The Vital Pre-Requisite: The Battle of Britain and the Enduring Importance of Control of the Air

By Air Commodore Al Gillespie

Air superiority, underpinned by an effective air command and control system, was fundamental to victory in the Battle of Britain. The Royal Air Force and Dowding's Fighter Command denied Goering's Luftwaffe the control of the air deemed the vital pre-requisite for an invasion of southern England in 1940. This paper examines the genesis of the doctrine and capabilities that created the conditions for success, the strategic significance of the British victory and how the challenges associated with achieving air superiority have evolved since 1940. It considers how air superiority remains relevant in the contemporary and future operating environments and if the UK has the resolve to deliver against the aspirations cited in current doctrine.

In June 1940, Britain found herself standing alone against a German war machine that had brushed aside European resistance with alarming and unexpected ease. On 16 July 1940, Hitler issued Directive 16, authorising Operation 'SEALION' – plans for an amphibious assault against England, somewhere between Ramsgate and the Isle of Wight. The directive was clear that invasion was a last resort and would only be possible if air superiority could be established over southern England and safe passage secured for the crossing.[1] While the fact that this appeared to ignore the role of the Royal Navy in opposing any attempted assault appears to be a major oversight, it is significant that the need for control of the air featured most prominently in Hitler's planning.

Three days later, Hitler offered unconditional peace to Britain.[2] Although many of the preparations to defend against a German invasion were incomplete, Britons perceived Hitler's intent to invade as absolute and any assurances meaningless. Despite a peace lobby in the British cabinet, Hitler's increasingly triumphalist arrogance sealed a formal British rejection of the peace offer on 22 July 1940.[3] This was nearly a fortnight after the opening rounds of what we now know as the Battle of Britain, which officially spans the period 10 July to 31 October 1940, although by 17 September, Hitler had decided to postpone SEALION indefinitely.[4] The British victory was a decisive point in history that dramatically changed the outcome of the Second World War. Although the traditional historical view which sees the Battle as being exclusively between the Luftwaffe and RAF Fighter Command overlooks the part played by Bomber and Coastal Commands and the Royal Navy, the struggle for control of the air was the most important aspect of this critical struggle, and lies at the core of this article. How was it, though, that the RAF was able to fight the Battle to such effect? And what does the Battle tell us today about control of the air, a concept which some respected popular commentators seemed to think had become little more than a post-Cold War irrelevance used only to justify the procurement of expensive fighter aircraft?[5]

To address these questions, this article reviews the air power theories and doctrine that predated the Battle of Britain and which were the essential underpinnings of the British defensive effort. It contends that the fundamentals of an integrated air defence system (IADS) were in place across southern England as early as 1918, and that this construct, equipped with the emerging technology of the day and consistently updated and refined during the interwar period, contributed to success against the Luftwaffe. It then goes on to examine the strategic significance of the victory, and considers briefly a number of other examples to illustrate the validity of the view that control of the air remains a critical air power role. Finally, it offers a short consideration of the challenges of delivering control of the air in the contemporary and future operating environments, and the risks and opportunities facing the United Kingdom in this respect.

The Beginning

> *"The aeroplane is not a defence against the aeroplane…as a weapon of attack, [it] cannot be too highly estimated."*
>
> Brigadier General Hugh Trenchard, 22 September 1916 [6]

Between 1909 and 1914 airships and aircraft were transformed from exciting experimental curiosities into 'embryonic instruments of modern warfare'[7] By 1914, most European states had a fledgling air service. Britain, France and Italy focused on reconnaissance, while the French also pursued the development of bomber aircraft to attack German industrial centres. A period of rapid evolution in the opening months of the war culminated with the arrival of the Fokker *Eindekker* - a relatively mediocre aircraft, but one fitted with a fixed, forward-firing machine gun able to fire through the propeller blades, delivering a new capability – the true single-seat fighter aircraft. Previous types had either been forced to employ a 'pusher' design with the engine behind the pilot, leaving the nose clear for a machine gun, or had used weapons mounted above the top plane – drum-fed and limited in ammunition capacity, and difficult to reload swiftly, if at all, during the heat of battle. The *Eindekker* may not have had scintillating performance, but revolutionised the control of the air battle. By the end of 1915, it was clear that to be effective, a fighter aircraft needed to possess a good turn of speed and fixed, forward-firing weapons.[8] Rapid aircraft development resulted in a dynamic arms race that saw technological advantage pass frequently from one side to the other. A fascination with technology was to become a defining feature of air power (and airmen) that endures today.

While the Germans continued to configure defensively and concentrated their forces to seek limited control of the air over sections of the front, usually their own lines. The British and French, on the other hand, preferred offensive action. The land battles of 1916 on the Western Front were accompanied by the first true large scale battles for control of the air. As Trenchard noted, when the French air service had responded to complaints from ground troops at Verdun and ceased offensive action to provide visible cover over their own lines, the Germans had seized the initiative, but 'once the offensive policy was resumed, the enemy at once ceased to make hostile raids.'[9] At the Battle of the Somme, Trenchard's policy of a "relentless and incessant offensive" resulted in the majority of air combat occurring over enemy lines with the enemy over-committed to Defensive Counter Air (DCA) operations and unable to go on the offensive.[10]

Trenchard's preference for offensive action is further explained as follows:

> *"…owing to the unlimited space in the air, the difficulty one machine has in seeing another… it is impossible for aeroplanes...however numerous their formations, to prevent hostile aircraft from crossing the line…"*[11]

