JOINT SERVICES
COMMAND AND STAFF COLLEGE

DEFENCE RESEARCH PAPER

By

WG CDR S P KILVINGTON

ADVANCED COMMAND AND
STAFF COURSE

NUMBER 16

SEPT 12 - JUL 13
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# Defence Research Paper

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Delivering effective Air-Land Integration (ALI) in the next war: what enduring lessons can UK Defence draw from historical and contemporary operations to generate and maintain an efficient, joint ALI capability that is fit for future conflict?

Wg Cdr S P Kilvington RAF

ADVANCED COMMAND AND STAFF COURSE
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ABSTRACT

This paper analyses the history of Air Land Integration (ALI) from its origins in World War One through to contemporary operations in Iraq, Afghanistan and Libya. It identifies three pillars which are fundamental to ALI: capability, coordination and common understanding. It then demonstrates that historically, air and land have strengthened each pillar during conflicts to deliver effective ALI, but that this capability is left to wither once operations cease. The paper concludes by analysing existing ALI organisations; identifying future challenges for integration as forces withdraw from Afghanistan; and suggesting how key military structures should respond to sustain ALI capability.
CHAPTER ONE - INTRODUCTION

‘If there is one attitude more dangerous than to assume that a future war will be just like the last one, it is to imagine that it will be so utterly different that we can afford to ignore all the lessons of the last’. ¹

On 04 August 1914, the UK responded to the German invasions of Belgium and Luxembourg with a declaration of war, setting the scene for the first use of aircraft in major conflict. The aircraft of the Royal Flying Corps (RFC) finally saw action on 19 September 1914 as crews from number Two and number Three Squadrons, RFC first began flying sorties to spot targets for British artillery forces on the ground. As the marriage of air and land approaches its 100th anniversary the relationship is still intact, but it has not been without public spats and private dispute. Now, after more than a decade of joint operations in the Middle East, air and land have renewed their vows and are delivering integrated effect across the battlefield.

However, history suggests that air and land’s consolidated gains from prolonged conflict often become lost skills in the period afterwards; this is particularly true when resources are tight and each service is fighting to retain and sustain its individual capabilities. As the UK’s role in Afghanistan draws to a close, all three services will reconfigure to meet new challenges; this will place great demands on each of them, particularly in a tight fiscal climate when defence budgets are under continuous scrutiny. These restructures point to a period of self-reflection for each service, which will be underpinned by the ‘rustification’ of senior leadership from London back to their parish commands. The risk is that self-reflection becomes retrenchment and that the invaluable lessons learned through bitter experience on joint operations are lost again before the next war.

The subject of Air Land Integration (ALI) is large and it has been written about extensively; Joint Service Publication 918, the United Kingdom Forward Air Control Activity, defines ALI as ‘the integration of Air, Space and Surface effects to achieve Joint action through mutual trust and understanding’.² Whilst this broad definition covers the full range of integrated activity between components, this paper will focus on the integration of combat air in direct support of land-forces. This scope is not intended to dismiss the importance of other key areas, such as air-maritime’s role in integrating air and surface forces, or the criticality of rotary-wing support as a key enabler for ground forces; it merely bounds the paper in order

to draw key conclusions about the intimate integration of offensive air and the land
component. The clearest thread of ALI through history has been in the direct support of
ground forces and it is here where progress has been significant during the last decade.
Consequently, the paper will focus on this area in order to identify historical parallels and
where enduring lessons are most relevant.

This paper will analyse the history of Air-Land Integration (ALI) to identify the key strengths
and weaknesses in the relationship between the two components and will attempt to isolate
the fundamental elements that form the core of its success. By looking at ALI from its roots
in the First World War through to contemporary operations, it will show that whilst ALI
technology has evolved, its enduring nature has not. It will suggest that there are three
pillars of ALI: capability, coordination and common understanding. Each pillar comprises
sub-components that form their strength: capability requires appropriate equipment, trained
personnel and effective tactics, techniques and procedures; coordination needs joint
planning, benefits from colocation and is reinforced by successful command and control
(C2); common understanding is built from shared doctrine, education and recent, relevant
experience. This paper will argue that when these pillars have been neglected,
effectiveness has been compromised.

The paper will be split into six further chapters; the next, Chapter 2, will look at the
development of ALI from the start of World War One (WWI) to the period just prior to World
War Two (WWII), highlighting the early successes on the Western Front and key capability
developments. It will subsequently examine the inter-war years where both the Army and
the Royal Air Force (RAF) focused on single-service agendas, rather than developing the
capability that had been hard won during the war. The third chapter will analyse the
enormous development of ALI that took place during WWII; it will show that in 1939 British
forces had poor capability, poor coordination and a lack of common understanding, but that
the significant progress made in the subsequent years was a key element of successful
Allied operations in the second half of the war. The fourth chapter will look at ALI from 1945
until 1991 to examine where some capability and a degree of common understanding
endured during limited conflict in the British Empire and through training conducted by British
forces in Germany during the Cold War. However, it will go on to show that at the outbreak
of the next major conflict in the Falklands, there were significant issues which meant air and
land struggled to deliver effect. This chapter will conclude by looking briefly at the First Gulf
War to identify the effect it had on air-land thinking; most notably how the operation changed
the shape of future conflict and so the role of ALI in the next century.
The fifth chapter will analyse contemporary operations in Afghanistan and Iraq, using examples from both UK and coalition operations to highlight the enduring importance of the three pillars; it will identify the major shortfalls in capability and coordination that impacted UK ALI in Iraq in 2003 as well as the misconceptions about how to resolve them that were caused by a lack of common understanding between the air and land components. It will subsequently analyse how British forces strengthened the three pillars through changes made under Project Coningham-Keyes (PC-K) and by the Joint Air Land Organisation (JALO), highlighting how advances in ALI have made a critical difference on operations in the contemporary environment. The sixth chapter will assess current ALI and future challenges; it will focus on the period that has followed the 2010 Strategic Defence and Security Review (SDSR) in order to review current capabilities, the proposed restructuring of the Army and the RAF and will suggest where future issues lie. From this analysis, the paper will assess how these changes might affect the current integration between air and land and where the key vulnerabilities are. In the final chapter, the paper will conclude by suggesting that whilst many of the elements of the three pillars are currently in place, the future of ALI is in the balance: the combination of the restructure of the Armed Forces for contingency operations; the drawdown of UK forces from Afghanistan; and the pressures of the current fiscal climate could lead to the start of a messy divorce.
CHAPTER TWO – EARLY ALI

World War One

‘The combining of [air] operations with those of the other arms, and particularly of the artillery, has been the subject of constant study and experiment, giving results of the highest value’.

When the RFC was formed in May 1912 it had two separate wings: the Naval Wing and the Military Wing. The former developed a long-range bombing capability, whilst the latter focused on developing aerial reconnaissance to support the Army. At the outbreak of WWI, the relatively small Military Wing was deployed in support of the British Expeditionary Force (BEF) and used its reconnaissance capability to capture and rapidly relay accurate information to land commanders. Despite early scepticism, by autumn in 1914, RFC aircraft were using aerial photography and wireless air-to-ground communications to provide rapid transmission of information; this capability became increasingly critical as traditional cavalry reconnaissance became impossible in the restricted environment of trench warfare.

As capability evolved, so too did some elements of coordination and common understanding between air and land forces: when aircraft detected enemy formations attempting to surround the BEF at Mons, the information was passed rapidly, ultimately enabling a successful counter-attack by the allies. Field Marshal Sir John French wrote: ‘the admirable work done by the Royal Flying Corps … [has] furnished me with the most complete and accurate information which has been of incalculable value in the conduct of operations’. By the end of 1914, RFC aircraft were conducting artillery spotting and coordinating with allied guns to refine firing onto enemy positions. This direct coordination between air and land was unwieldy at first with crews using everything from horns, flags and flares to communicate with the gunners on the ground; wireless telegraphy was eventually fitted to number 4 Squadron’s aircraft and crews developed ever more advanced techniques to talk fires onto the intended target.

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5 ibid, 9-11.
6 ibid, 12.
7 Cited in Ralph Barker, A Brief History of the Royal Flying Corps in World War I, (London: Constable and Robinson Ltd, 2002), 47.
8 ibid, 62.
9 ibid.
Despite the successes, ALI had variable support from the Army: the Chief of Staff of the BEF, Field Marshal Sir Douglas Haig, was impressed with the advantages airpower offered: ahead of the Battle of Neuve Chappelle, Haig declared to the commander of the RFC First Wing, Colonel Hugh Trenchard, ‘if you can’t fly because of the weather, I shall probably call off the attack’. However, many artillery gunners were unwilling to take instructions from RFC aircraft until Haig ordered them to utilise the assets appropriately. Early tensions between air and land continued throughout the war. After the Somme battle, ground commanders called for control of gun observation to be transferred from the RFC to the artillery; and infantry officers complained about the shortage of RFC support following the Battle of Ypres. These criticisms reflected a lack of understanding amongst land forces about air execution: the latter complaint focused on a shortage of air patrols over British lines, when in fact the RFC were engaging enemy ground forces ahead of the advance. The critique highlights how quickly air power had become expected over the battlefield and how much it was missed when absent, fortunately Haig understood and promoted the wider value of air power whilst he trusted full command of the RFC to Trenchard, thus allowing the RFC space to develop plans to integrate with land more closely.

