‘Complete Failure’: The British and Dominion Aerial Re-supply 1915-16

By Warrant Officer Class 2 Paul Barnes

Biography: Paul Barnes is a Warrant Officer in the Regular Army currently serving with the Scots Guards. He holds a MA in Military History with Distinction from the University of Birmingham and was the Royal Air Force Historical Society’s Henry Probert Bursar 2014-16. He delivered a paper to the BCMH in November 2016, and is currently working on a PhD proposal.

Abstract: This article examines the role of the air services in the Mesopotamian Campaign from 1915 to April 1916 in general, and specifically the attempted aerial re-supply of British and Empire forces besieged in the town of Kut Al-Amara in 1915-16. The surrender of Kut Al-Amara to the Ottomans in April 1916 was, until the surrender of Singapore to the Japanese in 1942, arguably the single worst shock to the prestige of the British armed forces since surrender at Yorktown in 1781. This article will critically analyse the historiography of the Mesopotamian Campaign and suggest that the shock of defeat has imposed a meme of complete failure on the Campaign which is, in fact, far more nuanced. In terms of the air services, it will suggest significant and rapid transformation through adaptation and innovation which has been lost due to poor information management and the powerful meme of failure.

Introduction

Major-General Sir Charles Vere Ferrers Townshend, KCB, DSO, was General Officer Commanding (GOC), the Sixth (Poona) Division of the British Indian Army besieged in the town of Kut Al-Amara by Ottoman imperial forces from December 1915 to April 1916. Widely vilified at the time, and since, for perceived flaws of character and professional incompetence, his dismissal of the utility of aerial re-supply in the attempted relief of Kut Al-Amara has nevertheless remained the received view amongst historians since the end of the Great War.

This article will critically analyse the available primary sources from the United Kingdom and Australia to re-assess the efficacy of the aerial re-supply capability in 1916. The article will initially embark on a detailed historiography of the Mesopotamia Campaign from 1914 to 1916, looking at the development of ideas and opinions since the Great War to suggest an understanding of how the conventional view of aerial re-supply as a failure came to be such a potent meme. Following that, a narrative account of the British and Dominion air services' role in the Campaign will seek to isolate the strengths and weaknesses of air power in Mesopotamia, leading to a close analysis of transformation in contact by those air services, and specifically an examination of the efficacy of aerial re-supply as a method of mass logistic provision in 1916. The purpose of this article is not merely to tell a largely untold story and thereby suggest a revision of received wisdom, although it certainly aims to do that, but it also aims to offer an examination in microcosm of human and technological interface in contact and the vital importance of learning and influence in change and military success.

Technology is vitally important in warfare, but it is not an independent variable; for technology to enable military success it must itself be enabled by human ingenuity[1]. Human agency is thus transformational; it is not technology which changes the character of warfare, rather it is humanity's reaction to technology in terms of innovation, learning and adaptation[2]. It must be borne in mind, however, that whilst technology creates an opportunity for change, and the relationship between humanity and technology determines the direction of transformation; politics and power largely determine the speed of change[3]. Innovation and adaptation must also be seen merely as stages in a developmental continuum, the currency of which is knowledge. In order to bring about a successful transformation, new knowledge must be widely promulgated and adopted[4]. Knowledge management is thus a key piece in the transformation jigsaw; knowledge must be embedded and managed in order to both protect organisational memory and enable further development[5]. Aerial re-supply emerged during the Great War as just such an innovation; taking a technology, the aeroplane, and adapting it to deliver supplies to positions which could not, at the time, be re-supplied conventionally. Critically, differences in the effectiveness of knowledge management and political patronage would have important ramifications for the capability. Learning is, then, vital to military success, but is as nothing without good knowledge management and strong political advocacy. This article will argue that far from Townshend's 'complete failure', the effort at Kut Al-Amara

successfully proved the utility of the concept and also demonstrated considerable practical success in application.

The military operations conducted by Indian Expeditionary Force 'D' in Mesopotamia between 1914 and 1916 have been the subject of a good deal of literature commencing from the end of the Great War. The first stage of operations in Mesopotamia, which ended with the fall of Kut-al-Amara in April 1916, became the subject of the Mesopotamia Commission of 1916-17 following the fall of the Asquith premiership in December 1916. The Commission was highly critical of the preparations for war of the Government of India, military decision-making during the Campaign, and the standard of medical and logistic provision prior to April 1916[6]. The public interest generated by both the Campaign and the Commission saw, from 1920, a number of autobiographical works by those in command, such as Townshend, but also Staff and Regimental Officers like Major Edward Sandes and Captain Edward Mousley[7]. These works tended to be defensive in nature, perhaps unsurprisingly given the critical findings of the Mesopotamia Commission, and, certainly in the case of Sandes and Mousley who were besieged in Kut, rather less than objective when considering the efforts of the relief force. It is from this period that a perception of aerial re-supply as a curiosity and a failure, rather than a serious capability, emerges.