Trenchard had concluded that DCA operations to protect friendly forces would be impossible. In a world without radio telegraphy (R/T) or radar, even if the location of enemy aircraft could be determined, there was no practicable means of concentrating defensive forces to intercept them. Control of the air depended largely on the visual acquisition of enemy aircraft, and the experiences at Verdun and the Somme shaped Trenchard and air force thinking for decades. Trenchard remained unconvinced about the value of defensive fighter aircraft for anything other than the protection of civilian morale in a home defence context, even though

technological advances in both detection and air command and control (C2) made strategic air defence a possibility.[12]

While the *Luftstreitkräfte* fought a largely defensive war over the Western front, the Germans also undertook a strategic air offensive against England, utilising both Army and Navy airships.[13] It is in the analysis of the British response that we see the green shoots of a strategic AD system emerge. This was to be the London Air Defence Area (LADA), initially under the command of Admiral Sir Percy Scott (the result of the Admiralty having responsibility for the air defence of the UK between 1914 and 1916). During 1916, the airship threat was largely defeated, but a new challenge arose from raids by aircraft, most notably the infamous Gothas, from 1917. To reinvigorate the air defences in the light of this new threat, Major General Edward Ashmore was appointed to command LADA. Ashmore had commissioned into the Royal Artillery, but had joined the Royal Flying Corps (RFC) Special Reserve early in 1914; by 1917, he had commanded two RFC Brigades in France. His combination of extensive gunnery and flying experience made him an ideal man for the task of coordinating the air defence of London.

Ashmore placed a highly centralised system of command, control, communications and intelligence (C3I) at LADA's heart.[14] A combination of highly-effective intercept of enemy R/T, an army of observers and a reliable operational intelligence feed provided Ashmore's LADA system with a primitive but accurate Recognised Air Picture (RAP):

> *He could follow the course of all aircraft flying over the country as the counters crept across the map. The system worked very rapidly…as a rule not more than half a minute [from detection to display]…*[15]

Most importantly, by the end of 1918, Ashmore had the potential, through R/T, to vector his limited fighter force to intercept enemy raids, at day or night. Strategic air defence had become a realistic possibility.

The Inter-War Period

> *"To my mind in an air war…R/T will cause all enemy's attacks to be closely followed and aircraft of the defence concentrated to meet them."*
>
> Air Commodore J.A. Chamier [16]

As RAF senior officers debated the theory and practice of strategic air warfare, Chamier's prescient view was drowned-out by Trenchard's conviction that offensive air action, in the form of bombing, could win a war.[17] This was accompanied by a reinforced belief that air defence remained an impracticality. Stanley Baldwin's declaration that "the bomber will always get through…the only defence is in offence…" and its wide acceptance amongst the British public is testament to how long the strategic bombing narrative dominated thinking in the United Kingdom.[18]

Concern across Whitehall in 1922-23 that France might use its air power superiority to blackmail Britain spawned the construction of a strategic warfare-focussed Home Defence Air Force (HDAF) of 52 squadrons. [19] As the HDAF grew, the Air Ministry established Fighting Area Headquarters (FAHQ) to control all fighters and ground forces. This was the first time a HQ had been established with complete responsibility for strategic AD and it established the foundations of RAF Fighter Command (FC).[20] Between 1924 and 1934, FAHQ re-established the LADA and began systematic improvement to keep pace with technology. A highly-effective operational intelligence system provided, as it had done during the First World War, early warning that allowed fighters to be in the air by the time enemy bombers cleared 'The Channel Gap' and crossed the coast. The Chain Home (CH) radar system filled that gap, providing early warning and a more accurate and timely RAP that the FAHQ system was preadapted to absorb and exploit, using its existing C3I infrastructure. The further prioritisation of air defence as the growing threat from Germany became clearer led to a reorganisation of the RAF into functional commands. Air defence was placed in the hands of Fighter Command, led by Air Chief Marshal Sir Hugh Dowding. As the former Air Member for Supply and Research (1930-35) and then Air Member for Research and Development (1935-36), he was perhaps the ideal choice to lead the new command which would make use of much of the technology which began its development under his watchful eye in these two posts.[21]

The Czechoslovakia crisis of September 1938 sparked an Air Ministry-led inquest into the state of the RAF. The resultant enhancements to the strategic communications linking C2 nodes and radar stations were essential to the requirements of 1940.[22] A final expansion scheme ('M') was put in place to bring Fighter Command up to a total strength of 50 squadrons by April 1941. By September 1939, 35 were available for home defence with over 80% equipped with Spitfires or Hurricanes. Beaverbrook's Ministry for Aircraft Production worked miracles and by June 1940 was producing 446 fighter aircraft per month. Technological enquiry and development went hand-in-hand with this upsurge in production. Of these advancements, the most significant of 1939 was 'Pipsqueak'. This enabled direction-finding and geolocation of friendly formations to Fighter Command operations rooms allowing fighter controllers to vector fighters much more accurately towards the enemy. This ground-controlled intercept technique was to be the Air C^2 bedrock of the command's operations during the Battle of Britain.[23] By July 1940 Dowding had at his disposal a cutting-edge, centrally-controlled IADS which fused multiple data streams, disseminated the RAP widely and effected C2 of fighter aircraft to force-multiply firepower where and when it was most needed.

The Battle of Britain

"Thank God we're alone now."