By 1916, each BEF Army had a RFC Brigade allocated to provide artillery spotting, reconnaissance or fighter support. The Brigade commander was co-located at Army Headquarters to advise the land commander and RFC staff were allocated to liaise with the formations. At the senior level, this integration supported effective coordination, whilst at the tactical level, education and experience helped to develop a common understanding. Initially units unwittingly compromised theatre-wide understanding as they developed bespoke cooperation methods, but the generation of common procedures as the war progressed quickly eradicated this issue. Without the particular combination of Haig and Trenchard, it is conceivable that early air power developments could have been lost to land commanders intent on retaining direct control of air-power; by deliberately separating command, but integrating action of the two forces, they enabled effective coordination and development of a common understanding; this ultimately led to improved operational success.

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10 ibid, 73.
12 ibid, 70.
16 ibid.
17 ibid.
Trenchard’s freedom in command was enhanced by a degree of public and political
dissatisfaction to air power back in Britain, but this was shattered by German Gotha raids
against London and the south-east in mid-1917; the raids caused significant damage, injury
and the death of over 300 civilians. Trenchard was subsequently given command of a sub-
element called the Independent Force (IF) and tasked to conduct long-range, strategic,
bombing against targets in Germany. Trenchard protested that this would reduce intimate
support for the BEF, but he duly propelled the strategic campaign forward. Despite heavy
losses and poor results, Trenchard argued that the IF raids delivered strategic effect by
immobilising the enemy and disrupting production. These claims satisfied British
politicians and the public but were not quantitatively assessed; a German scholar later
concluded that the cost of IF aircraft lost in the raids, exceeded the cost of damage inflicted
on Germany. However it was British perceptions of the strategic bombing campaign that
would later dominate the RAF’s thinking during the inter-war period.

In the event, intimate air support in France continued and in mid-1918 the RAF were flying
more attack sorties in support of ground-forces than at any other time. In August 1918,
Allied forces won a significant victory at Amiens, but air became disconnected from land; the
previously effective brigading of air with Army units failed due to ineffective planning and
poor C2. As General Rawlinson’s Fourth Army planned the battle, their air advisor,
Brigadier-General Charlton, Air Officer Commanding (AOC) Five Brigade RAF, was not
involved; this lack of coordination was exacerbated when General John Salmond, the RAF
Commander in France, attended the penultimate conference and left without air’s role being
clearly defined. The air and land understanding of the strategic planning subsequently
diverged, until late pleas came from the Tank Corps for support and tasking was issued on
the day; this precluded normal coordination procedures. Charlton’s planning assumptions
were adequate to support the initial attacks and despite poor weather, they progressed well.
However, success on the ground exceeded expectations, with armour and artillery units

19 ibid,152-154.
History: Turning Points from Kitty Hawk to Kosovo, eds. Sebastian Cox and Peter Gray (London: Frank Cass Publishers, 2002),
11-12.
21 ibid, 12-13.
22 Barker, Royal Flying Corps in World War I, 468.
23 Jordan, “Air/Land Integration in the 100 Days,” 18.
26 ibid.
unable keep up with the infantry’s progress. With no air plan to account for this, Salmond intervened and switched air from interdiction against German resupplies to targeting fleeing German troops.\textsuperscript{27} The result was the significant loss of aircraft to German small-arms fire, for little practical effect on the enemy in retreat; meanwhile German forces reinforced through the untargeted resupply lines.\textsuperscript{28} The failure was a combination of inadequate joint planning aggravated by ineffective C2; neither Charlton nor Salmond had the complete picture of the planned offensive and there was no agreed command of the air assets.\textsuperscript{29}

These failures in C2 ultimately led to the creation of a radio-equipped Central Information Bureau (CIB), at Villers Bretonneux; this unit coordinated target information from aircraft with fighter-bomber bases or aircraft overhead.\textsuperscript{30} This capability was further exploited by number 3 Brigade who kept a flight of aircraft waiting over the forward edge of the battleground in order to strike targets of opportunity.\textsuperscript{31} By the end of the war, joint air-land operations in France had become fundamental to the campaign success; the integration of air and land in the headquarters and the battlefield had developed a common understanding of capabilities. The degree of comfort between the services contributed to the failings at Amiens, but this served as a timely reminder of the importance of effective coordination and ultimately led to further improvements in capability. However, back in Britain, it was the perceived success of the strategic bombing campaign that would dominate the RAF’s thinking subsequently.

\textbf{Inter-War Period}

\textit{‘Instead of tackling the problem in an objective fashion, the Air Staff set out from the beginning to safeguard the independence of the RAF’}.\textsuperscript{32}

During the inter-war years the development of air power was shaped by experiences from WWI, but also by the political will and relatively immature understanding of air capabilities. The successful integration of air with land during the war was evident, yet the inter-war period saw little development of air-land capabilities beyond small-scale operations such as imperial policing.\textsuperscript{33} The heavy losses air suffered supporting the Army on the Western Front suggested that the RAF could be more effective if it could operate free from the constraints

\textsuperscript{27} ibid, 23.
\textsuperscript{28} Slessor, \textit{Air Power and Armies}, 162-163.
\textsuperscript{29} Jordan, “Air/Land Integration in the 100 Days,” 23.
\textsuperscript{31} ibid.
\textsuperscript{33} Cox, “Air/Land relationship – an historical perspective,” 3.
of land forces. Similarily, the vast troop losses suffered in the trenches prompted a political view that future conflict could not afford large ground forces. These assessments, coupled with the perceived success of the IF’s strategic bombing, were reinforced by air power theorists. Douhet suggested that breaking the enemy’s will could be achieved at the outset by attacking his homeland; and British politician Stanley Baldwin advocated that ‘the bomber will always get through’.

In the face of post-war financial cutbacks, Trenchard’s fledgling RAF looked vulnerable; however, he capitalised on the strategic bombing concept to position air power as a more economical option than deploying ground forces. Strategic bombing became the main principle of air power and whilst the need for fighter aircraft was recognised in 1923, the RAF support to ground operations which occurred abroad was not drawn into any coherent doctrine or capability development. Poor results from bombing trials between 1929 and 1939; and data that showed Italian bombing operations in the Spanish Civil War to be largely ineffective; made no difference to policy. The RAF pursued a programme of day precision bombing until well after war had broken out and the Butt Report revealed the inaccuracy of their claim.

However, the view on strategic bombing was not unanimous and the War Office had increasingly voiced concerns over the inadequate provision of air support to land forces. In a journal article in February 1931, Major R H L Fink openly criticised the Air Ministry’s strategy stating that: ‘whatever direction future developments may take, closer cooperation between the soldier and airman is essential, and this can only be effected by coordination at the top.’ But the government stuck by the concept of a small land force and continued to place strategic bombing at the centre of military capability. Consequently, the last-minute policy-reversal in March 1939 to develop 55 army divisions was in conflict with the RAF’s plans for strategic bomber and fighter aircraft. Furthermore, air assets deployed in support of the Army in 1939 were directed to focus on reconnaissance, artillery spotting and interdiction, rather than the close air support that more mobile troops would require. The opportunity to develop WWI concepts had been lost amidst inter-service competition for funding, political nervousness about deploying a large land force and extravagant claims about the decisive nature of air power. This was a missed opportunity to mature capability, reinforce coordination and cultivate common understanding.

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35 Ibid, 84-86.
36 Ibid, 86.
38 Ibid, 66-69.
40 Ibid, 74.
43 Ibid, 3.
CHAPTER THREE – WORLD WAR TWO

‘There used to be an accepted term of “army co-operation”. We never talk about that now. The Desert Air Force and the Eighth Army are one … If you knit together the power of the Army on the land and the power of the Air in the sky, then nothing will stand against you and you will never lose a battle.’

Early Failings

Montgomery’s 1943 statement reflected the well-developed state of air land integration in the later part of WWII, but the situation was much less favourable between 1939 and 1941. When Germany invaded Czechoslovakia in 1939 and the British government decided to deploy a land force in France, the War Office repeated previous requests for a large air component to support the BEF. Only a modest detachment of fighter and reconnaissance aircraft were deployed along with the bombers of the Advanced Air Striking Force (AASF).

A British air command was eventually established in France to coordinate the two elements, but the organisational structure utilised French fighter aircraft and coordination between air and land required telephone communication via the UK.

Conversely, the Luftwaffe had developed WWI concepts identifying the criticality of air-land integration and had established the aircraft, weapons, communications, procedures and training to deliver effective ALI. The German Wehrmacht and Luftwaffe employed joint activity to great effect, using direct air support when required; German joint training and doctrine meant air and land understood each other. Meanwhile Allied forces arrived in France with unsuitable equipment and a lack of common understanding between air and land commanders.

