity of conventionally armed, long-range, long-loiter bomber platforms are currently vital military tools at the beginning of the 21st century

RAF Tornado GR4A

Air power proponents have extolled the ability of aircraft in the strategic bomber role to alter the opponent's will, but there has been continued, and as yet, unresolved debate over whether coercion or denial is the best method of utilising air power's characteristics

and will continue to provide, through EBO, a significant means of supporting political objectives across the spectrum of warfare for the foreseeable future. Recent operations in Afghanistan and Iraq have reinforced this argument, although there are limitations that air planners must recognise and work around. While the nuclear capability of strategic bombers is recognised (indeed complicates the debate, as will be shown) this aspect of their role is too broad to be considered within the scope of this essay.

Understanding the strategic bomber concept

The concept of strategic bombardment has been vigorously extolled by air power enthusiasts since the earliest theorising on the military utility of lighter than air vehicles. Indeed, the science fiction of Jules Verne (*Clipper of the Clouds*, 1873) and H G Wells (*War in the Air*, 1908) developed the visions of apocalyptic 'bolt from the blue' airborne attacks against nations.[4] The imaginations of science fiction writers were vivid, but they perceived that aerial warfare would have a huge effect in

shocking the civilian population into despair and defeat by means of air bombardment of enemy cities. The reality of military aviation in the era of World War I and 'total war' spawned theories about the practical use of air power to cause strategic effect, whilst others focussed on the use of air power to directly support land forces in the close battle.

The Italian air power theorist Douhet was an early advocate of the strategic bombardment but was also conscious of the broader context:

Objectives vary considerably in war, and the choice of them depends chiefly upon the aim sought, whether the command of the air, paralysing the enemy's army and navy or shattering the morale of civilians behind the lines. This choice may therefore be guided by a great many considerations — military, political, social and psychological.[5]

Douhet argues that the desired outcome has to be shaped by other influences but, importantly, the application of resources is considered in terms of the effect sought. Whilst these sentiments will be considered later in the contemporary concept of EBO, it is relevant to demonstrate from the outset the linkage between classic and modern theories in order to illustrate the long-term difficulty in settling the 'strategic bomber' paradigm. To build a conceptual and practical framework, a broad understanding of how military force is used to achieve a desired endstate is imperative.

The Prussian military theorist Carl von Clausewitz defined war as: '. . . an act of force to compel our enemy to do our will'.[6] In broad terms air theorists have argued that this may be achieved in one of two ways.[7] The solution may lie in confusing, deceiving, frightening or otherwise influencing the mind of the enemy in the hope of shattering will and thus causing surrender. This is known as the act of coercing the enemy into doing what you want them to do. A more physical and direct route of removing the capability to resist by attacking military forces, military equipment production and industry may lead to surrender. This is known as the strategy of denial. Air power proponents have extolled the ability of aircraft in the strategic bomber role to alter the opponent's will, but there has been continued, and as yet, unresolved debate over whether coercion or denial is the best method of utilising air power's characteristics.

The First World War strategic bombing campaign of the British initially involved attacks on specific German industrial production centres to deny them the means of supporting the war effort. Due to a perception that a more efficient use of their scarce bomber resources was targeting swathes of industrial areas, including workers' housing, they altered their strategy in an attempt to lower morale and thus coerce the Germans into surrender.[8] This policy was left unproven because other factors brought war to an end (issues of measuring the strategic effect of air bombardment are an enduring dilemma for airmen and will be covered later) but was, nevertheless, pursued vigorously by RAF Bomber Command during World War II. Conversely, the Americans retained their targeting policy, developed by the Air Corps Tactical School (ACTS), which aimed to cause German key industries, for example oil production, to fail.[9] Pape argues that coercion rarely works, and when it does it is only by denying the enemy the ability to achieve its goals on the battlefield.[10] Again, problems of measurement are apparent. These act in Pape's favour and obscure the point that the strategy chosen depends on many circumstances, and today on many constraints, such as rules of engagement, collateral damage and various political and media pressures. Meilinger suggests there is actually more of a direct and overlapping link between coercion and denial.[11] It is this school of thought that supports the modern, conventional use of long-range bombers that contribute to EBO. It should also be noted that inflicting massive casualties on civilians in order to break morale and thus force capitulation is not the objective of contemporary military planners — indeed, quite the reverse.[12] The advent of Precision Guided Munitions (PGM) provides two key benefits in this respect. Firstly, they significantly improve efficiency[13] and secondly, they reduce the likelihood of collateral damage.[14] Pape's arguments are critical of modern air power theories, but he stated his case prior to the Afghan and latest Iraq wars. It is therefore necessary to understand why strategic bombing enthusiasts

developed and continue to seek theories that have coercive tendencies. These modern theories continue to have their roots in classic ideas of warfare.

Long before Douhet's thoughts had been expressed and well before aircraft had been conceived, built and flown, Clausewitz considered strategy to be 'the employment of the battle as the means towards the attainment of the object of the war'.[15] He used the analogy of unbalancing the equilibrium of a system to shift the Centre of Gravity (COG).[16] It was the unity and cohesion of the fighting forces, which he regarded to be the hub of all the enemy's power, or COG. By attacking and defeating this hub, through decisive battle, the war would be won. To crudely summarize his ideas, it was the objective of armed forces to defeat the opposition in decisive battle and make the enemy defenceless, or at least disarm him.[17] This is an interesting thought to retain, particularly in light of Afghanistan and Iraq where residual

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B-2 Spirit

The USA has a monopoly amongst western powers of ownership of B-bombers but these aircraft do not have a monopoly on achieving strategic effect

elements of the regimes have inflicted more casualties after combat operations have officially ended than during them. The highly publicized success of strategic bombers' contributions in these two wars may be undermined by the lack of long-term effect, or denial, of key elements of the opposing forces.

More recently than Clausewitz, Sir Michael Howard, the British historian, argued that:

"Wars are not tactical exercises writ large. They are . . . conflicts of societies, and they can be fully understood only if one understands the nature of the society fighting them. The roots of victory or defeat often have to be sought far from the battlefield, in political, social, and economic factors."[18]

Although the above argument explains why military success in battle often fails to contribute to overall campaign victory, it also expresses the need to delve deeper into what will affect the enemy most and bring about its defeat. An example of this is the United States' overwhelming tactical wins in the Vietnam War, but overall failure to achieve their long-term aim.[19] Pape[20] considers that the American bombing strategy in Vietnam failed for three main reasons: an imbalance in the level of damage the opponent was willing to absorb to that which the assailant could inflict; mobile, guerrilla forces are not susceptible to air attack in the same way as mass conventional forces; and, even if these two problems can be understood, accurately assessing vulnerabilities and applying a coercive strategy will not work if the opponent's level of commitment and morale are very high.