Sir Hugh Dowding, June 1940 [24]

When Dowding expressed his relief that the Battle of France would no longer be a drain on his precious fighter resource, he must have been thinking of the 450 Spitfires and Hurricanes destroyed and the associated deficit of more than 360 pilots. [25] The Luftwaffe had also taken heavy losses of 1,300 aircraft, about one-third of its total strength, but remained a competent and potent threat.

The War Cabinet agreed with the Chiefs of Staff that "the crux of the whole problem is the air defence of this country" and that the ability to defend against invasion would depend on the extent to which the Royal Navy could operate in the face of heavy air attack. [26] The Admiralty was understandably unwilling to commit capital ships south of the Forth until German air power had been weakened but retained a significant maritime advantage over a *Kriegsmarine*, much weakened by the Norwegian Campaign. The RN had also accumulated over eight hundred light vessels in south-eastern ports and "…German invasion craft were certain to suffer very heavy losses if the small fast English warships got in amongst them". [27] With the Home Fleet intact, if the RAF could prevent the Luftwaffe from achieving air superiority across the English Channel and southern England, the risk to an invasion force would be intolerable to Hitler. [28] Churchill "…rested upon the conclusion that…we would beat the German Air Force. And if this were true our naval power…would destroy all enemies who set their course towards us." [29]

The British arguably had the strategic advantage. The RAF needed to deny the Luftwaffe control of the air to maintain the RN's credibility as a deterrent to invasion, and was appropriately configured, along functional lines, to do so. With the Observer Corps and anti-aircraft artillery (AAA) fully integrated into his C3I-enabled AD system, Dowding had the capability needed to do so. The Germans were organised differently into *Luftflotte* containing a mixed force of fighters, heavy-bombers and dive-bombers. This had worked well in supporting the Blitzkreig that preceded the fall of France but it was suboptimal in delivering an OCA or strategic bombing campaign beyond the useful range of Luftwaffe fighters.

The period 11 July to 11 August 1940, often referred to as 'The Battle of the Channel', was dominated by regular 'shoot-and-scoot' attacks by German bombers protected by large fighter escort formations. Although Dowding had the RAP to respond to the Luftwaffe attacks, he refused to be drawn into an attritional battle where the Germans enjoyed range and endurance parity. This gave Fighter Command additional time to refine its Air C2 system and exercise squadrons that would very soon be called upon to scramble against German raids. Hitler became frustrated at the apparent reluctance of the RAF to fight, and on 1 August 1940 issued Directive No.17 "to establish the necessary conditions for the final conquest of England…[and] overpower the English air force." [30] Goering's follow-on *Adlerangriff* (Eagle Attack) directive reiterated the extant objectives of establishing air supremacy and destroying the Royal Navy in advance of an invasion which, it was assessed, had to take place by 15 September 1940, before tidal conditions and weather became increasing limitations on the ability of an invasion force to set sail.

Adlertag, set for the 13 August 1940, marked the beginning of a month that nearly brought Fighter Command to its knees. Shaping attacks began against the Chain Home radar system but the lattice masts were difficult to destroy and mobile radar systems provided redundancy. They also had the unfortunate effect (for the Germans) of convincing Goering that the pre-war view that British radar sites were for experimentation rather than part of an integrated system was correct; the radar sites seemed of little importance, since the attacks appeared not to have had any effect on the RAF's defensive efforts.[31] The *Adlerangriff*-related attacks on Fighter Command airfields that followed mark the decisive period during the Battle of Britain. The Luftwaffe committed 2,277 combat aircraft (963 fighters) against approximately 1,000 operational RAF fighters. Although between 12 August and 6 September 1940 there were 53 attacks on airfields, mostly in the south-east of England, it was very difficult to close a 'grass strip' airfield for more than a few days. RAF aircraft also moved further inland, where the airfields were protected by fighter aircraft from 10 Group (southwest England) and 12 Group (Midlands).[32] On 15 August 1940, 'Luftflotte 5' launched the only attack across the North Sea from Norway. Notoriously poor German intelligence had incorrectly assessed that northern Britain had been depleted of fighters and the now highly-effective British C3I system, limited fighter escort and inadequate defensive armament on its bombers dealt the Luftwaffe a heavy blow.[33]

As Goering began to worry about the unexpected resilience of the RAF, he intensified airfield attacks. Although the Luftwaffe seriously weakened Fighter Command's defences, it did not cause a major withdrawal of fighter units from southern England.[34] At this stage of the battle, the Luftwaffe were losing four aircraft for every three they shot down, but losing aircrew at seven times the rate of the RAF. [35] By the end of August, exacerbated by a tendency to make extravagant claims about kills and double counting, German intelligence convinced Goering that the RAF had less than 100 fighter aircraft remaining; the truth was closer to 700 operational with more than 250 in reserve.[36]

In early September, perhaps born of the belief that the RAF was on its knees or as a reprisal for Bomber Command's attack on Berlin 25/26 August, Goering ordered the commencement of systematic attacks against London.[37] Hitler was convinced that with the RAF mortally wounded, a strategic bombing campaign would more rapidly bring Britain to its knees. The respite could not have come too soon for Dowding. The time-distance calculus gave the RAF more time to respond, further diminished the effectiveness of German escort fighters and brought relatively-unscathed No.12 Group aircraft directly into the fight. The period 7-15 September 1940 was a tipping point; during that week the Luftwaffe lost 298 aircraft. On 15 September more than 200 German bombers with escorts attacked in the now-predictable three waves. With no feints evident and an accurate RAP relayed to Dowding, the raids were met by over 300 aircraft. Although 158 bombers reached London, visibility and disruption by RAF fighters affected accuracy. The 25% loss rate endured by the Luftwaffe was unsustainable. On 17 September 1940, Operation SEALION was postponed indefinitely.[38]

It might be said that the Luftwaffe never fully recovered from the experiences of 1940. The US Eighth Air Force's counter-air campaign (as part of Operation POINTBLANK) in February/March 1944 dealt the decisive blow.[39] The offensive action by the USAAF inflicted enormous attrition on an air force which, by 1944, was running out of pilots and which had been forced to call upon its national aero-industry to abandon production of all aircraft other than fighters. It was not enough. Despite a last-ditch attempt (Operation *Bodenplatte*), to win air superiority in January 1945, the Luftwaffe ceased to be an effective fighting force in northwest Europe months before D-Day, its ability to gain anything more than occasional localised, temporally-limited control of the air long gone.