This view, whilst dominant, was not, at that time, universal and more balanced writers, particularly the three authors of the Official Histories of the Mesopotamia Campaign, Brigadier General Frederick Moberly, Frederic Cutlack and Henry Jones examined aerial re-supply far more evenly[8]. In the mid-1920s a study by the Indian Army Staff College in Quetta largely re-iterated the findings of the Mesopotamia Commission, but was rather more understanding of the effects of the fog of war on command than the largely civilian Commissioners. This view was reinforced by civilian and ex-service writers such as J Fitzgerald Lee, Sir Arnold Wilson, Dorina Neave, and P.W Long who sought to shift the blame for the failures of the Mesopotamia Campaign onto politicians in Delhi and London and away from the military[9]. It was perhaps predictable that this perspective would face a counter, with authors such as Sir George Buchanan, a veteran of the campaign and acquaintance of the CinC of the Army of India, General Sir Beauchamp Duff, seeking to absolve General Headquarters (GHQ) India of responsibility for the Campaign[10].

The view of Kut as a political failure, and of aerial re-supply as a novelty, remained until the late 1960s when, perhaps feeding on both prevailing anti-establishment sentiment and historical revisionism, a number of books criticising the military commanders were produced[11]. The view that aerial re-supply was a failure at Kut was re-iterated in these books such as A.J. Barker's works and Miller's *Kut: Death of an Army* (1969), which remained the standard work on the Mesopotamia Campaign for almost forty years. The coalition campaign in Iraq from 2003 re-awoke interest in the Mesopotamia Campaign of 1914-18. Since 2006 a number of works have been produced which broadly follow Miller's thesis and which are highly dependent on the accounts of men like Sandes, but which demonstrate little, if any, original, archive-based

research[12]. Indeed one of Barker's works has been re-packaged, in entirety, to take advantage of the wave of interest in Iraq[13]. The language used in the titles of these works also betrays the publisher's intent to tenuously link the Great War campaign of 1914 – 1918 to the United Kingdom's role in the Coalition campaign of 2003 – 2009; the cynical may see this spurious nexus as a ploy to sell books in an oversaturated market.

Recently, however, there have been more rigorous attempts by academics such as Charles Townshend, Nikolas Gardner and Nadia Atia to re-examine the Campaign[14]. These authors demonstrate, almost for the first time in terms of the Mesopotamia Campaign, a degree of archive-based research, but are perhaps less concerned with operational history than the social and political aspects of the Campaign, and do not attempt to question the historic assumptions about the efficacy of aerial re-supply. That is not to say that in recent years military historians have not examined the more operational aspects of the Campaign. Kaushik Roy and Andrew Syk are notable in this regard, whilst Michael Molkentin has produced an exceptional overview of Australian aviation in Mesopotamia in his *Australia and the War in the Air* (2014)[15]. These works, however, are unconsciously affected by national mythologies; post-colonialism in the case of Roy, and Australian exceptionalism in the case of Molkentin. Additionally, these works do not seek to tackle many of the original assumptions of the Mesopotamia Commission, not least of which regards the effectiveness of aerial re-supply. It would seem then, that the role of aerial re-supply in the relief of Kut Al-Amara and indeed the role of the air services throughout the early part of the Campaign in Mesopotamia has been largely lost in the historiography and has seen little, if any, rigorous academic research since the opening of the archives in the late 1960s. Perspectives formed almost a hundred years ago therefore remain largely unchallenged, unaffected by periodic revisionism, and hence ready for re-consideration and review.

Air Power in the Mesopotamia Campaign 1915-16

'Like most of the roles for air power that emerged in the war's first eighteen months, aerial re-supply indicated reasonable foresight: the aeroplane would come to occupy an important part in the supply chains of military forces later in the twentieth century. In 1915, however, the vision outstripped the available technology.'

Michael Molkentin[16]

This section examines the first operational use of aerial re-supply in 1916. In doing so, it firstly provides an extended, broad narrative of the campaign in order to place both the capability, and the use of air power in general, in context. This is important given the tendency to divorce the history of air power from the wider operational contexts in which it is utilised. It then examines the organisation of the air services in Mesopotamia in depth, uncovering the degree to which aviation was an afterthought for those in command. It goes on to examine the concomitant effects that the lack of preparedness, resource and understanding had on the performance of the air services during the period March 1915 – April 1916, and the degree to which innovation and adaptation were used to bridge the resultant gaps. With these vital contexts established, the section moves to provide an in-depth analytically-

driven examination of the use of aerial re-supply in 1916. The efficacy of the capability is investigated and it is suggested that its interpretation as a failure has been overstated; rather it should be seen as a limited success.