When German forces massed in the Ardennes on 10 May 1940, Allied air was grounded awaiting orders; Axis fighters patrolled empty skies above a vulnerable line of their own armoured vehicles. When Allied orders did not materialise the British Air Commander, Air Marshal Arthur Barratt, twice usurped the French command chain to order British Blenheim and Battle aircraft to attack Axis forces in Luxembourg; effective German flak made the

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46 Ibid.
49 MOD, AP3003, 99.
ineffective Battles sitting-ducks, but without coherent orders, they continued their attacks.\textsuperscript{50} Concurrently, ineffective intelligence processing had failed to interpret aerial reconnaissance imagery in time and German forces bridging the Meuse at Sedan were able to establish an impressive cordon of anti-aircraft flak; this was supported by over 800 Luftwaffe sorties which overcame the meagre 250 sorties from the Allies.\textsuperscript{51} As German forces poured into France, Barratt received a telegram from the Chief of the Air Staff suggesting that he might want to restrict the use of his medium bombers until the critical phase. When High Command finally called for maximum effort on 15 May, the forces were in disarray and Air Chief Marshal Sir Hugh Dowding was demanding that aircraft were preserved for the anticipated Battle of Britain.\textsuperscript{52} Ineffective equipment, a lack of training and poor C2 underpinned the loss of 320 aircrew and almost 1000 aircraft during the operation; a further 80 aircrew and 106 aircraft were lost during the Dunkirk evacuation.\textsuperscript{53} However, the RAF’s performance at Dunkirk salvaged some of their reputation. Careful coordination with the Navy delivered adequate cover to prevent Luftwaffe interference; overall though, the début of air-land integration in WWII had not been successful.\textsuperscript{54}

The War Office and the Air Ministry conducted independent reviews of the French campaign and drew very different conclusions: the War Office demanded direct Army control of air assets, whilst the Air Ministry suggested a lack of Air Superiority had caused failure.\textsuperscript{55} The Air Ministry were later vindicated, but the Army’s views are telling as they indicate the lack of common perspective that existed between air and land.\textsuperscript{56} In order to remedy the failings, trials for delivering rapid and accurate air power were conducted and published in the joint Wann-Woodall report;\textsuperscript{57} the results proposed ‘penny-packeting’ tactical air power under the control of corps commanders. However, the complex command structures meant forces could not respond flexibly to the ebb-and-flow of demand; this was evident in the Allies inability to coordinate airpower effectively when using this system in 1942 during Operation TORCH in North Africa.

\textsuperscript{50} Stuart W. Peach, “A Neglected Turning Point in Air Power History; Air Power and the Fall of France,” in From Kitty Hawk to Kosovo, 154-155.
\textsuperscript{51} Byford, “The Battle of France”, 67.
\textsuperscript{52} Peach, “A Neglected Turning Point in Air Power History,” 159-160.
\textsuperscript{53} MOD, AP3003, 99.
\textsuperscript{54} ibid 99-100.
\textsuperscript{55} Byford 68-69.
\textsuperscript{56} Ibid, 69.
\textsuperscript{57} Brad Gladman, “The Development of Tactical Air Doctrine in North Africa: 1940-43,” in Turning Points from Kitty Hawk to Kosovo, 191-192.
Later Success

Meanwhile, by late-1941 the Western Desert Air Force in Africa had grouped all assets under Air Marshal Sir Arthur Coningham’s command and had collocated with the Eighth Army headquarters. With direct access to relayed ground intelligence the air component could direct aircraft against the most critical targets. The joint operation emphasised the importance of effective coordination; understanding of systems and processes; and provision of appropriate capability and trained crews. By the Battle of El Alamein in mid-1942, the RAF could conduct Interdiction and Close Air Support (CAS) missions simultaneously and responded to requests for intimate support in as little as 30 minutes. This ability to mass firepower against enemy forces and to interdict supply lines undermined Axis mobility and protected the Eighth Army’s flank; this ultimately provided the foundation for successes in late 1942.

Lessons from TORCH and the Western Desert led Lieutenant General Dwight D. Eisenhower, the Supreme Commander in North Africa, to unify regional air components under a single commander. Mediterranean Air Command was formed under Air Chief Marshal Tedder who commanded three subordinate elements, each of which co-located air and land headquarters to centralise C2. Air and land staffs worked closely together at the headquarters and developed an understanding of each other’s roles; aircraft were allocated to the most critical tasks and emerging intelligence could be quickly processed to deliver rapid effect in support of ground forces. By late 1943, the system had positioned Forward Air Controllers (FACs) with leading armour units, who used radios to direct aircraft from a waiting pool against the most suitable target; this system became known as CABRANK and was essentially an evolution of the technique used by the CIB in WWI. On arrival at the designated battlefield area, crews checked in with the FAC controlling the area to be allocated a target and briefed; marking techniques differentiated targets and friendlies. Aircraft could typically deliver effect within ten minutes of a request for support. Where CAS was not required, aircraft arriving at CABRANK had an alternative, pre-briefed target to

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58 ibid, 192-193. 
59 ibid, 193. 
60 ibid, 193-194. 
63 ibid, 197-198. 
65 ibid, 87.
attack. This system was later developed to link ground reconnaissance patrols with airborne reconnaissance.

By the Allied invasion of Normandy in 1944, air C2 was generally very efficient. In January 1944, Air Marshal Sir Arthur Coningham took command of Britain’s Second Tactical Air Force (2 TAF); equipped with a mix of fighters and light and heavy bombers, they would be fundamental to the war in France. The degree of Allied Air Superiority allowed Eisenhower to promise troops that the only aircraft overhead would be friendly; this was essentially proven to be true. As Allied forces subsequently advanced against the Axis, the value of intimate support was evident: airborne troops were protected by CAS and armour was supported by leading fire and the CABRANK system. Operation GARDEN on 17 September 1944 used CABRANK particularly effectively.

During a 2nd Irish Guards tank offensive, 60 miles ahead of the Allied front, well concealed German positions ambushed the tanks in the centre of their column. The RAF controller in the lead armour called in support from Typhoons on CABRANK, who decimated the previously concealed positions and cleared the route ahead. The same system was employed widely over France and Italy to great effect. Although radio failures, procedural constraints and weather occasionally limited the effectiveness of CABRANK, the utility of rapidly advancing, intimate air support against the more cumbersome and less accurate artillery fire was evident. The employment of CAS in the latter part of the war became a pre-requisite for successful armoured attacks and the ability to target enemy forces in close proximity to friendlies was a force-multiplier: many German troops refused to man weapons, instead surrendering when aircraft arrived overhead.

These advances in ALI were not without problems. In September 1944, air and land failed to integrate properly during the airborne assault of Arnhem. 1st Airborne arrived in France without previous experience of ALI tactics, techniques and procedures and with radios that were essentially inoperable. In the planning phase, Montgomery and Coningham failed to coordinate effectively and little planning for the airborne forces’ requirements was conducted until the last minute. Fighter support was based in the UK and had little or no experience of

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66 ibid.
68 MOD, AP3003, 144.
69 Ibid, 144-146.
70 Gooderson, Air Power at the Battlefront, 84-87.
71 ibid, 87-91.
72 Ibid, 91-93.
73 Ibid, 89-99
such operations; number 83 Group’s assets in France were prohibited from operating during the drops to reduce fratricide risk;\textsuperscript{75} and interdiction tasking against enemy logistics dispersed number 83 Group aircraft widely.\textsuperscript{76}

Poor weather impacted the operation significantly, but the inexperience of 1\textsuperscript{st} Airborne’s forces and the failure of most of their communications equipment would have made CAS almost impossible anyway.\textsuperscript{77} When the weather cleared and coordination was resolved, it was too late to prevent the devastating defeat of troops at Arnhem.\textsuperscript{78} The choice of airborne forces for such an operation, the presence of substantial enemy forces and the dispersion of the operation were contributing factors.\textsuperscript{79} However, the poor capability, lack of training, inadequate joint planning and ineffective command of the operation, were in contrast to the operations that had been developed by this time. Fortunately, lessons were identified and by the Allied assault across the Rhine in March 1945, dedicated CAS support using CABRANK doctrine was employed with great success.

From the poorly equipped and inadequately trained Allied airpower which failed to support operations in the Ardennes, to the highly flexible CAS operations that supported Allied advances in the later stages of the war, the development of ALI underwent a spectacular transformation. The clear requirement for close co-operation between the RAF and the Army had been thwarted by their fractious relationship during the inter-war period; consequently it took significant losses in the early part of the war to trigger activity to address the shortfalls. However, by 1945 the services shared a common understanding about the employment of tactical air power in support of land operations and had developed capabilities and a coordination system that delivered timely effect in support of ground forces. Joint doctrine, capability and C2 had developed alongside improved relationships between the services; when combined with allied air superiority, this delivered a battle-winning effect. Unfortunately, in the post-war period, this well-developed capability, shaped through hard-won lessons, was to decline again.

\textsuperscript{75} Gooderson, \textit{Air Power at the Battlefront}, 97.
\textsuperscript{76} Ritchie, \textit{Arnhem: Myth and Reality}, 235-236.
\textsuperscript{77} ibid, 240-241.
\textsuperscript{78} John Golley, \textit{The Day of the Typhoon: Flying with the RAF tankbusters in Normandy}, (Shrewsbury: Airlife Publishing Ltd, 1986), 187.
\textsuperscript{79} Ritchie, \textit{Arnhem: Myth and Reality}, 83-84.
CHAPTER FOUR – FROM COLD WAR TO GULF WAR

The Malayan Emergency

For British forces, the 20 years following WWII were characterised by the development of the Cold War and decline of the Empire, resulting in numerous Counter-Insurgency (COIN) operations.80 Whilst the Army and the RAF operated together, the same intimacy was not required and inter-service rivalries again came to the fore in competition for equipment such as helicopters in the mid-1960s.81 Some ALI lessons were taken into subsequent operations and the crisis in Malaya in 1948 had bearing on air-land operations for a number of reasons.