Again, parallels to the recent wars against factions such as Al Qaeda that operate outside societal structures should be noted. Linking Pape's and Howard's arguments suggests a need to comprehend issues beyond the battle space in order to know the weaknesses of an opponent and thus the vulnerabilities that will allow the COG to be unbalanced. These points will be relevant when assessing the effectiveness of 'strategic bombing' in the recent air campaigns.

Contemporary air power theories

Appreciating the link between classic theories on warfare and contemporary air power doctrine provides the basis for understanding the concept of creating strategic effect. Current RAF doctrine[21] advocates the employment of air power to achieve strategic effect via an identified target set. It considers air operations for strategic effect to be:

". . . aimed to destroy or disrupt the defined strategic centre of gravity of an opponent. The effect sought by airpower could be destructive, non-destructive or a combination of both, against target sets which undermine an opponent's ability, will and means to continue his aggression. Air operations for strategic effect are not limited to bombing or solely the domain of attack aircraft. All combat aircraft and associated weapon systems are capable of action for strategic effect." [22]

In criticizing the RAF's use of the word 'strategic', its association with target set[s] and its adoption of the COG concept, Lock-Pullan[23] argues that the RAF has constructed a somewhat contradictory explanation that fails to sever the link between strategic effect and strategic bombing. He argues that the legacy of early air power definitions that justified the independence of the RAF, a hangover from Cold War 'deep strike' policy and the need to justify a single Service capability have moulded a 'bomber-centric' description of the concept. This analysis neatly illustrates that the effect air power can create is not directly linked to a specific air platform. Thus, any consideration of the resurgent utility of strategic bombers must acknowledge that they too are being used for an effect that crosses the boundaries of perceived aircraft roles. The RAF will perhaps state this more clearly in the next version of its air power doctrine.[24] By dealing with similar conceptual and platform related employment issues, the USAF has forced through changes in its thinking and structure that has facilitated the contemporary use of their B-bombers in roles that they were not originally designed for.

In 1998, General John T Chain, Commander in Chief of the USAF's Strategic Air Command (SAC) recognised that SAC would have to offer more than merely contributing to the USA's nuclear deterrent.[25] He identified three pillars of conventional wisdom that would have to be knocked down in order for the bomber force to have wider defence utility. The first pillar was that bombers were for nuclear use only; the second that strategic meant nuclear and that SAC bombers were tied to the nuclear mission; and third, that theatre warfare was solely for tactical or fighter aircraft.[26] The need to reshape the USAF to the threat at the end of the Cold War, combined with experience in Gulf War I and the ability to carry a variety of weapon systems, including unguided bombs, PGMs and CALCMs[27] subsequently highlighted the potential for a wider use of these aircraft. SAC was amalgamated with Tactical Air Command in June 1992 to create Air Combat Command.[28] Importantly, the linkage between 'strategic' and 'nuclear' in the context of bombers had been broken. The Department of the Air Force's 1990 White Paper '*Global Reach-Global Power*' was an indicator of the changes that were to follow. The recent resurgence in 'strategic bombers' must therefore acknowledge that the foundations for any recent success were laid in the late 1980s and early 1990s. The concurrent developments in technology and doctrine during this period reinforce the need to isolate 'strategic' from 'bomber' in order to understand what the B-bombers are employed to do. The essay will therefore build a case to argue that the term 'long range/loiter effects platform' (LRLEP) is a more relevant description of what has historically been referred to as the 'strategic bomber'.

The United States (US) has invested in the largest and most capable air forces in the world. The combined USAF, USN, US Army, USMC inventory

(all types) is in excess of 16,000 military aircraft.[29] In contrast, China and Russia have approximately 9,000 military aircraft each and all other nations hold below 2,000. The USA has a monopoly amongst western powers of ownership of B-bombers but, as will be discussed, these aircraft do not have a monopoly on achieving strategic effect. The following foreword to the USAF Strategic Attack Doctrine Document[30] by Major General Ronald Keys, Commander, Air Force Doctrine Centre clearly establishes the priority that the USAF places on air operations that lead directly to the achievement of strategic campaign goals:

"Strategic attack is not defined by the weapons or delivery systems used — their type, range, speed, or destructiveness — but by their effective contribution to directly achieving national or theatre strategic objectives. Air and space forces, with their responsiveness, range, and unique ability to exploit the third dimension, can transcend normal operating limitations imposed on land and maritime forces in attaining strategic objectives [Strategic attack] is the Air Forces' most decisive combat mission and function."

Importantly, he distinguishes between the effect desired and the means, or platform, used to attain it. The term 'bomber' is not included; the adoption of 'attack' also provides a broader context to the concept. The USAF doctrine builds on this premise by stating that 'strategic application of aerospace power has had a decisive impact on war'[31] and supports this proposition by declaring that experience in conflicts as diverse as World War II, Operation DESERT STORM (Gulf War I, Iraq, 1991) and Operation ALLIED FORCE (Kosovo, 1999) prove this argument.[32]

The current formal USAF definition of strategic attack is as follows:

". . . those operations intended to directly achieve strategic effects by striking directly at the enemy's Centres of Gravity (COGs). These operations are designed to achieve their objectives without first having to directly engage the adversary's fielded military forces in extended operations at the operational and tactical levels of war."[33]

A modern interpretation of the concept of COGs is: "those characteristics, capabilities, or localities from which a force derives its freedom of action, physical strength, or will to fight".[34] These are targeted to meet the overall objectives that are set by senior political and military leaders. Interestingly, the important relationship between COGs and identifying means to undermine or defeat them is not articulated.[35] This issue will be raised later in terms of measurement of effect. The definition also refers to the levels of war, which are particularly relevant to the discussion because they help to define 'strategic attack' by exposing its relationship to the spectrum of conflict, military planning and the direct achievement of the political objective by attacking the COGs.