If the Second World War demonstrated the importance of control of the air (and space precludes a detailed analysis of the relevance of the concept in the war against Japan), events in the post-war world validated the lessons drawn from the Second World War. The first main test came in the clash between United Nations forces and those of North Korea and the People's Republic of China. The growth of so-called 'brush-fire' or 'proxy' wars appeared to offer similar lessons, if not on the same scale. The classic illustration of the importance of control of the air in this sort of conflict lies in the experiences of the United States in Vietnam, and it is to the Korean and Vietnamese examples that we now turn.

Korea / Vietnam

The surprise North Korean invasion of the South on 25 June 1950 appeared, at first, to be on the verge of stunning, rapid success. Seoul fell to North Korean (DPRK) forces at the end of June, and within a month they occupied half of South Korea's (the RoK's) west coast. Stratemeyer (Commanding General Far East Air Forces (FEAF)) clearly defined control of the air as a priority precondition that would enable the FEAF to provide Close Air Support (CAS) to UN land forces.[40] His premise applied equally, of course, to US Marine Corps assets and to the aircraft operating from American and British aircraft carriers. The DPRK's air force was quickly destroyed, both in air-to-air combat and on the ground, its airfields rendered unserviceable. Although ground-based air defences (GBAD) were an ever-more potent threat, UN aircraft were able to exercise air supremacy over the entire peninsula and safeguard UN land forces against air attack.[41] Having come close to being pushed off the peninsula, UN forces regrouped and won a decisive air-land battle at Pusan where Air Superiority, CAS and Air Mobility combined with UN reinforcement to force communist forces back. Coupled with General Douglas MacArthur's simultaneous amphibious assault at Inchon, 150 miles to the rear, severed enemy supply lines and by late October 1950 UN forces were approaching the border with China. This provoked a Chinese response, changing the dynamics of both the war as a whole and the contest for control of the air.

On 1 November 1950, UN forces attacked the Chinese for the first time, coincident with the appearance of technically-superior People's Liberation Army Air Force (PLAAF) MiG-15 fighters. Political constraints meant that the MiGs could operate from Manchuria unmolested and, ably supported by ground-based radars, they were able to regain air superiority over the

northwest corner of the peninsula ('MiG-alley') as they pushed UN forces back towards the 38th parallel. Both sides developed an IADS but here US and Soviet doctrine (which inspired the North Korean and the Chinese approaches) diverged rapidly. The USAF provided information to their pilots and allowed them significant autonomy (mission command) while Soviet doctrine placed a tight ground-controlled rein on fighter pilots. Near-parity led to mass dogfights with neither side able to provide the enduring control of the air necessary to support offensive ground manoeuvre.[42] As the mid-1951 stalemate settled around the 38th parallel, it mirrored the situation in the air above with the Chinese reluctant to venture south beyond ground-based radar coverage. This, of course, ceded control of the air elsewhere to the UN forces, enabling the provision of effective air support for the remainder of the campaign. It is, perhaps, worth noting the repetition of a further lesson from the Second World War – namely that technologically inferior aircraft are often outclassed; sometimes pilot skill may offset technological superiority, but the risk of taking on advanced fighter opposition flown by pilots of at least comparable skill was all-too clear from the experiences of the USAF's F-80 Shooting Star squadrons and the Royal Australian Air Force Meteor squadron. Overall, the experiences of Korea validated those from 1940 and beyond: control of the air proved a critical enabler. It was not, though, an end in itself, since the possession of control of the air did not enable UN forces to break the stalemate that emerged after their retreat to the 38th Parallel.

An examination of control of the air in Vietnam highlights similar lessons. It also represents the point at which the increasing dominance of Surface-to-Air Missile (SAM) systems within an IADS can be seen. This gave ever-increasing importance to electronic warfare (EW), a factor first seen in the 'beam bending' conducted by the RAF in a bid to prevent German bombers from finding their targets during the Blitz, and then in the significant EW efforts of Bomber Command's 100 Group during the Allied air offensive.[43]