First, whilst the focus of RAF operations in the Malayan Emergency was air defence, there was a large requirement for operations in support of ground forces; operational control of these sorties was devolved from the Air Headquarters in Singapore to an advanced unit collocated with Army Headquarters, in the Malaya District.82 This co-location allowed more effective joint planning and coordination and mirrored the North African system of 1942. Second, operations required development of innovative tactics that maximised the effect of offensive air support against the insurgents. In 1949, the use of air strikes to flush-out concealed terrorists was modified to allow more direct targeting of the enemy.83 Third, the nature of the targets required techniques to improve accuracy and reduce collateral damage; this was mainly achieved through improved targeting systems and stringent clearance procedures undertaken before air strikes were mounted.84

However, ALI suffered many of the same challenges seen at the start of WWII. First, an early lack of understanding on the ground prevented air-strikes being employed to their full potential; this was resolved when RAF intelligence officers were deployed with ground patrols and State Police units.85 Second, the early C2 structure was unwieldy: Army commanders had to pass requests through a number of layers before aircraft were allocated. The ground-based Air Support Signals Units eventually circumvented this issue to allow direct requests for support whilst targets were authorised at the Joint Operations Centre; this enabled a more timely and flexible response.86

80 Jordan and Sheffield, “British Army and Air Power,” 82.
81 ibid, 82.
83 ibid, 65.
84 ibid, 82.
85 ibid.
86 ibid.
Although not studied in detail here, some ALI was also evident in Kenya in the early 1950s and later Borneo and Aden in the mid-1960s in support of forces from Britain and partner nations. However, the RAF was hardly involved in the three major conflicts between 1945 and 1982: the Korean War, the Arab-Israeli Wars and the Vietnam War. Consequently, only the long-term deployment of the RAF and British Army units in Germany supported continued development of ALI capabilities. This colocation did develop a degree of common understanding and facilitated joint planning and training. Unfortunately it did not lead to the seamless delivery of ALI in the South Atlantic in 1982.

The Falklands War

‘Harriers did fly that day … against other targets – targets arguably of far less pressing concern – in weather which must surely have been as bad’.

The Falklands War was a challenge for air power for three key reasons: the unilateral nature of the operation, the distance from the UK and the contested air environment. As in 1944, control of the air was critical; the joint activity of the Royal Navy and RAF Harriers; Special Forces; and the RAF Vulcan raid all contributed to achieving this. Operation PRELIM, the Special Forces raid on Pebble Island, destroyed an entire section of Argentinian reconnaissance and strike aircraft thus significantly reducing the threat to ground forces. Operation BLACK BUCK used Vulcans to attack the airfield and radar installations in Port Stanley, but it was the implied threat to Argentina’s mainland that compelled General Galtieri to move his Mirage fighter fleet north to defend key installations. This decision removed them from the conflict and effectively removed the air threat over the island.

However, the majority of strike operations were conducted by Royal Navy Sea Harrier and RAF Harrier GR3 squadrons embarked on HMS Hermes. In the Air Defence role both variants performed well against Argentine fighters, but the reconnaissance and ground-attack capabilities of the GR3s were poorly employed; the lack of understanding of their capabilities by commanders limited their effectiveness at the tactical level.

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87 MOD, AP3003, 212-219.  
88 ibid, 225-235.  
89 Cox, “Air/Land Relationship”, 6-7.  
The military-strategic command of the campaign was inherently joint, but the deployed force did not have a Joint Task Force Commander and was dominated by Rear Admiral John Woodward; as commander of the Carrier Battle Group Woodward controlled all associated air assets. The Chief of the Air Staff’s request for a senior ranking air advisor to follow the Task Force was not met; this left Brigadier Thompson, commander of the landing groups, trying to secure offensive air support after the ground campaign started. The brigade headquarters were located on HMS Fearless, whilst air was controlled on the carrier. Fearless had no dedicated communications or planning facilities and little access to the land-picture; the carrier was optimised for control of the air and anti-submarine operations. Consequently, tasking of Harrier GR3s became ad-hoc, intelligence was scant and operations were often rendered ineffective following interference from naval hierarchy.

The lack of understanding between the services was evident as Navy commanders tasked reconnaissance in inadequate light conditions; refused requests for pre-attack reconnaissance sorties; and directed tactics which ignored RAF procedures and led to risky repeat attacks of heavily defended targets. CAS missions suffered from a lack of communication and crews often had little indication of friendly troop disposition on the ground; this ultimately resulted in the loss of an aircraft that was persisting against a target when there was no imperative to do so. Notwithstanding this, RAF Harriers were eventually employed to devastating effect at Goose Green in support of 2 Para. Assisted by a FAC the GR3s accurately targeted enemy positions; the effect would finally crack the will of enemy forces who surrendered when faced with additional attacks. On the penultimate day of the war, air operations culminated with the GR3s first ever employment of Laser Guided Bombs against targets marked by FACs on the ground with a laser; the impressive capability and devastating accuracy was immediately apparent, although limited when Argentine forces surrendered the next day.

Whilst victory in the Falklands was ultimately supported by effective Air-to-air operations and by offensive air support to land, air assets were mishandled, their capabilities were neglected and their operations uncoordinated. There was poor coordination caused by inadequate intelligence and planning equipment; ineffective C2; and a lack of joint understanding of capabilities, tactics and procedures. The result was that ground forces did not have a Joint Task Force Commander and was dominated by Rear Admiral John Woodward; as commander of the Carrier Battle Group Woodward controlled all associated air assets. The Chief of the Air Staff’s request for a senior ranking air advisor to follow the Task Force was not met; this left Brigadier Thompson, commander of the landing groups, trying to secure offensive air support after the ground campaign started. The brigade headquarters were located on HMS Fearless, whilst air was controlled on the carrier. Fearless had no dedicated communications or planning facilities and little access to the land-picture; the carrier was optimised for control of the air and anti-submarine operations. Consequently, tasking of Harrier GR3s became ad-hoc, intelligence was scant and operations were often rendered ineffective following interference from naval hierarchy.

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not receive the level of support they could have. The relationship between air and land would change again in Iraq nine years later.

The Gulf War

‘Jointness flourishes in an environment of grave threat and scarce resources. Neither condition existed in the Gulf War.’

The Gulf War in 1991 provided an opportunity for western nations to deliver an effective joint and combined campaign against a credible and well equipped enemy; however the success of the campaign masks the recurrence of some familiar C2 problems. The first three phases of the plan were almost exclusively air operations to shape the battlefield for the land campaign in phase four. The land battle only lasted 100 hours and did not require British CAS. However, the conflict did include perennial air-land issues, particularly in the coordination pillar. The Commander in Chief, General Norman Schwarzkopf, elected not to appoint a dedicated Joint Force Land Commander, choosing instead to undertake the role himself; the consequence was that demands on his time at the strategic level meant he missed many of the joint planning meetings.

During execution of the short land phase, Schwarzkopf prioritised air power against strategic targets over direct support to land forces. The opacity of these decisions gave land commanders the impression they were being neglected by their air counterparts, causing unnecessary tensions between the components. From a capability perspective, many air assets in theatre were not equipped to provide the support required: for land operations conducted at night, many fielded combat aircraft were not equipped to identify targets or conduct intimate strikes; this forced crews to develop novel targeting methods. Fortunately, the destruction of Iraqi forces in the first three phases, and the vast amount of air power available, meant that few targets were missed. The weight of effort against the Iraqi Army and their lines of communication caused the majority of Iraqi forces to surrender or flee during the 100 hour ground campaign.

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102 Ibid, 8-9.
103 Ibid, 9.
Because the short ground offensive was not conducted against a robust enemy, it is misleading to draw robust conclusions about the success or otherwise of the air-land campaign. However, two issues stand out: first the lack of appropriate capability to support intimate fires at night could have been critical if the first phases had been less successful or Iraqi forces had resisted; representative joint training could have highlighted this issue sooner. Second, the absence of a dedicated land commander in the command structure caused a degree of confusion and mistrust between the components; development of a common understanding of roles and more transparent coordination could have mitigated this. However, the Gulf War was important in that it refocused allied partners on combined operations and ultimately developed many capabilities that were employed in Afghanistan and Iraq a decade later.
CHAPTER FIVE – CONTEMPORARY OPERATIONS

Operations in Afghanistan

‘It is no longer a matter of the soldier making his plan for battle on the ground and then turning to see how the air can help him. Land and air operations must be deliberately planned to get the best out of each other’.106

Slessor’s words from 1936 resonate with contemporary operations where air and land deliberately coordinate action to achieve effect. In 2001, Operation Enduring Freedom in Afghanistan saw a further revolution in this relationship: air power was almost exclusively employed directly with the land component, which comprised small American Special Operations Forces (SOF) teams and local rebels; such was the success of this structure, it became known as the ‘Afghan Model’.107 The conflict began in a traditional way with air power employed to strike key Taliban targets in order to secure control of the air.108 During the subsequent land campaign SOF and Northern Alliance rebels systematically targeted the Taliban with the support of offensive air; between October and December, the Taliban were removed from key cities across Afghanistan, culminating in the fall of Kandahar on 6 December 2001.109

Whilst the structure of forces was different, the same ALI challenges existed: the need to develop common understanding; to conduct joint planning; and to exercise robust C2 were critical. Without previous training between air and proxy forces, common understanding was absent. At Bei Beche in November 2001, SOF forces called in pre-emptive air strikes against a Taliban position in preparation for an assault; the rebel forces understood that to be their attack cue and were simply lucky that they arrived at the target seconds after the bombs struck. This contemporary example highlights the risks of operating with components that do not share understanding or who employ significantly different tactics. It was only the high degree of integration between SOF and air that allowed a high-tech, well trained air-force to operate with a land component that had little understanding of modern tactics.

This integration was compromised when General Franklin Hagenbeck, Commander of 10th Mountain Division, led a combined US-Afghan attack against Taliban and al Qaeda forces in

106 Slessor, Air Power and Armies, 212.
the Shah-e-Kot Valley. Operation ANACONDA took place shortly after the fall of the Taliban regime and after initial planning by the US 5th Special Forces Group, it was handed over to Hagenbeck’s Combined Joint Task Force (CJTF). Almost immediately, CJTF planners downgraded SOF estimates of enemy forces by a factor of ten; elected not to utilise intelligence assets prior to the strike; and did not integrate air experts into the planning process. 