Bucknam[36] considers the levels of war to be the conceptual tools that usefully facilitate thinking about and planning for military activities. The relationship between the levels of war[37] is considered in the planning process that guides staff at various levels through a framework for understanding the grand strategic objectives of the civilian leadership, through the various commanders' intent, down to the tactical application of force.[38] Importantly, the process allows courses of action to be developed and evaluated. The air commander's analysis should provide a link between strategy and the task so that each sortie flown contributes to the overall strategic effect. The process recognises a hierarchical connection as each level of command undertakes its own analysis from a top down perspective. This is particularly relevant to understanding the modern role of the bomber platform, as these aircraft are capable of creating effects across the spectrum of warfare.

Peach presents a deeper analysis of the importance of levels of war to the military, and particularly to air forces.[39] The application of air power with its innate characteristics of speed, reach and ubiquity blurs the boundary between these levels. Furthermore, it is difficult to compare the strategic context of air operations during a limited war such as the UK's Op BLACK BUCK attack by Vulcan bomber aircraft on the Falkland Islands against the mass bomber raids on Germany during

World War II.[40] Peach's comment that coalition air power in Gulf War I was successful due to the mass effect of tactical air effort rather than systematic target selection indicates that even in a geographically contained conflict, there is a greying of the boundaries and varying degrees of what constitutes strategic, operational and tactical employment of air power.[41]

In a small-scale war, a tactical move is more likely to have a strategic impact, or effect than in a large conflict. Bucknam[42] states that the defining characteristic of things strategic is that they are linked directly to the ultimate or political objectives involved; things tactical are actions and events relative to an engagement and, importantly, are not mutually exclusive. Some strategic objectives can be pursued directly with each engagement, obviating the need for the intermediate operational level objectives. Again, the unique attributes of air power activities, particularly long-range and long-loiter bombing can have an impact at all levels of war. Bucknam[43] cites the example of allied bombing of German oil targets in the summer of 1945 to illustrate this point. As already discussed, these activities can have both coercive and denial effects. Applying the term 'strategic' to 'bomber' often obscures the role of certain air platforms and reinforces the case for adopting the term LRLEP rather than 'strategic bomber'. Rounding off the conceptual overview, it is essential to link EBO to the themes covered in order to provide firm foundations for an assessment of B-bombers in recent air operations.

It is therefore apparent that the term 'strategic bomber' is outdated. This further reinforces the case for describing these assets as LRLEP

Creating the desired effect

The development of EBO is generally attributed to Lieutenant General Deptula.[44] It provides a contemporary war-fighting thesis that incorporates the idea of parallel warfare.[45] It is important to note that the exploitation of the technological advances in air power, particularly stealth, PGMs, intelligence gathering capability and networked communications and data is central to the theory. Critics, particularly United States land forces, believe that the concept is flawed because of this very heavy reliance on perfect information, advanced technology and precision attack.[46] It is nevertheless at the forefront of Western military thinking and, as will later be discussed, the operations in Afghanistan and Iraq were designed along its principle tenets. In a study on behalf of the US Joint Forces Command, the US Rand organisation defined EBO as:

"Effects-based operations conceived and planned in a systems framework that considers the full range of direct, indirect, and cascading effects, which may – with different degrees of probability – be achieved by the application of military, diplomatic, psychological and economic instruments."[47]

The theory has grand aspirations to overcome attrition warfare, achieve success with limited resources and lack of forward basing, reduce casualties and limit the duration of conflict. It draws on the 'systems framework', which refers to the work of Colonel John Warden[48] and promotes 'rapid decisive operations' which in turn link to Boyd's 'Observe-Orientate-Decide-Action' (OODA) model.[49] These theories are empowered by aerospace and information gathering and analysis capability and, if fully understood, provide a framework for analysing and subsequently conducting war as effectively as modern capabilities and policies allow. It is the precise, synergistic targeting of nodal elements of the opposition's systems, by the most appropriate means that EBO advocates believe will generate the desired strategic effect. Thus Deptula argues that EBO can achieve the ultimate aim of war, compelling an opponent to act according to one's own strategic interests.[50]

The discussion has shown that there has frequently been a direct correlation between the use of air power, particularly 'strategic bombing' and the desire to achieve strategic effect and hence the

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US B-1B Lancer

fulfilment of strategic or political objectives. This explanation provides strategic bombing with an identifiable role that separates it from operations to gain control of the air, or those operations that involve air support to surface forces, whether directly or indirectly. The strategic use of air power, however, has been shown to have an impact at sub-levels of warfare and is not reliant on specific types of aircraft. Similarly, with the introduction of EBO theory, the achievement of the desired effect does not rely on a specific type of platform. It is therefore apparent that the term 'strategic bomber' is outdated. This further reinforces the case for describing these assets as LRLEP. The central issue of compellence that EBO aims to pursue, facilitated by the use of aerospace technology, will be considered in the following case studies. In doing so, the longstanding problem of measuring the effectiveness of air operations and whether or not there is an enduring role for LRLEP in the 21st century will then be assessed.

Afghanistan and Iraq case studies

Following the 11 September 2001 attacks in the United States, President Bush laid down the gauntlet 'to rout terror wherever it exists'.[51] Having identified the relationship between the Taliban and the perpetrators of the terrorist attack led by bin Laden, the United States set on a path to destroy Al Qaeda and its infrastructure within Afghanistan. The official Op ENDURING FREEDOM (OEF) combat air operations lasted 78

days and demonstrated a number of firsts for the US bomber fleet. Articles published immediately after the recent operations in Afghanistan and Iraq express the view that the USAF B-bombers were the signature weapons used during the wars:

● *USAF's heavy bombers dominated events in Afghanistan . . .*[52]

● *The abiding image from the war in Afghanistan was a US Special Forces soldier astride a horse using his laptop to send a digital burst of co-ordinates to a circling B-52 bomber.*[53]

● *The Return of the Strategic Bomber.* [54]

What the statistics fail to explain, however, is what effect each of the platforms was used to achieve, or indeed, how effective they were. Moseley, for example illustrated this by stating that a B-2 delivered 80, 500-pound bombs during one single sortie that involved a round trip from Whiteman Air Force Base in the USA