The British invasion of Mesopotamia in early November 1914 was ostensibly a sensible extension of British foreign policy in the Persian Gulf[17]. In the century prior to 1914, British policy towards the Ottoman Empire had been one of managing political decline and preserving regional stability; this was achieved by a combination of local alliances with Arab rulers in the Persian Gulf and the ever-present potency of the Royal Navy. When war came, and despite the misgivings of the Viceroy of India, Lord Hardinge, who was concerned that any operation which compromised the territorial integrity of the Ottoman Empire risked turning Muslim religious loyalty to the Turkish Caliphate into open rebellion throughout the British Empire, the British Indian Army was given the task of securing the Mesopotamian oilfields and pipelines at the head of the Persian Gulf[18]. In essence, however, the fear of jihad in Britain's empire was considered a less serious threat to Britain's strategic position than access to fuel for a Royal Navy increasingly dependent on oil[19].

The Force, Indian Expeditionary Force 'D' (IEF'D'), consisting of the 6th Indian Division under Lieutenant General Sir Arthur Barrett, easily achieved its limited objectives and was rapidly reinforced with a second division, the 12th Indian Division, under Major General George Gorringe and the 6th Indian Cavalry Brigade, under Major General Sir Charles Melliss VC[20]. The ease with which the Force captured its objectives encouraged a degree of hubris, leading to what would be termed in the twenty-first century, "mission-creep". The political advisor to the expedition, Sir Percy Cox, and Barrett's replacement as Force Commander, Lieutenant General Sir John Nixon, devised an ambitious plan to advance up the Tigris river and capture Baghdad[21]. Importantly, whilst Nixon's plan had the tacit support of the Government of India, Whitehall was both against any extension to the operation and blind to the advanced plans for such an operation[22]. Climate and geography made all military operations in Mesopotamia, but especially cavalry reconnaissance and artillery observation, extremely difficult; transport was largely limited to the rivers, the ground was either marshland or desert, fodder was virtually non-existent, and artillery observation, still at this time by direct-fire only, was obscured by heat hazes[23]. Nixon recognised that the aeroplane could fill this capability gap, and requested that GHQ India provide aerial reconnaissance and artillery observation assets for the advance of the 6th Division, under Major General Charles Townshend, on Baghdad[24].

The story of aviation in Mesopotamia is one of the creation of an air force from a standing start in less than four months. Many of the problems from which the IEF 'D' aviation component would later suffer can be traced directly to its founding; insufficient aeroplanes, poor logistics, and weak administration. GHQ India had virtually no aeroplanes in its inventory in 1915, and almost all its trained aircrew were already serving with the RFC on the Western Front. Following a negative response from Whitehall, the Government of India requested that the governments of Australia and New Zealand provide aircrew and ground personnel to

support IEF 'D'[25]. These governments agreed to provide a 'Half-Flight' of thirty personnel under the temporary command of Captain Henry Petre Australian Flying Corps (AFC), a former Chief Instructor at the Australian Central Flying School at Point Cook[26]. This Unit was to be facilitated by aeroplanes and an organisational architecture provided by GHQ India[27]. Major P.W.L. Broke Smith Royal Engineers (RE), a former Chief Instructor at the British Central Flying School, was appointed Deputy Assistant Director Aviation (DADA) on the staff of GOC IEF 'D' with responsibility for providing Nixon with advice on aviation matters and creating and running an aviation infrastructure in support of the flight, with facilities in India and Mesopotamia. In addition to Broke Smith, a Flight Commander, Captain H. L. Reilly of the 82nd Punjabis and an engineering officer, Captain W. R. Wills Indian Army Reserve of Officers (IARO), were appointed by GHQ India in March 1915. Critically, however, they were appointed with no organic administrative support[28]. Broke Smith would have a little less than two months to prepare the aviation component for operations. The inevitable lack of preparedness would necessitate an organisational dependence on innovation and initiative which, whilst laudable, would have ramifications for the provision of air support.