Air Liaison Officers embedded in the CJTF made a number of pleas for preliminary air strikes and for a team of eight TACPs, but their requests were persistently refused; the plan was simply to use Attack Helicopters against pockets of resistance. Furthermore, Hagenbeck, did not include the Combined Air Operations Centre (CAOC) in his planning and only briefed the Combined Forces Air Component Commander (CFACC) two days before the operation.

When ANACONDA began, heavy resistance from a large enemy force resulted in a surge of urgent requests for CAS to support troops under fire. Without prior planning of assets, CAOC staff and controllers on E-3 Airborne Early Warning and Control System (AWACS) aircraft struggled to prioritise fires and authorise strikes. This left the handful of Joint Terminal Attack Controllers (JTACs) battling to cope with the volume of fires; and operations staff struggling to prioritise up to 200 additional coordination measures.

Senior CJTF commanders criticised the CAS provided to ANACONDA and cited airspace coordination and an unwieldy Air Tasking Order (ATO) as being key failings; the proposed solution was the familiar call for increased organic air support: ‘every light infantry division needs an AC-130 squadron’. This criticism demonstrates a fundamental misunderstanding of the role of air-power at the operational and strategic level and highlights the root cause of the failure: the land commander’s lack of understanding on how to plan and integrate air support. Hagenbeck’s failure to involve air expertise in the planning process meant that adequate assets and effective C2 was not in place; sufficient air was available in theatre, but it was not pre-positioned to optimise response times and could not be effectively controlled. Many of these lessons were rapidly addressed and by 2006 the planning structure in Afghanistan had embedded an Air Support Operations Centre (ASOC) in the CJTF; this provided specialist advice and links to JTACs with ground forces and the CFACC.

111 ibid, 135-137.
112 ibid, 136-137.
115 ibid, 136.
117 ibid, 57.
118 ibid, 59.
at the higher level. However, not all of these lessons were learned in time for the 2003 Iraq War.

**Operation TELIC**

‘There is no doubt that we need to do more air-land integration. It is something that we knew about at least 18 months before we started this operation, and it was work that we had in hand: improving the procedures, looking at our equipment’.121

Operation TELIC, the UK contribution to operations in Iraq in 2003, was the first joint combat operation for British forces in over a decade and there were many familiar ALI challenges. Following coalition strikes against enemy counter-air capabilities, there remained only a limited threat to aircraft operating at low level from Man Portable Air Defence Systems (MANPADS);122 this is significant as it continued the trend of conflicts where control of the air was uncontested at medium level and further diluted experience of all-arms fighting against a comparable foe. A second key factor in the conflict was the political decision not to target Iraqi infrastructure; this reduced the Air Interdiction requirement and rebalanced offensive air power in support of land forces.123 In 2003, 78 percent of air activity was allocated in direct support of land forces, significantly more than the 55 percent in the first Gulf War.124

CAS in Iraq employed a version of the CABRANK system along with the use of Killbox Interdiction Close Air Support (KICAS): FACs directed aircraft held in a CAS-stack into 30 square-mile areas where they were given targets by a Joint Terminal Air Controller (JTAC).125 However, the higher apportionment of CAS assets was not always effective: UK 1st Armoured Division felt that despite having significant staff for the coordination of joint fires they received a low allocation,126 whilst in other areas, the vast amount of CAS available overran control frequencies.127 A British Army review suggested staff had ineffectively enacted air support planning procedures and were unprepared when assets were offered at short notice; it also identifying that targeting staff needed to be properly trained, rather than

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120 Michael W. Isherwood, “Five Years after Operation Anaconda – Challenges and Opportunities,” Joint Force Quarterly 47, no. 4 (2007), 142.
126 DGD&D, Operations in Iraq – Land Perspective, 3-10 to 3-11.
just supernumerary staff and that fire-coordination training should be less focused on artillery
planning and more on joint fires.128

The DGD&D Review also criticised the wider allocation and C2 of UK airpower. It suggested
that issuing the ATO 72 hours before operations was too inflexible for the unpredictability of
land combat; it proposed that centralised C2 should become decentralised once land forces
are engaged.129 This criticism fails to recognise the utility of an ATO which apportions
aircraft in advance to match planned tasking, but which is flexible enough to allow changes
on demand to accommodate emerging changes to priority.130 These misperceptions about
the ATO process remain prevalent at some senior levels in the Army131 which demonstrates
the importance of continued education to build common understanding.

The requirement for centralised C2 was critical for operational and strategic level targeting.
The Commander of British Forces in Iraq, Air Chief Marshal Sir Brian Burridge stated: ‘[the]
difficulty of prosecuting Time Sensitive Targets, against complex rules of engagement’ was a
task which would be mostly delivered in ‘a centralised way’.132 This maxim was
demonstrated during UK Harrier missions in the western desert operating as part of 410th
Expeditionary Operations Group: whilst tasking was routinely for tactical reconnaissance
missions, it was common for formations to be reallocated to strike higher priority targets at
some point during the mission cycle.133 The Harrier squadron had conducted intensive
training prior to deployment with UK Land Forces; they had briefed individual capabilities,
agreed common procedures and developed currency and experience.134 This type of
operation is evidence of the flexibility air power can deliver when the three pillars of ALI are
in place: capability, coordination and common understanding.

TELIC air support was enhanced by technology: the availability of laser and satellite guided
precision weapons meant fires could be delivered more accurately, in all weather conditions
and in direct support of ground forces.135 For the RAF however, the improved weapon
accuracy was not supported by a modern targeting system: UK aircraft deployed with the
almost obsolete Thermal Imaging and Laser Designation (TIALD) pods which lacked the
same accuracy and image fidelity as systems such as the American LITENING II targeting

128 DGD&D, Operations in Iraq – Land Perspective, 3-10 to 3-11.
133 Interview with Harrier pilot who served on operation TELIC in 2003.  
134 ibid.  
135 DGD&D, Operations in Iraq – Land Perspective,3-5 to 3-6.
pod; this required crews to operate lower to try and identify targets. Furthermore, unlike LITENING II pods, TIALD had no capability to datalink real-time video to ground units which meant that UK and US crews used different procedures between air and land components, thereby increasing the risk of errors.

**Project Coningham-Keyes**

Following TELIC a combination of Government direction and detailed lessons from Defence provided the foundation to deliver improvements. The shortage of air expertise identified by the Army was supported by the RAF: Burridge stated: ‘the number of Air C2 trained augmentees that we need to make our headquarters work in operational environments is very significant. We do not currently have enough’. Project Coningham-Keyes (PC-K) was set up in 2003 to develop air integration from a tri-service perspective: the RAF led Training and Simulation; Land led C2 and Concepts; and Fleet led Intelligence, Surveillance, Target Acquisition and Reconnaissance. Concurrently, the Joint Air Land Organisation (JALO) was established to coordinate training, to disseminate lessons and to address the shortfalls in technical capability and C2.

By 2004, PC-K had made several key recommendations: at the component level it articulated a need for dedicated, embedded air staff to coordinate the planning and execution of air activity; at the division and brigade levels it called for a significant uplift in Air Liaison Officers (ALO) emphasising the need for seniority and experience in those posts. Concurrently, the project worked to significantly increase numbers of Tactical Air Control Parties (TACP) and FAC to support tactical control of aircraft on operations.

In tackling the shortage of embedded air support, PC-K sought to build relationships and to tackle misperceptions, however a number of criticisms of air power endured. In 2006, British forces were engaged on Operation HERRICK IV, targeting insurgent forces in Helmand province; the summer saw a particularly intense period of operations where number 4 Squadron fired over 400 rockets in one month, over seven times more than the previous month. Despite this intimate support the Commanding Officer of A Company, 3rd Battalion, The Parachute Regiment wrote that the RAF’s operations against the Taliban had

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137 ibid, 22.
140 ibid.
141 ibid, 1.
been ‘utterly, utterly useless … in contrast to the USAF [who have been] fantastic’ and that ‘controlling and directing air, [artillery and mortars] is the best way to influence the battle’.142 This criticism was based on two occasions when British Harriers were first unable to identify the target and second unable to accurately target them.143 This highlights two issues: first the need for appropriate capability to identify and target the enemy and second, for air and land forces to have completed the required training to coordinate and deliver that capability. PC-K attempted to address both.

One of the challenges for PC-K was leveraging funding for new capability. Fortunately, the continuation of operations in Afghanistan and Iraq maintained focus on ALI capability and Urgent Operational Requirements (UORs) delivered key equipment improvements such as advanced targeting pods, datalinks and the FIRESTORM FAC system. These capabilities provided improvements in targeting identification, weapon accuracy, and communication which have ultimately improved integration between air and land. The continuing tempo of operations resulted in PC-K Phase 2, which focused on establishing JALO as a permanent organisation, setting up the ASOC and growing brigade and divisional air cells.144

PC-K also focused on increase and improving training. By 2005, the UK Joint Forward Air Control Training and Standards Unit (JFACTSU) at RAF Leeming was running regular four-week courses; UK and NATO forces were engaged in routine FAC exercises; and Army and RAF units were training regularly together. The benefits of this evolution are clear: joint training in 2005 between Tornado GR4s from number 617 Squadron and UK 7th Armoured Brigade in Canada allowed operators from both components to switch personnel to expose them to respective roles; a senior GR4 operator commented that it was ‘the most memorable and productive training sorties [he had] ever flown’.145 ALI education also includes more conceptual studies at the UK Defence Academy, the Air Warfare Centre as well as through senior level staff rides; the latter are conducted by service specialists, academics and historians in places of historical ALI significance such as Normandy.146 All of these developments have undoubtedly honed the skills of operators and commanders in Afghanistan and significantly improved the air-land relationship.