War in Afghanistan was unique in many ways but broadly involved a combination of standoff, precision air strikes and ground manoeuvre warfare. By the 76th day of operations, 57 per cent of the 17,500 munitions that were expended on over 120 fixed target complexes and over 400 artillery and guns were precision guided. B-1 and B-52 bombers flew 10 per cent of the strike missions yet delivered 11,500 of the weapons. The B-1 reportedly dropped more bombs on Afghanistan than any other aircraft, and was critically acclaimed as the workhorse of the conflict.[55] US strategists had exploited their first opportunity since Kosovo to employ the developing EBO philosophy and LRLEP. The headlines suggest that it worked. Biddle,[56] however, raises concerns that the lessons learned from the war would be the wrong ones and the war neither justified a radical restructuring of US military nor US foreign policy that the EBO advocates propose. He believes the argument that technology, particularly the use of PGMs, has introduced a new type of warfare model is inaccurate and that Afghanistan did not provide a template for success in other situations. The US attempted to use pinpoint air attacks against bin Laden's Arab-led fighters who, it could be argued, were the enemy COG that influenced the Taliban leadership. Initially these attacks were not decisive because the Northern Alliance could not see the results of precision attacks against infrastructure and leadership. The coercive effect was initially minimal on both the well-protected Al Qaeda and Taliban forces in cave complexes and the pro-coalition Afghan alliance. It required a shift in strategy to more dense and visible aerial attack, co-ordinated with American-supported land forces, to provide impetus to the Northern Alliance.[57] When the ground war gained momentum, air-ground manoeuvre, combined with the Afghans switching sides, led to a relatively quick Allied victory. Biddle's argument that the air-ground synergy and ultimately land battle were the decisive factors has merit. By implication, however, the utility of LRLEPs was critical to success; the effect they generated was valid, albeit in his view, only after the strategy had been adjusted. Importantly, within the EBO framework, the massive weapon loads and long loiter time of B-1B and B-52 bombers (because of being based relatively close to the region) was exploited to provide a CAS role supporting SOF-led alliance forces. While this was a tactical use of the bombers, it ultimately had strategic effect once the targeting policy had been adjusted. This reinforces the point that to be effective, EBO planning requires clear understanding of how both enemy and own forces will react to it.

Despite air power enthusiasts' rhetoric, the war also indicated that the advantages of PGMs could be outweighed when the enemy is not susceptible to their effects, as earlier lessons from Vietnam have indicated. EBO certainly contributed to US-led success in taking control of Afghanistan but many of the Al Qaeda and fundamentalist fighters

may have slipped away to continue their fight in other ways.[58] A similar residual problem linked to EBO strategy that occurred in Iraq will be revisited later. The result of the OEF air campaign was, however, viewed very positively by the coalition Air Commander, Lieutenant General Moseley who claimed success and was able to apply his experience in OIF.

General Moseley was responsible for employing air power to neutralise the Iraqi government's ability to command its forces; to establish control of Iraqi airspace; to provide air support for Special Operations Forces and Army and Marine units advancing on Baghdad and Basra; and to neutralise Iraq's force of surface-to-surface missiles and suspected cashes of biological and chemical weapons.[59] His 'By the Numbers' assessment[60] highlights that virtually all types of combat aircraft in the United States' inventory were used. Fifty-one B-bomber aircraft contributed 505 sorties out of a total of 41,404 [61] flown during the period 19 March to 18 April 2003. The combined use of PGMs was approximately 65 per cent of all munitions expended — a massive leap from the seven per cent in Gulf War I. What the statistics fail to explain, however, is what effect each of the platforms was used to achieve, or indeed, how effective they were. Moseley, for example illustrated this by stating that a B-2 delivered 80, 500-pound bombs during one single sortie that involved a round trip from Whiteman Air Force Base in the USA.[62] It is therefore necessary to refer to other reports, which incorporate interviews with the air commanders and the crews that flew the missions, to provide more substantial analysis.

Of the bomber sorties, the B-1B Lancer was a constant presence over western Iraq, ready to strike emerging targets.[63] To achieve this, one aircraft would be airborne on a specified orbit, one returning to base and one transiting to the theatre of operations. Over two-thirds of all Lancer operations contributed to the Time Sensitive Targeting (TST) process that had been developed by the Combined Joint Air Component Commander's staff.[64] There were three types of targets defined as TSTs: Leadership, which accounted for 50 missions; Weapons of Mass Destruction, which accounted for 102; and terrorists, four. These missions were tightly managed, and would typically have been supported by a variety of fighter sweep, suppression of enemy air defences, electronic warfare, ISTAR[65] and tanker aircraft. B-52 bombers were also used to provide precision strikes against a small number of key targets and then to attack the Iraqi Republican Guard with both unguided 'iron' bombs and precision weapons.[66] During the war, the coalition's methods were explained as a fighting synergy using intelligence, surveillance and reconnaissance assets to identify enemy locations and then use air and long-range shooters, and artillery systems to attrit enemy forces to ensure that when ground combat occurred it was not an even fight.[67] LRLEPs were instrumental in this and were particularly effective in terms of both denial and coercive effects on Iraqi forces during a period of adverse weather and sandstorms when they, more or less alone, maintained campaign momentum.[68]

Ultimately, the combined effect was that the Iraqi regime collapsed in 21 days. Grant goes as far as suggesting that "air and space power made the conduct of OIF nothing less than a new style of warfare".[69] In highlighting a renewed focus since losing during the Cold War the USAF's expeditionary competency forged in WW I and WWII, General Jumper, USAF Chief of Staff, provided more balanced views on the war: "joint warfare is imperative" and the war in Iraq demonstrated that "(the) USAF is thinking about things in 'new ways' — delivering close air support from B-52s aided by Global Hawk sensor (equipped) unmanned aerial vehicles and forging tight links between satellite, pilots in the air, special forces on the ground, and land force commanders to rapidly plough a path through enemy defences", and ". . . the days are over when any service assumes it can win a war by itself". Similarly, his comment that the war "showcased the Air Force's push to go back to its roots as an expeditionary force and its continuing rapid evolution as it applies new thinking to old hardware and doctrine"[70] is important. It recognises that intellectual application is essential but also implies

a longer term utility for platforms including the B-bombers. Hence the development and integration of new and old technology and evolving doctrine, tactics, training and procedures are at the core of how the USAF intends to contribute to resolution of any future conflict. It is nevertheless important to acknowledge that Iraqi and other insurgents have inflicted more casualties on the US coalition since the declaration of the end of hostilities than during official combat operations. This highlights the need to apply a strategy that has understood all aspects of the enemy. While outside the scope of this essay, further study of these residual effects of EBO is required. This should focus on the long-term results of EBO, particularly where rapid military victory, often by avoiding direct contact with ground forces, may not provide the desired longer-term strategic victory.