The 'Half Flight' arrived in Basra on 26 May 1915, less its Mule Transport section, and found that Broke Smith had already established an Aerodrome and Park at Basra for the repair and assembly of aeroplanes, and a Depot at Bombay, under the command of Captain E. L. Baxter IARO, providing spares, equipment, tooling and theatre reception for all personnel[29]. The aeroplanes they were expected to operate, two unarmed Henry Farman Shorthorns, were waiting for them in crates on their arrival and would be in the air within 48 hours. This initial operating capacity was clearly insufficient for offensive operations. The inclusion of aviation in the plans for Townshend's advance to Baghdad, which began only two days later, demonstrates both IEF 'D's urgent requirement for reconnaissance and its lack of understanding of aviation. Broke Smith made it clear in his Report, however, that the aviation component was a work in progress; the aspiration being for it to rapidly expand to a point where it would 'become self-sufficient'[30]. Self-sufficiency being defined as two operational flights with a third, training flight based in Basra[31]. Broke Smith was already, in May 1915, trawling the IEF 'D' for officer volunteers for aircrew training and had requested floatplanes to take advantage of the rivers, lakes and marshes[32].

Broke Smith was clearly industrious; in the space of two months he had travelled from India to Mesopotamia, identified suitable operating and accommodation facilities for IEF 'D' aviation assets and personnel, built an aerodrome, infrastructure and workshops and organised precious river transport assets to support the advance to Baghdad[33]. Additionally, in his role as a staff officer he was advising Nixon of the aircraft types and number he would need for the next phase of operations[34]. It is apparent, however, that whilst the aviation organisation was not short on adaptability and drive, with such a herculean workload, day-to-day administration, including knowledge capture, would be subsidiary activities. The frenetic tempo of those first few days certainly encouraged innovation and adaptation, but was unsustainable. It is notable that all of Broke Smith's written replies to requests at this time are handwritten and in pencil,

despite being a staff officer in a large headquarters[35]. In addition to this, insanitary conditions, the effects of heat and other illnesses took a heavy toll on the limited manpower available[36]. The 'Half Flight' commenced operations in support of Townshend's Tigris advance on 28 May 1915, flying only two relatively untested aeroplanes.

The initial advance culminated in the capture of Al-Amara on 3 June 1915. Although successful in providing reconnaissance and rudimentary artillery observation, the aviation capability was already under severe strain and delivering outputs far below what was commonplace on the Western Front at the time; indeed, on 16 June 1915, Broke Smith was reminded by Nixon's HQ that his role was that of a Staff Officer, not an operational pilot[37]. Broke Smith was clearly struggling to balance his role as a Staff Officer with a requirement to both administrate the aviation capability and cover operational flying missions, thus highlighting the immaturity of the organisation and the inexperience of Broke Smith's subordinates. Nixon's decision to divide his force in order to advance up the Tigris and Euphrates rivers simultaneously, further exacerbated the problems of the 'Half Flight', with the two operational aeroplanes being used on both fronts from 22 June 1915. The 'Half Flight' had not, at this stage, received any further aeroplanes, although two Caudron G.2s would arrive at Basra on 14 July 1915, and the intense heat and illness rates continued to take a heavy toll on aeroplanes and manpower alike[38].

Nixon recognised the value of his aviation assets and understood that, without reinforcement, even their limited outputs were unsustainable. His requests for additional aeroplanes and aircrew, whilst accepted positively in India, Australia and New Zealand, could not be provided immediately[39]. In these circumstances, and given both the change of the Campaign's status since November 1914, and the ongoing offensive operations in the Dardanelles and Egypt, the War Office asserted its authority; absorbing the 'Half Flight' into Number (No.) 30 Squadron RFC as 'A' Flight, and adding a 'B' Flight from Egypt. Simultaneously, the personnel of the 'Half Flight' were taken on the British establishment, with all commissions converted to the RFC. Although the role of DADA remained, Broke Smith lost authority over the flying component, being limited to providing advice on aviation to HQ IEF 'D' and facilitating the aviation support function for No. 30 Squadron RFC[40]. Major S.D. Massy RFC was appointed to command the Squadron, with Captain Reilly relegated to command of 'A' Flight and Captain E.M. Murray Queen Victoria's Own (QVO) Corps of Guides commanding 'B' Flight[41]. The effect in materiel terms on the aviation capability was immediate; from late August 1915 the number of aeroplanes was doubled to eight, albeit the Martinsyde S.1 aeroplanes provided were obsolescent in the context of the Western Front by that time[42]. Critically, however, little changed in terms of administration and although much had been learnt by Broke Smith, his staff, and the personnel of the 'Half Flight', particularly in relation to flying in extreme temperatures, the lack of a mechanism to formalise learning left this knowledge as tacit and thus easily, and rapidly, lost. This failure to formalise and the concomitant loss of knowledge supports the work of Catignani, Foley et al, and O'Toole and Talbot which warns against the perils of tacit learning[43]. The 'Half Flight' thus remained dependent on innovation to span the administrative gap but failed to create a mechanism to learn from these innovations.