Arguably the biggest issue for PC-K was addressing the C2 tensions identified during TELIC, particularly considering the long-standing disagreement about who should exercise control.

142 Cited in ibid, 1.
143 ibid, 28.
In 2004, a land-led PC-K working group recommended a complex command structure for the Air Support Operations Centre (ASOC). The proposal was to shift control on an ad-hoc basis to the supported component; this contradicted NATO and US doctrine, but the group suggested it was a more flexible approach to control of air assets.\(^{147}\) The proposal still missed the importance of centralised control; however considering the proximity of this debate to the misperceptions in TELIC, it is perhaps not surprising that such views had not yet been resolved. The final solution was for an ASOC at Corps Level to administer sub-unit air activity under CAOC directives.\(^{148}\) It would retain a direct link to the CAOC to escalate short-notice fires or re-task air support to meet emerging priorities when authority was devolved.\(^{149}\)

Despite this solution, the debate persists; in 2009 a highly-rated Army colonel on the UK Higher Command course stated: ‘I am bored with all this air co-operation … what I, an army commander, want is to call up air when I need it to bomb something in front of me’.\(^{150}\) This misinformed view has endured since WWI and does little to inculcate a positive relationship between components or give confidence that junior ranks are in receipt of sound education. Many of the other lessons from TELIC in 2003 mirror historical ones: air and land forces deployed to Iraq with legacy capabilities, an inability to coordinate effectively and a lack of common understanding. In the period after TELIC, PC-K tackled these failings and strengthened the three ALI pillars whilst operations in the Middle East continued.

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\(^{149}\) ibid, 5-5.

CHAPTER SIX – TODAY’S CAPABILITIES AND TOMORROW’S CHALLENGE

The level and sophistication of Air-Land integration we’ve now achieved both as the UK Armed Forces and as a coalition have been very hard won. As we begin to transition to a non-combat role in Afghanistan, the skill we’ve developed in integrating air-land operations is something we simply cannot afford to lose - the next time we need it, we might not have the luxury of several years in which to re-develop it.151

Current ALI

In the ten years since TELIC, PC-K and JALO have driven forward significant improvements in the delivery of effective ALI. The failures in 2003 ultimately delivered the Joint Fires Coningham-Keyes steering group which now meets with one-star representation from all four commands, Special Forces and DCDC.152 The ability of this organisation to bring all elements of defence to the same table in order to agree on key ALI issues has helped strengthen the three ALI pillars: capability, common understanding and coordination.

New capabilities are enabling air and land to deliver precise effect: modern targeting systems provide greater image fidelity, increased weapon precision and the ability to datalink video to ground forces; the FIRESTORM system for ground units has significantly improved the ability of FACs to mensurate targets, monitor designation, view datalinks and communicate with aircraft.153 These improvements have been underpinned by an increase in TACPs, FACs and ALOs and more frequent and focused air-land training.

Common understanding is being developed by tactical lessons and operational procedures drawn from theatre and published by JALO.154 Improved pre-deployment training has familiarised both air and land components with equipment and procedures which has ultimately led to improved tactical success.155 The increase in TACP and FAC training has increased the number of land specialists able to consider air power’s utility and how to employ it; put simply, deployed forces are more able to understand where air can work for them. Similarly, positioning more Air Staff Officers (ASOs)156 with Army units has placed

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152 Brigadier ‘Paddy’ Allison, Commander JALO, interview with author May 01, 2013.
156 Air Liaison Officers are now known as ASOs in the UK.
expertise at the interface between land and air; the ability for air specialists to live and breathe with the ground unit prior to deployment has not only increased the degree of trust between components, but also provided a ready source of air knowledge that units can tap into at any time. Improved understanding is also evident at the operational level, where commanders recognise the value of joint training prior to operations, are more aware of the paucity of assets in theatre and appreciate the need to prioritise their use.157

However, improved understanding has come from ten years of operational experience and it will diminish as operations wind down. Air Chief Marshal Sir Clive Loader identifies ALI doctrine as a key area where the gap needs to be closed.158 This suggests the need for more personnel to read and digest the doctrine, particularly when common understanding diminishes after a period away from operations. The Development, Concepts and Doctrine Centre (DCDC) suggest ‘a significant part of the [doctrine] target audience is in land formations’.159 Developing air expertise in the land component has been achieved in two key ways.

First, ASOs positioned at Corps level and below provide tactical planning expertise and a link to the higher command chain. At divisional level they work across the three functional areas of ‘plan, refine and execute’,160 where they advise and influence planning and execution directly.161 When deployed, ASOs become the specialist for coordination of air support and link to the control authority for coordination of fires. Critically, the right people must be selected for these posts; if common understanding is going to be developed, the air experts embedded with land components must have a detailed knowledge and be able to impart it.

Second, the increase in TACPs and FACs at the unit level along with improved equipment allows more efficient management and control of fires in the terminal phase. UK FACs are now equipped to support Digitally-Aided CAS (DACAS) and programmes to fit this capability to UK aircraft are in place.162 These manpower changes provide air expertise at all levels of the land component and the means to access air support in a flexible, timely manner. However, this doctrinally pure model relies on a clearly defined chain of command at the national or coalition level; HERRICK has shown that operations are likely to blur this command structure, making it less clear.

158 ibid, 51.
160 Wing Commander Jason Payne, SO1 Air G5 at 3 Division, interview with author, May 15 2013.
161 ibid.
162 Allison, interview with author.
This leads to the third pillar of ALI, coordination. Coalition operations in Afghanistan are commanded by a land centric, ISAF HQ at Kabul, supported by a regional Combined Air Operations Centre that is separated by 1600 miles in Qatar; to add complication, in-theatre NATO operations exist under a separate command chain and are further confused by numerous bi-lateral arrangements in place between the Afghan government and participating nations. The positioning of the CAOC outside of theatre is required to support air operations in the wider region and so the Joint Fires cell at Kabul coordinates and prioritises in-theatre tasking for the CAOC, before assets allocated to theatre are executed by the ASOC. The system works well and has addressed many of the C2 issues identified in 2003; however, as Air Cdre Al Byford notes: ‘it is a specific model for a specific, static, campaign in a narrowly defined area’. It is improbable that this model will suit the interface between air and land in the next conflict and so C2 architecture will need to adapt quickly. The model employed in Afghanistan required almost ten years to re-learn old lessons and to fine-tune capabilities; this is unlikely to be an affordable luxury in the next conflict; whatever it looks like.

The Next War

‘The Army also must confront the reality that the most plausible, high-end scenarios for the U.S. military are primarily naval and air engagements … any future defense secretary who advises the president to again send a big American land army into Asia or into the Middle East or Africa should “have his head examined”.

The vision for the next war is unclear. Campaigns in Iraq and Afghanistan have shaped perceptions of future conflict and honed skills for a particular kind of conflict; but operations in Afghanistan are unlikely to be representative of the next war. Secretary Gates’ comments above suggest a less land-centric war. DCDC’s Future Character of Conflict paper (FCOC) suggests the number of conflicts will increase in more congested, contested, connected and constrained battlespace. The 2010 SDSR and National Security Strategy (NSS) define

163 Loader, “Is True Air/Land Integration Achievable?” 51.
164 Payne, interview, May 15.
165 Air Commodore Al Byford, Deputy Commandant JSCSC, interview with author, May 15 2013.
167 DCDC, Strategic Trends Programme: Future Character of Conflict, (Shrivenham: DCDC, 2010), 15.
various threats\textsuperscript{168} and the military structure\textsuperscript{169} required to meet them. Whichever concept is closest to reality, UK forces will need to be ready to adapt to it.

Operation ELLAMY in 2011 reinforced this point: a NATO coalition, led mostly by European states delivered air and naval support for proxy (rebel) forces, against a brutal regime operating in a contested environment.\textsuperscript{170} Consequently, the delivery of ALI changed. First, coordination of forces was conducted using an improvised command structure, delivered through NATO; the size of the theatre meant assets were spread thinly and C2 was predominantly executed through AWACS.\textsuperscript{171} The land component were rebel forces, which made communication with the CAOC in Italy challenging. Following an inadvertent strike against a rebel-captured tank, satellite phones were provided to rebels to aid coordination\textsuperscript{172} and open-source reports suggest SOF played a critical role in coordinating fires.\textsuperscript{173} Airspace coordination with naval assets was unfamiliar: the integration of Naval Gunfire Support (NGS) typically blocked out airspace which limited offensive-air’s flexibility and post operational feedback suggests that the transfer of control between AWACS and naval assets in theatre would have been more effective if it had been rehearsed.\textsuperscript{174} Finally combined Air Operations between UK combat air operating from Italy and Apaches on HMS OCEAN were well coordinated by secure telephone or email and executed successfully.\textsuperscript{175} These C2 complications are indicative of the likely challenges in future campaigns and demonstrate the importance of forces being able to adapt.