Prior to April 1965, despite the existence of North Vietnamese (NV) AAA there was no obvious challenge to US air superiority. On 4 April 1965, this changed. North Vietnamese MiG-17s, under the C2 of NV ground-based controllers, avoided USAF fighter escorts and engaged an incoming strike package, inflicting several losses on the strike package. In an illustration of the importance of effective C2, it subsequently transpired that at least two North Vietnamese losses were as a result of 'friendly fire' by their AAA, rather than to US fighters as had been first presumed.[44] In response to this, the US deployed EB-66 EW aircraft to deny the RAP to the North Vietnamese and withdrew the ageing F-100 aircraft from the fighter role, replacing it with the F-4C Phantom. The latter was equipped with air-to-air radar and radar guided missiles that theoretically handed the technological advantage back to the US. Again, though, technology was not the sole answer. Restrictive rules of engagement; problems with missile reliability; sub-optimal tactics and determined opponents who appeared to learn lessons from the engagements meant that the technical superiority of the American aircraft was not exploited to the full.[45] The key to countering the MiG-17 threat was a more timely, accurate, dissemination of the RAP to the F-4C escorts, especially when they were operating beyond

friendly ground-based radar coverage. The arrival of EC-121 Airborne Early Warning (AEW) aircraft provided exactly that and addressed many of the challenges faced by the Luftwaffe in 1940 and the NKAF in 1950. Such was the force-multiplying effect that the NVAF withdrew – temporarily - from the fight within weeks.[46]

On 24 July 1965, the North Vietnamese shot down a US aircraft with a Soviet-built SA-2 missile. Prior to this event, US aircrews had operated with impunity above a low-tech AAA threat; the situation had just changed irrevocably and it initially drove the US to much more hazardous low-level attacks in the vicinity of Hanoi where the IADS was concentrated. Ultimately, the North Vietnamese IADS would incorporate around 200 SA-2 launchers moving randomly between myriad prepared sites[47] and the US moved towards using the F-100 and F-105 to suppress enemy air defences in the so-called 'Wild Weasel' role. This required the development of emitter locator systems and anti-radiation missiles such as the AGM-45 Shrike and AGM-78 Standard ARM. The lesson of the air offensive in Europe between 1942 and 1945, namely that EW was a key part of maintaining control of the air was validated once more. The threat of the North Vietnamese IADS was never fully conquered by the USAF, demanding complex Composite Air Operations (COMAO) to fight hard for air superiority in North Vietnam on a daily basis.

The failure of US air forces to dominate the skies over North Vietnam prompted much investigation during the war itself. The US Navy and USAF identified similar reasons for their disappointment, and similar solutions. Much improved training, led by the Navy's famed Fighter Weapons School ('Top Gun'), in tactics and weapons employment, coupled with technological advances in air-to-air missile capabilities (such as 'dogfight' versions of the radar-guided AIM-7 Sparrow and more sophisticated versions of the Infra-Red homing AIM-9 Sidewinder) helped to redress the balance, but this was arguably a case of 'too little, too late'. It must, though, be noted that the perceived failure of US air forces to gain air supremacy, or even air superiority over North Vietnam often conceals a critical point – namely that the North Vietnamese air force did not fight for control of the air over South Vietnam. Once again, the control of the air battle – even if the results were felt to be disappointing by many Americans, practitioner and analyst alike – served as a critical enabler for other operations. No American transport aircraft were intercepted and shot down on their way in to the South by enemy fighters; the CAS sorties generated in South Vietnam did not have to fight their way into the target area, or to worry about enemy fighters attacking them on their weapons run. AAA presented the most serious threat to American aircraft operating above the 17th Parallel and the Demilitarized Zone, and although this inflicted large numbers of casualties, there can be little doubt that the air campaign over the North facilitated operations in support of the counter-insurgency operations. We can, perhaps, see here some resonance with recent times, when aircraft have operated in a relatively permissive environment – the difference being that in Vietnam, nobody questioned the relevance or need for fighters to gain control of the air.

There is little question that the experience of Vietnam scarred the United States – politically, militarily and socially. It saw significant rethinking of doctrine, a reconsideration of training

and professional military education, and a revitalisation of thinking about control of the air. While it was accepted that the F-4 Phantom II, the mainstay of both the USAF and the USN, was a magnificent aircraft which had achieved a great deal, the development of two new fighters, the McDonnell Douglas F-15 Eagle for the USAF and the Grumman F-14 Tomcat for the USN pointed to a willingness to learn the tactical lessons presented by the Vietnam experience (the first F-14 squadrons were ready in time to cover the evacuation from Saigon in 1975, although they saw no action).

Validation of the new types came in a number of limited engagements. The Israeli Air Force (IAF) used its F-15s effectively in a number of air combats during the late 1970s, while the US Navy's F-14s engaged Libyan aircraft over the Gulf of Sidra in 1981. The following year saw the reaffirmation of the importance of control of the air over Lebanon, where the IAF with its new F-15s in the vanguard, destroyed over 80 Syrian aircraft without reply. Thousands of miles away, in the South Atlantic, Britain experienced its first UK-only battle for control of the air since the Second World War – and it was again a critical enabler for operations.

While these actions sustained the notion that control of the air was fundamental to success, perhaps the most spectacular modern illustration of the concept came in 1991 with Operation DESERT STORM.

Desert Storm, 1991

> *"As I report to you, air attacks are under way against military targets in Iraq...I've told the American people…that this will not be another Vietnam."*
>
> George H W Bush, 16 January 1991

Operation DESERT STORM, the US-led operation to expel Iraqi forces from Kuwait lasted from 16 January to 28 February 1991. Coalition ground forces were engaged in combat operations for only the last 100 hours.[48] The experiences in Vietnam and the overwhelming technological advantage delivered by 20 years of investment in AEW, Suppression of Enemy Air Defences (SEAD), EW, Signals Intelligence (SIGINT), stealth and precision strike crushed the Iraqi Air Force (IZAF) and severely weakened Iraqi ground forces. The Vietnam-born concept of a COMAO to enhance friendly force situational awareness and deny the same to the enemy while achieving air superiority *en route* to conducting a precision strike was an art form that the US had perfected through exercises such as RED FLAG. Coalition fighter aircraft outperformed the ageing IZAF opponents in all respects and the advent of tactical data links (Link 16) and encrypted identification friend or foe (IFF) provided widely-distributed real-time RAP and Air C2 information. E-3 Airborne Warning and Control System (AWACS) aircraft transmitted the same information via encrypted, jam-resistant radios. Conversely, IZAF pilots were denied the RAP and Air C2 from their ground controllers by heavy Allied jamming. Without Air C2, they were relegated to relying on visual acquisition and were bound to suffer a swift defeat.