B-52 Stratofortress

The employment of LRLEP in the Psychological Operations role, supporting Commando Solo airborne TV broadcasts with leaflet drops (34 B-52 leaflet missions over Iraq out of a total of 158 contributing to over 31 million leaflets dropped) is another example of considering the employment of means to achieve the desired ends

Notwithstanding residual issues, recent conflicts have demonstrated that LRLEP has been pivotal to providing 24-hour effect, at a specific place and

time and thus provided the air commander with unmatched flexibility. There is no need to constrain B-bombers by the legacy of strategic bombing; they are equally capable of performing other roles. General Jumper stated "the USAF's emphasis on EBO as opposed to fighting a war of attrition allowed it to employ the B-1B strategic bomber in non-traditional ways to provide CAS".[71] The employment of LRLEP in the Psychological Operations role, supporting Commando Solo airborne TV broadcasts with leaflet drops (34 B-52 leaflet missions over Iraq out of a total of 158 contributing to over 31 million leaflets dropped) is another example of considering the employment of means to achieve the desired ends.[72] Conversely, following EBO and its technology and doctrine-based concepts, other platforms that are considered tactical were used to conduct strategic missions. Two such examples of tactical aircraft used in the strategic role are the American F-15 and the British GR4. Carrying PGMs and CALCM they operated both deep in enemy territory and at standoff range to achieve strategic effect in Iraq.[73] When supported by tanker aircraft and the typical Composite Air Operations packages of fighter and EW aircraft they can significantly add to the air planner's options and are likely to be available in more numbers than LRLEP. These aircraft do, nevertheless, require far more ground support, more tankers and put more crews at risk to achieve effects similar to LRLEPs. They are not as capable of short-notice, long-range power projection, but they may prove preferable in certain environments or where power projection from an aircraft carrier is appropriate.

It is accepted that, at present, only USAF B2 aircraft can penetrate enemy defences with impunity, the B1-B may operate in a low-medium threat and the B-52 at standoff ranges or in a low threat environment only

Similarly, the precision and ubiquity of cruise missiles, which were used 985 times in Op IRAQI FREEDOM, provide commanders with an effect controlled at the high operational and strategic levels. Expertise in selecting the right weapon against the right target to achieve the right effect is essential. Weapons such as TLAM may provide competing capability to LRLEP, but in terms of EBO they are more likely to provide a complementary effect. Issues, including, but not limited to cost, stock availability and politics contribute to the decision on weapon selection but ultimately, the decision taken must be justifiable in terms of contributing to the strategic objective.

Whatever weapon platform is employed, the air commander will almost certainly be required to establish appropriate control of the air, not only within a classic sequential campaign, but also within any parallel EBO. Although having to contend with the so-called 'Super-MEZ'[74] around Baghdad, in OIF (and OEF) the US-led air forces enjoyed near air supremacy that allowed offensive operations to proceed unhindered. This is possibly, but not absolutely, typical of the situation US-led coalition forces will operate within in the future. However, even if conflicts are only limited to small or medium scale regional affairs, future adversaries may have access to Russian S-400 Surface- to-Air Missile (SAM) systems, high speed, highly agile, long-range air-to-air weapons or a variety of other weapon technologies that are currently emerging. It is accepted that, at present, only USAF B2 aircraft can penetrate enemy defences with impunity, the B1-B may operate in a low-medium threat and the B-52 at standoff ranges or in a low threat environment only. While these factors cannot be allowed to detract from the successful employment of LRLEP in recent conflicts, they are relevant to the analysis. Contrasting LRLEP effectiveness in a relatively benign environment to one against a more

formidable threat raises broader issues regarding measuring the effectiveness of modern air power platforms and the doctrine, tactics and procedures employed. From the earliest days of air power, and equally evident in recent operations, the short, medium and long-term, or tactical, operational and strategic effects that each bomb and offensive mission has had on the opposition have been difficult to accurately gauge.

The measurement of effects dilemma

For several months prior to operations, as part of the assessment of the Iraqi regime's strengths and weaknesses, the US had been preparing the intelligence picture in order to generate a detailed understanding of Iraq.[75] It should be added that 12 years of policing the two 'no-fly zones' after the first Gulf War also provided substantial insight into Iraqi military capability and tactics. Once military action commences, however, an effects-based concept is difficult to conduct if the effect cannot be measured, particularly in the fog and noise of war. Even detailed post-war analysis of the results of bombing campaigns is difficult and often influenced by various agendas.[76]

Secretary of the Air Force, James G Roche recognised after the Afghanistan and Iraq conflicts that measurement, particularly Battle Damage Assessment (BDA) was a problem.[77] He stated that the BDA process must be "dynamic and responsive to our ability to strike". He added "anything less undermines the inherent deterrence and compelling effects air power brings to (our) war fighting team". It follows that the success of EBO relies not only on a detailed knowledge of the opposition, their systems and courses of action, but also how effectively each tasked mission contributes to the overall objective. Once an assessment of the damage is achieved, expertise is required to understand how the effect impacts on one's own objectives, and importantly, enemy strategic objectives. This must avoid 'mirror imaging' one's own considerations and get into the mind of the enemy. It is challenging, but necessary, to define and construct measures of effectiveness that are meaningful to a campaign strategy. The right choice of measurement will affect how resources are allocated and how the campaign develops. Williams's argument that both predicted and unpredicted and desired and undesired effects must be accounted for and correctly analysed is particularly valid.[78] The correct analysis of imagery and the timely transfer of information up and, importantly, back down the command chain in order to successfully conduct activity at all levels of warfare is essential. This is key not only to the observation and orientation phases of the OODA cycle, but critically, to the decision and action phases. Thus, EBO not only demands knowledge of the enemy, but also ability to transition quickly from one effects-based activity to another. There is therefore a balance to be struck between perfect knowledge and sufficient knowledge to take decisive action. Overall, the relatively quick victories in Afghanistan and Iraq substantiate the claims for EBO success and the ability of the US leadership to deal with the measurement of effect dilemma in terms of gaining territory. The shift in bombing strategy in Afghanistan, for example, certainly supports this view.