Second ALI capabilities to support ground forces needed modification. NATO’s rules of engagement required eyes on target prior to engagement and without dedicated FACs on the ground to mensurate or designate for strikes, other ways had to be found to observe, assess and target.\textsuperscript{176} This meant adjusting well-honed capabilities developed in Afghanistan: fast-jet crews either coordinated directly with ISR assets for authority to strike specific targets or conducted their own assessment using on-board sensors and specific Rules of Engagement.\textsuperscript{177} Finally, common understanding between the coalition and the

\textsuperscript{171} RAF Pilot, interview with author, 9 May 13.
\textsuperscript{172} Dave Sloggett, The RAF’s Air War in Libya: New Conflicts in the era of austerity, (Barnsley: Pen & Sword Aviation, 2012), 84.
\textsuperscript{173} RUSI, “Accidental heroes, 1.
\textsuperscript{174} Allison, interview with author.
\textsuperscript{175} RAF Pilot, interview with author.
\textsuperscript{176} RUSI, “Accidental heroes, 5.
proxy forces was initially low but was developed during the conflict through communication with rebel forces and via military-liaison teams providing support to the National Transitional Council.\textsuperscript{178} This lack of a dedicated land component complicated ALI in Libya and it is worth considering briefly whether this is a potential norm.

The lack of ‘boots on the ground’ in Libya was significant for three reasons. First, the financial cost of operations was significantly less than if coalition ground forces had been deployed: figures cited by Christian Anrig suggest that the six month operation cost the UK 260 million pounds; when scaled across a year this represents only around 13 percent of the four billion pounds that Afghanistan costs British taxpayers each year.\textsuperscript{179} Second, the militarily contribution to the operation was conducted at the limit of available capabilities: European forces could not have conducted the operation without the support from the US. Third, the political implications of deploying western ground forces was significant, although the UN mandate precluded a ground force, Christian Anrig suggests: ‘infidels on the ground scoring decisive victories and occupying yet another Muslim country might have led to strategic backlashes’.\textsuperscript{180} This consideration was underpinned by domestic politics; the fiscal crisis made it unlikely the public would have supported another prolonged war of choice. These factors are important as they suggest future conflict aligned to that suggested by Secretary Gates in 2011, but future governments and international coalitions may still choose a different approach. Consequently, the UK’s Armed Forces will need to be flexible in their response.

The Chief of Defence Staff, General Sir David Richards, described his concept \textit{How we will fight}\textsuperscript{181} at his annual lecture to RUSI in December 2012. Central to this is the development of a UK Joint Expeditionary Force (JEF); this will integrate elements of all three services into a force that will train and operate together to deliver the core element of UK contribution to military operations.\textsuperscript{182} The force will flex in size to operate independently or to contribute to military activity through NATO or another coalition such as the Anglo/French Combined JEF (CJEF).\textsuperscript{183} This suggests the need to develop flexibility and tempo rather than mass. Drawing capability together into a more fully integrated force suggests a single command chain; this may mean primacy of command determined by the type of operation.\textsuperscript{184} If so, the need for common understanding will become absolute if assets are to be employed

\begin{itemize}
\item \textsuperscript{179} ibid, 103.
\item \textsuperscript{180} ibid, 102.
\item \textsuperscript{182} Ibid.
\item \textsuperscript{183} Ibid.
\item \textsuperscript{184} For example, an Economic Exclusion Zone might be commanded by the Joint Force Maritime Component Commander with Air and Land in support for littoral activity.
\end{itemize}
effectively to deliver operational and strategic effects; furthermore, joint training will be critical. At the time of writing, the concept is still being developed by DCDC as the ‘Defence Joint Operating Concept (DJOC)’\(^{185}\) with publication expected sometime in summer 2013. However UK forces are utilised in the future, their size and shape is changing at the same time as they withdraw from Afghanistan. As the Armed Forces prepare for contingency operations, the capability, coordination and common understanding developed between air and land will be most at risk.

**Future Challenges**

Operations in the Middle East have dominated the attention of UK Armed Forces over the last decade and many capabilities that were previously considered core warfighting activity have been necessarily shelved to release capacity for operations in Helmand. As each service starts to recuperate some of these capabilities their structure is also fundamentally changing. The Army will move to a two division structure: 3 Division will become the Reactive Force (RF) and will deliver the primary offensive ‘spearhead’ capability; 1 Division will become the Adaptable Force (AF) focusing on standing commitments, UK operations and capacity building.\(^{186}\) Concurrently, the RAF is seeking to address the critical manning shortfalls caused by support to Afghan operations: Commander JALO and the JFACC have recently completed a paper that supports a reduction in ASO numbers by around 50 percent: the RF Division, the Land Warfare Centre (LWC) and Directorate Training HQ (Land) will retain some ASOs, but RF Brigades and the AF will lose their dedicated expertise.\(^{187}\)

In order to offset the impact of these changes, some ASOs will be transferred to the Air Surface Integration Training Advisory Team (ASITAT).\(^{188}\) This new organisation will merge with the existing ASOC to form a centralised pool of air experts at the LWC available for secondment to AF training or RF operations.\(^{189}\) Commander JALO is adamant that both the RAF and the Army will maintain air-land posts wherever they are able to emphasising that ‘Army formations are better equipped if they have embedded staff’;\(^{190}\) but accepts Defence Planning Assumptions will prioritise manning elsewhere. This is a key point; the criticality of common understanding to ALI relies on co-location of forces or use of embedded representatives. If the RF is truly able to react and the AF able to adapt, both divisions will need to be able to deliver as part of a joint force, with a clear understanding of each other’s

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\(^{185}\) Byford, interview with author.

\(^{186}\) Payne, interview with author.

\(^{187}\) Allison, interview with author.

\(^{188}\) ibid.

\(^{189}\) Payne, interview with author.

\(^{190}\) Allison, interview with author.
capabilities and experience of how to employ them effectively. The proposed ASO reductions put this at risk; the use of ASITAT personnel will mitigate the shortfalls, but the lack of a continuous air presence within the division will not only dilute land’s exposure to air, but also the ability of ASOs to react intuitively to brigade or divisional planning needs. The senior ASO serving at 3 Division agrees: ‘the plan to use ASOs from a central pool, to support training or operations, could create a perception that they are a “bolt-on” capability rather than an integral part of the unit.’

Dislocating air and land at the operational level risks damaging the common understanding that has been developed in the last ten years and could signal a return to the planning and coordination seen in Iraq in 2003.

The risk is understood at JALO and the need to develop ALI education further is high in Commander JALO’s priorities: ‘there has to be an understanding now in our staff colleges and other schoolhouses of [what] air used to do and, in the next war, potentially will have to do’. This is an important point: ALI is not about maintaining an understanding of ALI in Afghanistan, it is about ensuring that each component understands core roles in different types of conflict. Coalition dominance of the air in recent conflicts has prevented enemy air attacks on ground forces and allowed allied air to support; but as Montgomery noted: ‘If we lose the war in the air, we lose the war and lose it quickly’.

The last time that UK forces operated in contested air environment was during the Falklands war in 1982. Whilst Iraq and Libya both had counter-air capabilities, the Integrated Air Defence System (IADS) of each was destroyed quickly. However the recent freedom of manoeuvre in the air domain that we have enjoyed may not persist, particularly if forces are fighting a “peer” or “near-peer” threat. Consequently a clear understanding of the impact of a contested air environment is required across the components. Conflicts that include a credible air threat will divert aircraft away from ALI to target enemy air capabilities, defend airspace or protect high value assets. Furthermore, if the land component is operating inside the engagement zone of enemy Surface to Air Missiles (SAM) or tactical Ground Based Air Defence (GBAD), the threat to air may mean that they cannot get close enough to their land colleagues to support. It is vital that air and land elements both understand these issues, appreciate the limitations and have trained for such scenarios.

Underpinning future ALI capability will be the training of air and land forces. As forces withdraw from Afghanistan, the amount of live ALI training for aircrew, TACPs and FACs will

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191 Payne, interview with author.
192 Allison interview with author.
reduce; pre-deployment training will decline and front-line fast-jet squadrons will focus on capabilities that have been shelved over the last ten years. Front-line Tornado GR4 squadrons already use periods between operational tours to focus on developing the skills that are not specific to operations in Afghanistan. Developing crews who can operate in high threat scenarios by day and night takes time and requires training assets;\(^{194}\) both are in short supply and the majority of high-end training is completed on large-scale exercises such as UK CQWI\(^{195}\) or an international FLAG\(^{196}\) exercises. The timing of these opportunities can lead to a significant imbalance in capabilities between squadrons who can attend and those who cannot.\(^{197}\) Although not operationally deployed in Afghanistan, the Typhoon force will face similar issues as they develop air-to-surface capabilities whilst trying to maintain air-to-air qualifications.

From the land perspective, current regulations require FACs to conduct a minimum of six CAS controls in a rolling six-month period to retain currency; one must include live weapons and a maximum of two can be completed in an accredited simulator.\(^{198}\) This training burden currently applies to around 100 FACs but will reduce to around 70 in the future;\(^{199}\) this will still require over 550 flying serials per year. The existing fast-jet fleets will struggle to service this requirement and it is unlikely that the UK Joint Strike Fighter force will be able to prioritise ALI training when the aircraft enters service at the end of the decade. Furthermore, as the RAF attempts to reduce flying hours by rebalancing the live-synthetic training ratio to 50:50 by 2030,\(^{200}\) even less sorties will be available to ALI training. JALO are focused on this shortfall and are working with Air Command to align training opportunities in the Defence Exercise Programme (DXP), looking for ‘even the slightest opportunities to [train] people together’.\(^{201}\) This will be a critical part of maintaining ALI capability and should be considered as part of the wider Joint Force training initiatives being discussed as part of DJOC.