Broke Smith's influence was further challenged from September 1915 with the arrival of two Shorts seaplanes of the Royal Naval Air Service (RNAS) from East Africa. The Seaplane detachment was commanded by Lieutenant Colonel R. Gordon Royal Marine Light Infantry (RMLI), an experienced pilot who had commanded an RNAS seaplane detachment in action against the German battle-cruiser *Königsburg* in Tanganyika[44]. Gordon's rank created a problem for HQ IEF 'D'; he out-ranked both Broke Smith and Massy but commanded far fewer aeroplanes and personnel than either and was wholly inexperienced in operations in the desert. After a good deal of correspondence, including a discussion of their relative seniority and the dates of their commissioning, a compromise was arrived at granting Gordon the appointment of 'Flying Commander' with authority over the overall direction of all flying operations, but subordinate to IEF 'D'[45]. This compromise left Broke Smith as principal aviation staff officer, with control over the aviation support function for the RFC and as the key advisor to Nixon, and Massy in undisputed command of his Squadron, but allowed Gordon to direct operations in the field and also protected the independence of the RNAS detachment.

The effect of this arrangement was to further compromise the fragile administration of the aviation capability; the RFC and RNAS continued to operate through separate supply chains, there remained no effective method of knowledge management beyond the Unit War Diaries, and the flow of information was often seriously impeded by the complicated command arrangement. The situation came to a head following Townshend's withdrawal from Ctesiphon to Kut Al-Amara in early December 1915; a combination of a rapid retreat, loss and lack of supplies and transport, and the attritional effect of weather and high flying hours left the aviation capability without a single airworthy aeroplane[46]. Massy comments on these failings in the Intelligence Summary of No. 30 Squadron RFC War Diary for February 1916; his frustration with the Staff and his chain of command is palpable; they enjoy the benefits of aviation but fail to understand its fragility[47]. As a result of this almost complete failure, the command arrangement was revisited, and on 9 March 1916 the RFC and RNAS elements were effectively merged under the command of Gordon, but remaining under Army authority[48]. This arrangement received joint Admiralty and War Office approval and considerably improved the supply and transport situation, although neither administration nor knowledge management saw any benefit as a result of unity of command.

Despite the administrative and logistic difficulties faced, and notwithstanding the absence of an effective system of knowledge management, the aviation capability of IEF 'D' remained highly innovative. A.J. Barker claims that the aviation capability in Mesopotamia was underdeveloped: 'even aerial photography was unknown'[49]. In the specific instance of aerial photography, Barker does not acknowledge that resources were scarce and that storing photographic paper and developing chemicals in the field, in temperatures in excess of fifty degrees centigrade, was a significant achievement. His comment also ignores the regular use of aerial photography by No. 30 Squadron RFC from February 1916[50]. Prior to that, it is apparent that IEF 'D's aerial reconnaissance usually depended on Observers' sketch maps, however,

Broke Smith proposed posting RE cartographers to No. 30 Squadron RFC as a pragmatic solution to the problem of delay and human memory, thus demonstrating effective bottom-up innovation[51]. Barker is also incorrect in a wider sense; solutions to problems are rarely identical, instead they are influenced by environmental and other factors, so that the answer to a problem in verdant and resource-rich Flanders may be unsuited to the deserts of the Middle East. A further example is provided by the development of a system of proto-fighter control during attempts to relieve Kut Al-Amara.

From mid-February 1916, enemy aircraft began observing and bombing the positions of the Tigris Column from an Ottoman aerodrome a short distance to the north of Kut Al-Amara. Although besieged troops in the trenches closest to the enemy aerodrome could clearly see the German aeroplanes being prepared for flight, there was no way to pass this intelligence to HQ Tigris Column and thence to No. 30 Squadron RFC. A solution was devised whereby pre-arranged codes were sent 'in clear' by wireless to HQ Tigris Column as soon as a German aeroplane left its hangar, followed up by further messages giving codes for direction of travel once it had taken-off, thus giving British aeroplanes an opportunity to intercept the enemy aircraft[52].

IEF 'D's aerial capability was almost wholly independent of the RFC and RNAS from March until September 1915, and thereafter operated on a semi-detached basis. There was little, if any, opportunity for inter-theatre learning and even when pamphlets and manuals made their way out from France they tended to be either outdated or irrelevant to the local situation; for example, from February 1916 No. 30 Squadron RFC began ranging artillery using a pamphlet, OB/114, which had been issued in France in July 1915 and which had since been superseded[53]. Solutions to problems therefore tended to be local in nature and were not promulgated beyond the Theatre, both because of a lack of a system of knowledge management internally, and the absence of a formal system of inter-theatre knowledge exchange.