The Iraqi French-supplied 'KARI' IADS was at the heart of a competent layered defence containing Soviet and French SAM systems. Much of the static portion was disabled by Tomahawk Land Attack Missiles and Precision-Guided Munitions dropped by F-117A stealth fighters. In receipt of over 500 High-speed Anti-Radiation Missiles (HARMs) within the first day, Iraqi operators soon elected to maintain radar silence.[49] IZAF airfields were also targeted although RAF Tornados suffered significant losses as they employed runway denial weapons from low-level. Such was the psychological effect of coalition air power on the IZAF, they only flew 100 air-to-air sorties during the first 3 days and then ceased to operate. Iraqi commanders admitted within 7 days that "the enemy has achieved air superiority…the Iraqi Air Force has lost the ability to move between bases."[50]

Although the KARI system was rendered inoperable, it was almost impossible to completely destroy the layered IADS; the residual SAM systems operating independently continued to influence Coalition tactics throughout the Air Campaign. In Kosovo, only 10 years later, the USAF brought a similarly complex level of COMAO to bear against the Serbian Air Force. Although NATO air power achieved overwhelming air supremacy, Milosevic conserved his SAMs by firing 2-3 missiles per day, often unguided to avoid being targeted by a HARM. Although Allied losses were limited, Serbian asymmetric tactics were sufficient to drive the Allies above 15,000 feet and reduce their effectiveness in targeting the Serbian Army.[51]

Kosovo, though, may be said to mark something of a turning point in the way in which control of the air has been considered in the United Kingdom. Since the Falklands campaign, British fighters have not been called upon to engage in air-to-air combat; suggestions that the character of war had changed have abounded, and as alluded to above, a number of prominent commentators and opinion-formers have expressed serious doubts about the validity of the concept of control of the air. This, of course, is to miss the point, not least since control of the air, as discussed, is about much more than air to air combat. This is why UK air power doctrine remains constant in stressing the importance of control of the air, and it is appropriate to end with an examination of the British approach to the concept within the contemporary environment.

The Contemporary Environment

UK Doctrine defines Control of the air as "freedom, over a given time, to use a volume of airspace for our own purposes while, if necessary, denying or constraining its use by an opponent." It also recognises Control of the air as the most important of the four air power roles because it protects political (strategic) and military (operational) freedom of action from attack.[52] The doctrine cites frequent historical and contemporary examples, many discussed above, which validate the thesis that Control of the air is a vital prerequisite for operations across all domains. It also acknowledges the importance of the AEW mission as an enabling force multiplier and, although Air C2 is not defined as an air power role or mission, it is appropriately recognised as "essential to delivering air power."[53] Sir Hugh Dowding would not disagree.

Control of the air and Air C2 are, therefore, appropriately to the fore and remain relevant to contemporary doctrine and operations. The perceived absence of an existential threat to the UK and the Afghanistan/Iraq meme that exists within the British military may restrict the extent to which doctrine is underpinned by the capabilities necessary to survive in a future operating environment in which "the proliferation of A2AD[54] capabilities will enable a wider range of potential adversaries to…deny our access to…operational areas" using increasingly prolific and sophisticated capabilities such as ballistic missiles and increasingly-effective and longer-range AD systems.[55]

This trend is already evident and the UK is struggling to keep pace. In Syria, as Coalition operations are ongoing against Islamic State, the highly-competent Syria IADS that made military planners think twice about airstrikes in 2013 continues to influence Coalition behaviour. The probable shoot-down of a USAF Predator drone on 17 March 2015 is a timely reminder. To render the IADS ineffective would take weeks of offensive military action and total destruction would be almost impossible to achieve. As NATO looks to its Eastern flank, towards the Baltic States, the airspace above is similarly challenged by Vladimir Putin. His Kaliningrad-based, state-of-the-art SAM systems have employment ranges of up to 180 miles and the layered, integrated nature presents an almost insurmountable challenge to all but the most advanced, low-observable aircraft or cruise missiles. Of most concern, this airspace is strongly contested without a need for even the hint of a NATO Article V-style border incursion.

Conclusion

Had the RAF failed to recognise the importance of home defence during the 1920s, the United Kingdom might well have lost the Battle of Britain, with the nation being forced to sue for peace or facing the threat of an invasion. Hypotheses postulating that the Royal Navy would have smashed any invasion attempt are persuasive – but the key point, of course, is that the Battle of Britain was not lost, which is why the British response to an invasion remains hypothetical. The roots of this success lay in the interwar period, with a recognition of the key factors within any contest for control of the air. Even with this prescience, the RAF achieved fighter force parity with the Luftwaffe only just in time but it was the force-multiplying effect of Dowding's C3I/AD system, centrally controlled from the Bentley Priory Operations room, which demonstrated the importance of maintaining the technological edge that tipped the balance back in favour of the RAF. Victory was a direct result of the country's single-minded preparedness to defend itself and maintain sufficient Control of the air to deter a German invasion. There can be little doubt, therefore, about the immediate strategic significance. In what followed, the availability of the British Isles to allied forces ensured that Hitler would continue to be harassed from the northwest as he expanded to the east. Britain also provided a mounting base essential to achieving victory in the Battle of the Atlantic and enabling the Allied air offensive. The latter enabled Allied air forces to achieve a level of air superiority that had eluded Hitler in 1940 and was an essential prerequisite to the D-Day landings which would ultimately lead to Allied victory in Europe.