It has been shown that LRLEPs were a major factor in the military successes and sufficient evidence has been given to illustrate the potent capability that the B-bombers provided. Whether or not the same effects and end result could have been better achieved with the improved BDA that Roche seeks will require much deeper analysis of classified information. One way that these measurement problems are being addressed is through the expansion of operational analysis in the Combined Air Operations Centres (CAOCs). Expertise in these areas contributes to intelligence-led and intelligent EBO targeting, but to achieve the desired strategic outcome it must be capable of understanding the enemy and his ways of thinking.[79] Thus BDA and the ability to think like the enemy are aspects of EBO that are always likely to need continuous effort. Recent LRLEP use, across the levels of warfare, illustrates the contemporary problems. In the CAS role, visual assessment of target damage is often simple to measure by the Forward Air Controller (FAC), for example, the enemy stops shooting. Conversely, destruction of a vehicle as part of TST may be witnessed by the FAC but exact knowledge of who was in the vehicle and the longer-term strategic effect may take significantly more time to assess and understand. Similarly, the coercive effect of a

parallel EBO approach on the civilian population in Afghanistan, particularly via warlords and tribes, was different to those in Iraq, where an uprising did not overtly occur. Pape argues that the bombing that knocked out power generation in North Korea (90 per cent), North Vietnam (85-90 per cent) and Iraq in 1991 (more than 90 per cent) did not cause civilians to rise up against their respective regimes.[80] He goes on to suggest that the increased clinical use of PGM's, (only seven per cent in 1991) while politically sound for US-led coalitions, is not likely to increase the chances of a civilian uprising against a regime. This PGM argument was to some extent justified by the initial lack of success in prompting the Afghan Northern Alliance to attack the Taliban, but this was quickly addressed after analysis of the situation. Significantly, however, the transformation in doctrine and technology since his assessment appears to partially invalidate his findings in terms of the broader use of coercive bombing.

While lacking the detailed operational analysis of these wars,[81] the coercive effect of air power through the high use of LRLEP, nevertheless, appears to have been effective. The lack of Iraqi Air Force activity (including the burial of aircraft) implies that the enemy's will was broken by

The lack of Iraqi Air Force activity (including the burial of aircraft) implies that the enemy's will was broken by threat alone

A MiG-25 Foxbat is recovered after being buried in the sand by the Iraqis

threat alone. Similarly, the shaping operations and rapid, overwhelming defeat of large ground forces without direct contact[82] implies that coercion was a factor. When more information is available it might be possible to measure how strategies targeting leadership, organic essentials (including electricity) and infrastructure, compared to the effect of bombing fielded forces. As already outlined, the residual difficulties facing coalition forces in both countries indicate that decapitating key leadership has not yet created a stable security environment in either country — although presumably a key strategic aim of each war. It is on this point that Pape's argument may prove to be valid. However, in terms of modern air power, there must be a distinction between the outdated concept of a 'strategic bomber' that he refers to and the broader use of aircraft that contribute to EBO.

On balance, and despite measurement difficulties, LRLEP has provided a significant contribution across the levels of warfare to both the coercive and denial elements of EBO in recent limited wars. However, the longer-term validity of the B-bombers that have so far defined LRLEP in this essay may be questioned if the pace of technological change continues. Therefore, it is appropriate to look at what tools air power can provide to successfully conduct EBO in the 21st Century.

LRLEP in the 21st century

The USAF leadership's comments 'post-Afghanistan and Iraq' underscore their enthusiasm for both EBO and the aircraft technologies that facilitate it. The current world security situation 'post-Cold War' is such that the US and many Western nations consider policies involving effective rapid reaction expeditionary forces to be necessary for the foreseeable future. A capability to create early and decisive effects, where and when necessary, whether opposed or not, and without the time to build up to an event will be an increasingly critical element in the ability to face down, and ultimately remove, acute threats.[83] B-bombers can already provide a strategic and tactical effect within hours of an incident, can operate from continental USA, pack a massive punch per aircraft, minimise the risk of friendly casualties and have the ability to minimise collateral damage in the target vicinity. Thus, the USAF has assets that can quickly carry out western global strategy and are capable of coercive options that avoid the political ramifications associated with overseas basing. General Jon Loh, USAF, stated that:

"Bombers fit perfectly in the new way of waging war in the network centric real-time targeting system of systems, because bombers provide the engage link in the FFTTEA kill chain. The Air Force has not fully appreciated the long endurance characteristic of the bomber. It does recognise the long-range capacity. By exchanging range for loiter time with huge bomb loads it is able to respond rapidly to reduce the time lines for Find-to-Engage significantly." [84]

Coupling these comments with the conclusion of the 1990 White Paper, aptly summarised in the its title *Global Reach — Global Power*,[85] and the 1999 USAF White Paper on Long Range Bombers,[86] there is a clear determination in the USAF to sustain long-range bombers up to the second half of the 21st century. In terms of Aerospace Expeditionary Force (AEF) tasking, bombers can "demonstrate their global power capability" and "integrate to form a synergistic force that is at the core of a lean, lethal, tailored, and rapidly responsive AEF".[87] Future weapon upgrades, largely comprising smaller and standoff PGMs, avionics and countermeasures upgrades are being integrated and there are no signs that intentions to further develop them will diminish. With self-targeting PGM capability on these platforms, and under political and media pressure, air planners are expected to call on these assets as the air platform of first use, if not first choice. The inherent flexibility and utility they provide is a potent instrument of deterrence, coercion and denial.

As technology advances alternatives to B-bombers may fulfil the LRLEP role. At present, variants of cruise missiles are vastly more expensive and thus limited in stock compared to PGMs. They are not as flexible for TST, are less effective against hardened targets and the platforms that deliver them are limited in the number they can carry. Also, they lack utility in circumstances when Rules of Engagement are tight or positive identification

Predator UAV armed with laser-guided Hellfire missiles

UAVs capable of deploying munitions have demonstrated their worth in the find-to-engage process in recent conflicts

of targets is necessary. Nevertheless, they already complement PGM-carrying bombers and cannot be discounted as a means of delivering cross-spectrum warfare effects, particularly if technology develops and costs reduce. Other pilot-less air vehicles — Unmanned Combat Air Vehicles (UCAV) and Unmanned Air Vehicles (UAV) — are highly likely to play a part in how effect is delivered. UAVs capable of deploying munitions have demonstrated their worth in the find-to-engage process in recent conflicts. A cost versus capability analysis would be valuable at this point, but requires comparative data on weapons effect, loss rates, risk and so on, that are currently unavailable.