In many ways then, the development of air power in the Mesopotamian theatre was homogenous, evolving to adapt to local conditions and demands; a military Galapagos. Its dependence on innovation was a function of the shortages and other weaknesses it faced, it adapted in order to solve problems pragmatically, creating largely bespoke solutions. On several occasions, these unique solutions were rejected by the War Office because the solution was at odds with common practice in France and Belgium, for example, the idea of posting cartographers to No. 30 Squadron RFC was rejected because cartography was not a recognised function of operational units, but rather a matter for an intelligence branch in a headquarters[54]. Aerial re-supply, as a method of mass logistic provision, was devised as such an empirical solution to a local problem, feeding Townshend's troops besieged in the town of Kut Al-Amara and cut-off from any means of conventional relief. The concept underlying it was, however, far from novel, 'the dropping of limited quantities of ammunition and food supplies to beleaguered garrisons or in other emergency' is mentioned in a 1911 programme for a demonstration to the Parliamentary Aerial Defence Committee at Hendon[55]. Aerial re-supply at

Kut Al-Amara is unique, however, in that it represents the first use of the capability in wartime and on such a large scale.

Townshend's advance on Baghdad had been repulsed at Ctesiphon on 22 November 1915 and he had rapidly withdrawn to the town of Kut Al-Amara to re-supply[56]. His Division arrived in the town on 3 December 1915 and was surrounded by Ottoman forces four days' later. Townshend accepted the siege, as he believed he had stores and provisions sufficient for at least a month and in the belief that the siege was, in effect, halting a potential Ottoman advance on Al-Amara, and thence to Basra via Qurna[57]. Every attempt by British troops to relieve the siege met with failure, due largely to a combination of stubborn Turkish resistance, limited numbers of available assaulting troops, insufficient supplies, and tenuous lines of communication exacerbated by the annual flooding of the Tigris[58]. By careful rationing and the planned butchery of draft animals and cavalry horses, Townshend's force was able to hold out until 29 April 1916, before surrendering to the Ottoman commander, General Halil Bey. A siege which Townshend had expected to be lifted within thirty days had in fact lasted 147, cost the British 23,000 casualties and ended in the captivity of the Kut Al-Amara garrison[59]. The reasons for the failure to relieve Kut Al-Amara remain hotly debated, however, in large part they have at their root the failure on Townshend's part to give a firm and consistent estimate of his food stocks. Too often Townshend's staff would find more food, thereby extending resistance, only after the relief forces had spent themselves attempting a breakthrough; had the food estimates from Kut Al-Amara been accurate initially, the relief force may have summoned sufficient mass to breakthrough and relieve the town[60]. Additionally and arguably, waiting until the eleventh hour to approve aerial re-supply limited the effect that re-supply could bring, thus further highlighting a lack of understanding of air power. Although both arguments are dangerously counter-factual they do present an interesting and compelling argument, albeit the variable estimates of the duration of the town's resistance were, in no small part, due as much to reductions in per capita rationing as poor accountancy and hoarding.

The first attempts at aerial re-supply for Kut Al-Amara involved the dropping of newspapers, parcels and letters to Townshend's Headquarters on 31 January 1916[61]. There was nothing new in this, the dropping of messages from aeroplanes had been common since before the War, but it marks the first drop of any significance and the beginnings of an adaptation. By mid-February 1916, this activity had become commonplace, with aeroplanes regularly flying the 23½ miles from the forward aerodrome at Ora, near Shaikh Sa'ad, dropping loads as diverse as wireless parts, fishing nets, medicine, and money[62]. On 4 March 1916, No. 30 Squadron RFC personnel began experimenting with dropping a millstone weighing seventy pounds using a parachute specially designed by Sergeant John Stubbs; this represented a departure from the routine, and demonstrates the cumulative nature of learning in contact[63]. The millstone was required to enable flour-milling within Kut Al-Amara, the town millstones having been taken by retreating Ottoman troops in September 1915, and was finally dropped from a Betuci aeroplane on 27 March 1916[64].

It is unclear who devised the idea of dropping food into Kut. Moberly states that the idea originated with Broke Smith and that it was disseminated through the new commander of IEF 'D', General Sir Percy Lake, however, in mid-April 1916 Broke Smith messaged Massy asking for details of the new innovation of which he had just been notified, which would seem to contradict Moberly's account[65]. It seems likely that the idea probably originated in No. 30 Squadron RFC, this further reinforces the idea of the bottom-up nature of innovation being tied to shortage and necessity. The first experiments with the aerial delivery of food took place on the 11 April 1916 at Ora, with a workable mechanism being in place by 13 April 1916. Townshend granted permission to try the concept on the 14 April 1916, stating that Kut Al-Amara would require around 5,000 pounds of foodstuffs per day to hold out. The aerial re-supply effort commenced on 15 April 1916 and from then until the end of the siege a fortnight later, No. 30 Squadron RFC managed to supply 19,000 pounds of food, although only 16,800 pounds could be recovered by the besieged troops. Townshend would later describe the aerial re-supply effort as 'a complete failure'[66].