A brief analysis of operations prior to and since the Battle of Britain supports the thesis that air power is a vital prerequisite for operations across all domains. The articulation of this enduring requirement does not adequately reflect the technical advances that have been (and remain) necessary to maintain superiority in the air. Korea was, arguably, the last time that aircrew prowess in aircraft-on-aircraft dogfights was the sole, decisive determinant, and the difficulty in projecting Air C2 and Control of the air forward was often a limiting factor in the ability to project force on the ground.

In Vietnam, the arrival of radar-guided SAMs, without the persistence limitations of aircraft, challenged air superiority and AEW aircraft enabled a long-range RAP and the concomitant projection of air superiority. Electronic warfare, which became a reality in the Second World War expanded massively in scope, becoming an integral part of control of the air. COMAOs, capable of operating in the increasingly contested environment, became a norm that endured to dominate the post-Cold War doctrine employed in the first Gulf War. Such was the coalition's technological advantage that ground forces enjoyed air supremacy from the moment they crossed the line of departure. Although air supremacy was achieved as quickly in Kosovo, the Serbs were able to challenge it with asymmetric use of relatively inexpensive SAM systems.

Although control of the air remains as doctrinally relevant today as it was during the Battle of Britain, the technical complexity associated with achieving it continues to grow at an alarming rate. Real-time Air C2 and an accurate RAP remain doctrinally-recognised as fundamental but, as predicted in Future Operating Environment 2035, the technological gap between western military technology and that of potential state or non-state adversaries is closing. Although the US continues to invest in maintaining the technological edge, the UK and the majority of NATO members have no answer to the A2AD effects associated with an increasingly-prevalent ballistic missile threat (Iran, North Korea) and Russian-built IADS (Kaliningrad, Syria). After 25 years without an existential threat to the UK, as Russian aircraft continue to penetrate our airspace, we are poorly configured to defend our territorial boundaries against anything other than an isolated incident. The realities of post-Cold War disinvestment are reminiscent of the 1930s and risk generating an inadvertent capability gap in the counter-air and Air C2 capabilities that remain fundamental to the defence of the UK and its overseas dependent territories as well as the collective defence of NATO. While control of the air therefore remains fundamentally relevant to British doctrine, the UK risks responding to this doctrine based on the experiences of the last 25 years rather than the requirements of the next. It is a picture with which Sir Hugh Dowding and his colleagues from 75 years ago might have been all-too familiar.

Notes

[1] Richard Overy, *The Battle of Britain* (London: Penguin Group, 2004), 19. Citing "Führer Conferences on Naval Affairs", 1939 -1945.

[2] See, for example, Peter Fleming, *Operation Sea Lion: Hitler's Plot to Invade England* (1957: London: IB Tauris, 2011), pp.77-78

[3] See Robert Mnookin, *Bargaining with the Devil: When to Negotiate and When to Fight* (New York: Simon and Schuster, 2010), pp.83-105. For a counter to the traditional view of a vacillating, 'peace at any price' lobby led by Lord Halifax, see Andrew Roberts, *The Holy Fox: The Life of Lord Halifax* (London: Phoenix Giant, 2004), pp. 195-257.
[4] Amongst numerous sources, see Christina JM Goulter, 'The Battle of Britain: The Air Perspective', *RUSI Analysis* (20 October 2006), **https://www.rusi.org/analysis/commentary/ref:C4538E034F182D/#.VbfP0PkYNFI** (accessed 22 July 2015).
[5] See Simon Jenkins, 'Defence budget? I prefer to Call it Showing Off', *The Guardian* 10 September 2010 **http://www.theguardian.com/commentisfree/2010/sep/07/defence-budget-expensive-showing-off** (accessed 22 July 2015); the same author's 'If the MOD can't name the enemy, it shouldn't buy the weapons' *The Guardian*, 16 January 2014 **http://www.theguardian.com/commentisfree/2014/jan/16/mod-cant-name-enemy-shouldnt-buy-weapons-threat-cold-war-defence** (accessed 22 July 2015) and Sir Max Hastings's interestingly-titled 'Britain's armed forces are beset by bureaucracy and big willy syndrome', *The Guardian* 2 August 2007, **http://www.theguardian.com/commentisfree/2007/aug/02/comment.politics** (accessed 22 July 2015)
[6] "Future Policy in the Air' (September 22, 1916), *RAF Air Power Review*, Spring 2013, pp.119-122.
[7] John Olsen, *A History of Air Warfare* (Washington DC: Potomac Books, 2010), 1.
[8] Ibid, 15.
[9] Trenchard, "Future Policy in the Air."
[10] Ibid.
[11] Ibid.
[12] Sir Charles Webster and Noble Frankland, *The Strategic Air Offensive Against Germany: Volume IV Appendices and Annexes* (London: HMSO, 1961),' Minutes of a conference held in the room of the Chief of the Air Staff, 19 July, 1923', pp.62-70, especially p.66. John Ferris, 'Fighter Defence before Fighter Command: The Rise of Strategic Air Defence in Great Britain, 1917-1934', *Journal of Military History* 63:4 (1999), pp.845-44.
[13] Olsen, *A History of Air Warfare*, 21.
[14] John Ferris, 'Airbandit: C³I and Strategic Air Defence During the First Battle of Britain, 1915-18, in Michael Dockrill and David French, *Strategy and Intelligence – British Policy during the First World War* (London: The Hambledon Press, 1996), p.24.
[15] E.B. Ashmore, *Air Defence* (London: Longmans, 1929), p.93.
[16] Ferris, 'Fighter Defence Before Fighter Command', p .859.
[17] Ferris, 'Airbandit', p.63.
[18] *Parliamentary Debates (Hansard)* 10 November 1932, Column 632. *The Times* (11 November 1932) reported on the speech with the bye-line 'Aerial Warfare – A Fear for the Future', and the speech is sometimes referred to as 'A Fear for the Future' speech in online sources.
[19] John Ferris, 'The theory of a 'French air menace', Anglo-French relations and the British home defence air force programmes of 1921–25', *Journal of Strategic Studies* Volume 10:1 (1987), pp. 62-83; Hines H Hall III, 'British air defense and Anglo-French relations, 1921–1924', *Journal of Strategic Studies* Volume 4: 3 (1981) pp.271-284.
[20] Ferris, 'Fighter Defence Before Fighter Command,' p. 859.