Some training shortfalls can be mitigated by the Air Battlespace Training Centre (ABTC) at RAF Waddington. Whilst initially funded as a UOR, it is likely that this simulator will be extended to 2019; final funding approval is expected in mid-2013.\(^{202}\) The ABTC can deliver up to one-third of a FAC’s annual training and allows air and land personnel to practice in

\(^{194}\) Wing Commander Jez Holmes, Officer Commanding number 2 Squadron, interview with author, May 28, 2013.
\(^{195}\) The Combined Qualified Weapons Instructor (QWI) exercise that supports the various UK QWI courses.
\(^{196}\) Large-scale multi-national exercises such as Red Flag in the United States.
\(^{197}\) Holmes, interview with author.
\(^{198}\) JALO, JSP 918, 2B-2.
\(^{199}\) Allison, interview with author.
\(^{201}\) Allison, interview with author.
\(^{202}\) ibid.
realistic scenarios, with realistic equipment and with as much complexity as the instructors choose to include.203 A key feature is the ability to watch the other component performing their task; this is critical, as it improves common understanding of capabilities and challenges through direct experience of each other’s roles. Simulation is obviously not impacted by real world weather or system failures and allows FACs to repeat training serials several times, but it cannot completely replace live training for FACs and aircrew. Five more years of investment in the ABTC represents a significant training capability at a fraction of the cost of equivalent live training; withdrawal of funding for this facility would have a disproportionate effect on the future of ALI capability, as experience and currency starts to wither during the withdrawal from Afghanistan.

From the equipment perspective, ALI capabilities in service today are good: targeting pod developments and the planned upgrades to enable digital CAS will increase air’s capability,204 the plan to fully fund FIRESTORM equipment and the replacement capability, Joint Fires Integrator (JFI), should equip FACs well into the next decade.205 However, securing funding for equipment to sustain capabilities going forward will continue to be challenging, particularly as the services compete for funding at subsequent Defence Reviews; the recent move of JALO to the Joint Warfare Division in Joint Forces Command on 1st April 2013206 should help leverage the support required from the three services.

As an organisation, JALO will remain based at Air Command at RAF High Wycombe, which will enable a closer interface with key RAF components,207 but it is critical that this does not create an impression of JALO being an ‘Air’ organisation if it is to retain the support of the other services. Commander JALO wants to institutionalise ALI and aims to establish structures from the tactical to the strategic level to continue ALI development. He is focused on integrating the forces as part of Future Force 2020, mitigating the reductions in ASOs through increased education and on reinforcing ALI lessons at the highest levels of all three services.208 Whether he will retain the support and resource to do it remains to be seen.

203 Ibid.
205 Ibid.
206 Allison, interview with author.
207 Ibid.
208 Ibid.
CHAPTER SEVEN - CONCLUSION

‘We learn from history that we do not learn from history’.209

As the operational integration of air and land power approaches its centenary, Hegel’s words seem compelling. From the first use of offensive air in support of land, the benefits of ALI have been clear and yet the hard won lessons wrenched from each conflict are too often forgotten by the next. As the character of conflict continues to change and the integration of air and land is required to adjust, the three distinct ALI pillars of capability, co-ordination and common understanding, remain as important today as they were almost 100 years ago.

This paper has analysed the history of ALI: from the first flights calling in artillery on the Western Front, to the precise lethal effects delivered in the streets of Libya. As quickly as RFC sorties began in 1914, new and innovative ways of integrating air and land developed and many of those early innovations remain familiar in contemporary ALI. What is even more surprising is the extent to which contemporary problems often mirror historical issues. In analysing ALI’s 100 year history, this paper has demonstrated that UK air and land forces have continually struggled to prepare for joint operations before conflict.

ALI capability has ebbed and flowed as lessons drawn from difficult experience in each war have been lost by the start of the next. In the years between conflicts, each service has focused on individual capabilities at the expense of joint activity. Accordingly, as each subsequent combat operation arrived, forces deployed without the right capability, without an ability to coordinate effectively and without a common understanding of each other’s role. Following the failures in Iraq in 2003, UK Defence set about addressing the issues; the PC-K initiative and the formation of JALO have delivered fundamental changes in the last ten years, which have built the impressive ALI structure that exists today. Not since the end of WWII has air and land been so well integrated, but confidence in this success could become ALI’s undoing if the architecture and resources supporting it are not maintained.

ALI capabilities have evolved beyond all recognition from the system of flags and lamps used to direct aircraft over the Western Front. Modern equipment is highly complex and allows FACs to direct airborne fires with precise effect. However, the fundamentals of capability have not changed: the requirement for suitably qualified personnel and appropriate joint training endures. As UK Armed Forces reconfigure, Defence must prioritise training;

tightening budgets, fewer aircraft and more complex equipment will make joint training more difficult and more expensive; however, history has shown us that training is the cornerstone of capability and without it ALI will fail to deliver.

This paper has also shown the criticality of effective coordination between air and land. Joint planning and effective C2 are at the core of this pillar and failures such as those seen at Amiens serve as a reminder of the cost of failure. Current planning and coordination structures are robust and greatly assisted by embedded air staff within land units. However, the planned changes to the ASO structure represent a significant change to this and put at risk the robust coordination that exists today. The ASITAT may mitigate this reduction in ASOs, but it will need Army units to seek engagement with air, rather than it being integrated as part of their structure. Future coordination also requires a robust, but flexible C2 system that can respond to operational challenges; Operation ELLAMY showed the potential complexity of the next war and the need for ALI to adapt quickly. Finally, the perennial challenge between services for control of aircraft must now be concluded; the strategic nature of air and paucity of assets means that command and control needs to be centralised in order to deliver decentralised execution effectively.

The pillar of common understanding bridges capability and coordination and is arguably the most important. Understanding is a combination of doctrine, education, experience and currency and successful ALI relies on individual expertise to liaise, advise and fine tune. The increase in ASOs that followed the failures in Iraq in 2003 went a long way to establishing air expertise in land units and it is concerning that this is set to reverse as part of the future force structure. Both the RAF and the Army will need to consider this carefully and engage with JALO’s initiatives to increase education; without this commitment, single-services run the risk of diluting current knowledge and failing to build a base for the future. Finally, understanding must be common: General John Salmond in Amiens in 1918 and General Franklin Hagenbeck in Afghanistan in 2002 both failed to understand how best to employ air power in support of land and their decisions caused significant failures during high-tempo operations.

Personalities are important: the relationships between Haig and Trenchard in WWI; and Eisenhower and Tedder in WWII allowed ALI to flourish. Conversely, the relationship between Woodward and Thompson in the Falklands constrained air’s support of land. These examples reinforce the need to indoctrinate ALI at all levels of the service and Commander JALO is right to aspire towards ALI instutionalisation. His aim to engage at the Strategic level, to lecture at the Defence Academy and to brief Army officers at
Warminster\textsuperscript{210} will be critical to sustaining and developing the knowledge base. But ultimately it needs to go wider and deeper; only when it permeates every serving person’s career at frequent intervals will there truly be a common understanding and only then can all three pillars stand.

As the UK’s armed forces withdraw from Afghanistan in 2014 and begin to reconfigure for future conflicts, they will necessarily look inwards to focus on areas that have been neglected during operations in Afghanistan and Iraq. Undoubtedly, the next operation for UK Armed Forces will look fundamentally different to the last, but the ALI lessons learned in the last ten years will remain relevant. The marriage of air and land is shortly to celebrate its 100\textsuperscript{th} anniversary, but as they return from their third honeymoon each partner will have to keep working to support the other if they are to avoid another temporary separation.

\textsuperscript{210} Allison, interview with author.
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Interview with RAF Pilot with operational experience in Iraq, Afghanistan, and Libya, May 9 13.

Payne, Wing Commander Jason, SO1 Air G5 at 3 Division, interview with author, May 15 2013.
TO: Stephen Kilvington
SUBJECT: Approval of ethics application

Dear Stephen,

KCL/12/13-306 – ‘Delivering effective Air-Land Integration (ALI) in the next war: what lessons can UK Defence draw from historical and contemporary operations to generate and maintain an efficient, joint ALI capability that is fit for future conflict.’

I am pleased to inform you that full approval for your project has been granted by the WSG Research Ethics Panel. Any specific conditions of approval are laid out at the end of this email which should be followed in addition to the standard terms and conditions of approval, to be overseen by your Supervisor:

- Ethical approval is granted for a period of one year from 02/04/2013. You will not receive a reminder that your approval is about to lapse so it is your responsibility to apply for an extension prior to the project lapsing if you need one (see below for instructions).
- You should report any untoward events or unforeseen ethical problems arising from the project to the panel Chairman within a week of the occurrence. Information about the panel may be accessed at: [http://www.kcl.ac.uk/innovation/research/support/ethics/committees/sshl/reps/index.aspx](http://www.kcl.ac.uk/innovation/research/support/ethics/committees/sshl/reps/index.aspx)
- If you wish to change your project or request an extension of approval you will need to submit a new application with an attachment indicating the changes you want to make (a proforma document to help you with this is available at: [http://www.kcl.ac.uk/innovation/research/support/ethics/applications/modifications.aspx](http://www.kcl.ac.uk/innovation/research/support/ethics/applications/modifications.aspx)
- All research should be conducted in accordance with the King’s College London Guidelines on Good Practice in Academic Research available at: [http://www.kcl.ac.uk/iop/research/office/help/Assets/good20practice20Sept200920FINAL.pdf](http://www.kcl.ac.uk/iop/research/office/help/Assets/good20practice20Sept200920FINAL.pdf)

If you require signed confirmation of your approval please forward this email to crec-lowrisk@kcl.ac.uk indicating why it is required and the address you would like it to be sent to.

Please also note that we may, for the purposes of audit, contact you from time to time to ascertain the status of your research.

With best wishes,

Rosie Pearson – Research Support Assistant
On behalf of
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