By April 1916, No. 30 Squadron RFC had nine aircraft available for duty at Ora: four Betucis, one Henri Farman Voisin, one Voisin and three Shorts seaplanes[67]. Although all of these could be used for aerial re-supply duties, the vast majority of sorties were flown by the land aeroplanes largely because the seaplanes were relatively underpowered and had trouble rising and landing when burdened with a heavy load[68]. Additionally, the different aeroplane types had to be loaded differently according to their flying characteristics, this in turn affected the maximum load carried: Betucis could carry a load of 150 pounds, the Henri Farman a load of 200 pounds, the Voisin a load of 150 pounds and the Shorts between 200-250 pounds[69]. With the exception of the Betucis, all loads were mounted on a modified bomb rack designed by the OC of 'B' Flight, Captain E.M. Murray, with loads being dropped from an altitude of 5,000-6,000 feet[70]. The Betucis carried a 50 pound load on the improvised bomb rack and a 50 pound loads on each lower plane alongside the pilot's seat[71].

Molkentin states that the loads were dropped with the aid of parachutes, this is incorrect; whilst the millstone was dropped on 27 March 1916 using this method, all other loads were free-dropped[72]. In repeating the parachute myth from the secondary sources, Molkentin demonstrates the danger of depending, even in the smallest detail, on the work of others; he is unfortunately far from rare in this unfortunate, if understandable, mistake. Initially, loads for the Henri Farman and the Voisin were dropped in a four-gallon petrol drum but the experimentation phase discovered that the drums tended to burst on impact with the complete loss of the load. Instead, the loads were packed tightly into food sacks and then double-sacked inside a loosely tied sack to ensure that if the inner sack burst on impact, the contents would be contained in the outer sack. This was entirely successful and accounts from officers besieged in Kut Al-Amara describe watching the curious sight of the sacks falling end-over-end from the aeroplanes trailing a faint white cloud of flour[73]. The bomb rack modification involved removing the bomb guides and fittings, and fitting a bar pivoted at one end, the other end being fastened by a quick release attachment operated by the pilot. The load was

carried in pairs of sacks fastened together and slung across the bar. The loads on the lower plane of the Betucis were attached by a cord passing around the bottom end of the rear spar; when over the target the pilot would cut the strings and pull the sacks over the trailing edge of the plane[74].

Notwithstanding issues with engines and the lifting of loads from the Tigris, aerial re-supply appears to have been more problematic for the RNAS than for the RFC. Anecdotal evidence from inside Kut Al-Amara is scathing regarding the ability of seaplanes to deliver the load to the marked dropping point, this criticism varies from humorous inter-Service banter to annoyance at the RNAS' reticence to modify their aeroplanes[75]. Whilst these anecdotes are hard to ignore, it is clear that the seaplanes did more than their share of the workload. Although RNAS seaplanes represented less than a third of the flying strength of the Squadron, in the period 17 – 30 April 1916 they completed almost 40% of the flying hours flown[76]. To a degree this is explained by the use of seaplanes on other tasks, specifically artillery support, but perhaps it was easier to criticise the more recognisable shape of a float-plane than a land-based aeroplane when supplies were lost.

Overall, in the period 15 – 29 April 1916, No. 30 Squadron RFC delivered 16,800 pounds of food into Kut Al-Amara which represented around 22% of the requirement[77]. This raw data is deceptive, however, as it fails to recognise many of the factors which retarded the capability. On the first day of re-supply, for example, in clear skies and without serious opposition, the aeroplanes managed to deliver 3,750 pounds of food into Kut Al-Amara, representing 75% of requirement[78]. This is contrasted with the second day of resupply when, in high winds, only 1,335 pounds was received into Kut Al-Amara, 26% of requirement[79]. On average, aeroplanes delivered 1,600 pounds of food each day[80]. It must be remembered, however, that prior to the start of the operation, it had been thought that the re-supply effort was feasible; this indicates that a number of variables were either unforeseen or not included in the planning. These variables can be summarised as the effect of high flying hours on old airframes and tired aircrew, competing operational demands on the air service, adverse weather and the unfavourable climate of Mesopotamia and, perhaps most importantly, the loss of air supremacy in the theatre.