[21] Vincent Orange, 'Dowding, Hugh Caswall Tremenheere, first Baron Dowding (1882–1970)', *Oxford Dictionary of National Biography*, Oxford University Press, 2004; online edn, May 2008 http://www.oxforddnb.com/view/article/32884, accessed 20 July 2015
[22] Richard Hough & Denis Richards, *The Battle of Britain* (Sevenoaks: Hodder and Stoughton, 1989), 58-59.
[23] Ibid., 63-64.
[24] Michael Glover, *Invasion Scare* (London: Redwood Press, 1990), 51.
[25] Hough, *The Battle of Britain*, 100.
[26] The National Archives, CAB 66/7/48 'War Cabinet Chiefs of Staff Committee, "British Strategy in a Certain Uncertainty," (May 25, 1940): 6,8. I am grateful to Dr David Jordan for providing a copy of this document.
[27] Friedrich-Karl von Plehwe, "Operation Sealion 1940," *RUSI Journal* (March 1973),p. 51. See also John Terraine, *The Right of the Line: The Royal Air Force in the European War 1939-1945* (Sevenoaks: Hodder & Stoughton, 1985), p. 173.
[28] Terraine, *Right of the Line*, p.171.
[29] Winston Churchill, *Their Finest Hour* (New York: Houghton Mifflin Company, 1949), 249.
[30] Hough and Richards, *Battle of Britain*, p.137.
[31] Overy, *The Battle of Britain*, 71-73; Sami Puri, 'The role of intelligence in deciding the Battle of Britain', *Intelligence and National Security*, Volume 21:3, (2006), pp.416-439
[32] Ibid., 70.
[33] For an overview of German intelligence, see Puri,'The Role of Intelligence', Horst Boog, 'German Air Intelligence in the Second World War', *Intelligence and National Security*, Volume 5:2 (1990), pp.350-424; Sebastian Cox, 'A comparative analysis of RAF and Luftwaffe intelligence in the Battle of Britain, 1940', *Intelligence and National Security*, Volume 5:2 (1990)pp.425-443.
[34] John Ray, *The Battle of Britain: New Perspectives* (London: Weidenfeld Military, 1994), pp.80-82.
[35] Probert and Cox, *The Battle Re-Thought*, 27.
[36] Overy, *The Battle of Britain*, 72-73.
[37] Ibid., 82.
[38] Ibid., 86.
[39] Noble Frankland, *History at War: The Campaigns of an Historian* (London: Giles de la Mare, 1998) pp.70-73
[40] Olsen, *A History of Air Warfare*, 89.
[41] Ibid.
[42] Ibid., 100.
[43] See Martin Streetly, *Confound and Destroy: 100 Group and the Bomber Support Campaign* (London: Macdonald and Janes, 1979); Martin Bowman and Tom Cushing, *Confounding the Reich: The Operational History of 100 (Bomber Support) Group* (Cambridge: Patrick Stephens Limited, 1996)
[44] See Istvan Toperczer, *MiG-17 and MiG-19 Units of the Vietnam War* (Oxford: Osprey Publishing, 2001)pp.30-31.
[45] Marshall L Michel, *Clashes: Air Combat Over North Vietnam, 1965-1975* (Annapolis: Naval Institute Press, 1997);

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[47] Olsen, *A History of Air Warfare*, 113.
[48] Ibid., 177.
[49] Ibid., 184
[50] Kevin Woods, *The Mother of all Battles* (Michigan: Naval Institute Press, 2008), 190.
[51] For a full account, see, for example, Anthony Cordesman, *The Lessons and Non-Lessons of the Air and Missile Campaign in Kosovo* (Praeger, 2001); Stephen Hosmer, *Why Milosevic Decided to Settle When He Did* (Santa Monica: RAND, 2001).
[52] MOD, *Joint Doctrine Publication 0-30 – UK Air and Space Doctrine* (Shrivenham: DCDC, 2012), 3-3.
[53] Ibid., 3-30.
[54] Anti-Access and Area-Denial (A2AD).
[55] MOD, *Strategic Trends Programme: Future Operating Environment 2035* (Shrivenham: DCDC, 2014), 15-16.

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