The next generation of fighter-bombers will add to the air power tool bag, but the current USAF bomber fleet will continue to provide a capability for at least 30 years.[88] The only impact that future aircraft procurement may have is deflecting resources from the USAF bomber fleet or vice versa. General Loh stated "the Air Force fears that if it pushes for greater number of bombers, it will be at the expense of the F/A-22".[89] Current manned platforms can provide similar effects, particularly when deploying PGM, CALCM and, from the surface, TLAM but are less flexible, or more costly both financially and in personnel, to deploy quickly to achieve the same effect. Ultimately, the number of LRLEPs in use will be limited and only the USA is currently willing and able to maintain the capability in its inventory.[90] One spin-off from the latest PGM technology is that it could be fitted to variants of other large aircraft that have potential for medium-level, long-range/loiter. Examples include the RAF's planned MRA4 or any number of current and future airlift platforms. Indeed, the MoD Deep Target Attack Equipment Capability Directorate's vision is, by 2020, to field 10 times the effect of (current) long-range strike weapon systems, with one-tenth the deployed logistical tail, 50 per cent of the manpower and at half the cost of ownership compared to 2002.[91] The RAF's Future Offensive Air System (FOAS) will be developed to meet these requirements. This hints at the prospect of a variety of other nations gaining LRLEP capability

Other nations may soon be capable of deploying LRLEP to meet their own global aspirations with, without or against the USA

at a fraction of the cost of the B-bombers. Nevertheless, the current enthusiasm for these platforms, coupled with neo-conservative lobbying in the USA, could potentially see a drive to acquire a new supersonic/hypersonic stealth bomber sooner than 2030.[92] From senior USAF commander's comments on joint solutions to success in conflict, there seems little validity to the argument that: "To many senior leaders in the US Army, the concept of EBO is another attempt by strategic bombing advocates to line Air Force coffers at the expense of land forces".[93] Whatever academics, cynics and detractors argue, current USAF doctrine and its recent application appear to be shaping how the US, and in coalition its partners, will fight future wars. All evidence suggests that the B-bombers will remain a significant LRLEP in support of EBO for at least 25 years; other platforms and burgeoning technologies will complement rather than replace them during this period.

Conclusion

Strategic bombers have proved to be an important, if not decisive, tool in the development and employment of air power. Equally, they have been at the centre of the most long-running and contentious debate on how air power should best be exploited and measured. Understanding the strategic bomber concept has, therefore, always been an important but multifaceted issue. Advances in technology, specifically in PGMs, and the commensurate evolution of air power doctrine, particularly towards EBO, have further obscured the role of aircraft that fly fast, far, and with large payloads. At present, only USAF B-bombers are characterised by their long-range projection, enduring presence over an area of interest and effect across the spectrum of warfare. In order to better place these interlinking capabilities and conceptual issues in the air power lexicon, the term LRLEP should replace 'strategic bomber'. Other technologies will be developed that initially complement B-bombers and, if cost and capability allow, will eventually replace them, quite possibly in a completely different, and potentially unmanned form. In these circumstances, many other nations may soon be capable of deploying LRLEP to meet their own global aspirations with, without or against the USA.

EBO and the 'new warfare model' have still to fully develop, particularly in terms of the timely understanding and measurement of effect and the longer-term implications of warfare that avoids destruction of the opponent's future fighting capability. However, while recent wars have not provided a credible air force and air defence challenge to the conduct of air operations, LRLEP operating within an EBO framework were decisive in pure air power projection terms and equally instrumental in the success and tempo of ground force's activity. The recent Afghanistan and Iraq wars appear to be typical of modern conflicts and have supported the case for the employment of aircraft with such powerful coercive and denial capabilities well into the 21st century. The combination of technological advances, international security crises and the development of doctrine and subsequently, tactics, training and procedures that support joint and combined campaign objectives have created a niche capability for B-bomber LRLEPs. Under these circumstances, LRLEP has never been more relevant in fulfilling air power's role as expressed by Air Marshall Funnell in the opening quote.

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Notes

1 Withington (2003)

2 The period between finding and engaging a target

3 To be referred to in the essay as B-bombers

4 Knight (1989), p.2

5 Westenhoff (1990), p.31

6 Howard and Paret (1976), p.75

7 Meilinger (2003), p.180

8 Biddle,T (1995), p. 92. Biddle's comprehensive study of early British and American air strategies through the First and Second World Wars argues that strategic bombing was shaped by the availability of aircraft and their capability, the military organization, politics and bureaucracy and the influences of dominant theories on warfare, particularly the impact that aerial bombardment could have on civilian morale.

9 See Biddle (1995) and Gentile (2001) for detailed analysis of why these strategies were pursued and case studies on the effectiveness of strategic bombing.

10 Pape (1996), p. 314. His book gives an extensive assessment of the success of coercion and denial in various bombing campaigns. He argues that coercion strategies, aimed at attacking civilians (Germany, Japan, Korea and Vietnam and to a lesser extent Iraq (1991) did not provide concessions to any part of the coercer's demands. He argues that in the same cases conventional denial strategies (against the fighting forces) that were pursued had some success (but not in Vietnam).

11 Meilinger (2003), p. 180

12 US Secretary of Defence Donald Rumsfeld stated at the outset that Operation IRAQI FREEDOM strikes would be carried out with breathtaking precision. The air commanders were required to obtain his approval for any planned air strikes that might result in more than 30 civilian deaths.

13 A frequently repeated statistic, purported to originate from Col John Warden, is that the number of allied aircraft required to succeed against one German target in 1944 during WWII, even in a benign environment, was 1000. In comparison, a single aircraft and one PGM during Gulf War I could achieve the same effect. Satellite navigation, PGM technology and availability of stealthy bombers (B-2) have improved this capability significantly since 1991.

14 To be considered a precision weapon, munitions must be capable of hitting within 9.9 feet of the aim point. If outside the circle, but within 66 feet munitions are called near precision weapons.

15 Knight (1989), p. 1

16 Lock-Pullan (2002), p. 63

17 Howard and Paret (1976), p. 77

18 Howard (1981), p. 14

19 Accepting that the US failure was partially because of their lack of a clearly articulated strategic aim.

20 Pape (1996), p. 209

21 AP3000 (1999), p. 2.6.2

22 ibid, p. 2.6.1

23 Lock-Pullan (2002), p. 60

24 Finn (2003), p. 2

25 Lambeth (2000), p. 164

26 Chain, (1988), p. 23, quoted in Lambeth, B (2000), p. 164

27 Conventional Air Launched Cruise Missile

28 Lambeth (2000), p. 166

29 Meillinger. Statistics provided during a brief to the Advanced Command and Staff Course Number 7, 14 Oct 2003

30 Air Force Doctrine Document 2-1.2 (1998)

31 ibid, p. 1
32 ibid, pp. 4-11
33 ibid, p. 1
34 id
35 Strange (1996). In his study of COGs, Dr Strange links the modern concept of COGs to critical capabilities, critical requirements and then, importantly, critical vulnerabilities. It is the critical vulnerability, or opponent's weaknesses that are most susceptible to attack that must be identified and exploited with an appropriate focus of effort.
36 Bucknam (1998), pp. 315-318
37 British Defence Doctrine (2001), p. 1-2 defines levels of war. Grand strategy refers to the co-ordinated use of economic, diplomatic and military power. Military strategic is the art of developing and employing military forces consistent with grand strategic objectives. The operational level is the level at which campaigns are planned by establishing operational objectives. The tactical level is the level at which warfighting actually takes place.
38 For example see JWP 0-10 or JWP 3-00 for two versions of the UK estimate format.
39 Peach (2003), pp. 57-63
40 See Knight (1989), p. 46 for an assessment of the value of these raids.
41 Peach (2003), p. 59. Peach contends that, notwithstanding Warden's Five Rings systems construct (discussed later), General Horner, the Air Commander, employed a classic NATO Cold War style air campaign. This involved sequentially suppressing Iraqi integrated air defences, establishment of a degree of control of the air and then attacks on other targets including Iraqi leadership. He suggests that it was actually the ability to manage over one thousand sorties per day during the first Gulf War that allowed concentration of force to achieve a strategic effect on Iraqi defences.
42 Bucknam (1998), p. 316
43 Bucknam (1998), p. 317. At the Tactical level, the bombers were used as bait to draw Luftwaffe fighters into combat with allied fighters. At the Operational level, loss of oil hindered German ground mobility and enabled Allied land advances to meet their objectives. At the strategic level, oil shortages undermined the overall war effort, forced changes in training and operational policies and affected munitions production.
44 Deptula (2001). His essay explaining the use of an effects-based approach during Gulf War I provides an influential argument for how American forces should be structured to fight in the future. It appears to have the backing of Joint Force Command and, significantly, Donald Rumsfeld, US Secretary of State for Defence.
45 Deptula (2001) argues that in air campaigns prior to the first Gulf War, force was applied sequentially to roll back the enemy defences prior to attacking high value targets. The analogy of the electrical circuit, where electrons flow in a line through light bulbs sequentially to complete a series circuit illustrates the concept. In warfare this requires assets to be tied up suppressing enemy defences before reaching the objective thus giving rise to high attrition, limiting the overall surprise and dispersing the mass of main effort. In a parallel circuit, electricity reaches the light bulbs almost simultaneously. In parallel warfare the simultaneity of attack against high priority targets enables surprise at the tactical level, a larger span of influence, fewer casualties, paralyzing effects and shorter time to impose effective control over the enemy.
46 Williams, (2002), p. 133
47 Davis (2002), p. 7
48 Warden, (1996), pp. 364-374. His highly influential 'Five Rings' concept is acknowledged as the basis of coalition air operations planning for the 1991 Gulf War. The theory uses the analogy of a target board with leadership at the centre. Wrapped around the core are the organic essentials (for example electrical power). The next layer out is the infrastructure, then the population, then finally the outer layer, the fielded military. Simultaneous (non-linear) attacks on these sub-systems of a 'system' provide an inside-out approach to warfare, as opposed to the classic outside in method where the fielded forces are peeled away to expose the opponent's infrastructure. Importantly, it provides a framework for analysing COG in order to achieve the desired effects.
49 Boyd focussed on creating a time advantage over the enemy by rapid transition of activities based on better intelligence, effective assessment of it, fast decision making (using intuition) and decisive action. By accelerating the O-O-D-A loop cycle, the enemy is increasingly confused and ultimately defeated.
50 Deptula (2001), p. 26
51 Quoted in Friedman (2003), p. 88
52 Tirpak (Feb 2002), p. 32
53 Brookes (Apr 2002), p. 26
54 Withington (2003), p. 86
55 Website: globalsecurity.org
56 Biddle,T (2002), p. 50
57 Friedman (2003), p. 184
58 Prof Rodgers, Bradford University, presentation on International Terrorism to ACSC 7, 8 Mar 2004.
59 Brookes (2004), p. 40
60 USCENTAF (2003)
61 Excludes Special Operations Forces, Army helicopter and coalition sovereignty flights.
62 Quoted in Hebert (Nov 2003), p. 27
63 Hebert (Jul 2003), p. 49
64 TST was designed to Find, Fix, Track, Target, Engage and Assess (FFTTEA) important targets that were available for only a fleeting time.
65 Intelligence Surveillance Target Acquisition and Reconnaissance. These may include E-3 AWACS and JSTARS for example.
66 Newman (2003), p. 52
67 General McCrystal, quoted in Finn (2003), p. 6
68 See General Jumper's comments regarding the utility of airpower in poor conditions in Hebert (2003), p. 27
69 Grant (2003), p. 83
70 Jumper quoted in Tirpak and Hebert (2003), p. 81
71 Jumper quoted in Finn (2003), p. 15

72 USCENTAF OIF – By the Numbers (2003), p. 8
73 Tirpak (2002), p. 38
74 Missile Engagement Zone
75 Newman (2003), p. 52
76 See Gentile (2001) for a detailed study of the US bombing surveys from WWII and Gulf War I.
77 Tirpak and Hebert (2004), p. 80
78 Williams (2002), p. 144
79 Peach (2003), p. 4A-8
80 Pape (1996), p. 320
81 Due to classification of material
82 Significant numbers of Iraqi soldiers dispersed or surrendered
83 Anderson (2003), p. 43
84 Loh quoted in Boyne (2003), p. 176
85 Air Force & National Security White Paper (1990), p. 15
86 USAF White Paper (1999) outlines the USAF's long-term requirement for B-bombers
87 ibid, p. 15
88 ibid, p. 24.
89 Quoted in Boyne (2003), p. 177
90 The Russian Federation does retain Blackjack aircraft but these are far less capable than the USAF B-force
91 Anderson (2003), p. 45
92 Boyne (2003), p175. NASA proved hypersonic capability on 27 Mar 2004 with the launch (from a B-52) of X-34, its SCRAM-jet platform that is surely destined for military application.
93 Cheek (2002), p. 73