The number of flying hours performed by the nine aeroplanes of No. 30 Squadron RFC rose from around 43 in the period 20 – 25 March 1916 to over 152 in the period 17 – 23 April 1916[81]. General Sir Percy Lake was well aware that the air service of IEF 'D' was operating with aeroplanes which 'were obsolete and in need of repair' and Massy had warned in February 1916 that, given the age and disrepair of the equipment and the enhanced servicing required, the workload demanded by the Tigris Column was unsustainable[82]. It is clear that by April 1916 this problem would likely have been even more apparent, indeed on 17 April 1916 no flying was possible because of issues with the maintenance of the aero-engines and all seaplanes were withdrawn from Theatre in May 1916 due to wear and exhaustion[83]. The climate and insanitary conditions also took their toll on the aircrew; during the period of the re-supply

almost every pilot was hospitalised for a short period and No. 30 Squadron RFC's War Diary makes it clear that only six pilots were available for flying duties in the squadron during the week ending 23 April 1916[84].

In addition to a shortage of pilots and aeroplanes, and notwithstanding the importance of the aerial re-supply mission, the squadron was tasked with providing aerial reconnaissance and artillery observation for the Tigris Column. In the week of the 17 – 23 April 1916, the squadron carried out almost 34 hours of reconnaissance, 34 hours of aerial re-supply and over 48 hours of artillery co-operation[85]. This continues a theme of a lack of understanding of the limitations of aviation by those in command and an inability to talk truth to power on behalf of Massy and Gordon. The ferocious climate of Mesopotamia also played a part in hindering the re-supply mission, on several occasions the squadron's aeroplanes were unable to fly because of high winds and poor weather conditions, notably on 18 April 1916 when stormy weather grounded all air activity[86].

Until February 1916 the British air services enjoyed complete air supremacy in Mesopotamia. This changed with the arrival of four German Pfalz monoplanes, which quickly achieved air superiority and began to bomb Kut Al-Amara from 13 February 1916[87]. Despite this new arrival, the aerial re-supply effort was not seriously impaired by the German machines until 24 April 1916 when a German monoplane attacked one of the food carrying aeroplanes[88]. The carrying of additional weight had necessitated the reduction of the crew of each aeroplane to the pilot only; the pilot was unable to fly and fight the aeroplane at the same time. The solution to this was to provide an escort armed with a Lewis gun for each food carrying aeroplane, however, the Pfalz was faster and more agile than the British escort aeroplanes which thus acted as only a limited deterrent and further reduced the number of aeroplanes and aircrew available for aerial re-supply missions[89]. Although this defensive measure mirrors developments on the Western Front, given the doctrinal isolation of the Mesopotamian theatre it seems likely that any similarity is purely coincidental. Perhaps more than any other factor, the loss of air superiority made the aerial re-supply of Kut Al-Amara untenable[90].

Although the practical application of aerial re-supply had failed to provide sustainable relief to the garrison of Kut Al-Amara, the concept itself was sound and far from Townshend's 'complete failure'. No. 30 Squadron RFC had provided a considerable amount of food and other vital equipment which undoubtedly extended the resistance of the besieged Division and could, it is argued, have provided even more succour if a series of factors and unforeseen circumstances had been absent and if the effort had begun earlier. Michael Molkentin states that the operation was a failure because 'the vision outstripped the available technology', but this is only fair within the bounds of the Mesopotamian Theatre. It is argued that with more aeroplanes of a more modern type, better logistic provision and more aircrews, it is possible that the aerial re-supply of Kut Al-Amara could have been successful in practical as well as conceptual terms. Since the end of the Great War, historians have accepted the view that the aerial re-supply of Kut Al-Amara was a noble, but flawed, experiment. Instead, it should be

viewed as an innovative and audacious concept, which fell short in practical application due to a number of external factors, unrelated to the concept itself. It is further argued that the reason for the perception of aerial re-supply as a failure lies with a failure to promulgate the concept and the lack of a powerful patron to champion its cause. This would certainly not be the case when the concept was re-incarnated in France in July 1918.

Conclusion

In warfare the ability to innovate and adapt, to use technology to its optimum effect, is central to success on the battlefield. This can only be achieved, however, by understanding the innovation, learning its strengths and its weaknesses, exploiting its qualities and thus finding an effective way of using the innovation to gain a competitive advantage over the enemy. Technology of itself does not win wars, human understanding of that technology and exploitation of its characteristics are the critical factors to victory[91]. This study of aerial re-supply during the Mesopotamia Campaign has demonstrated that organisational maturity, a 'learning culture', and superiority of knowledge management are key to transformation in contact.

In the instance of the relief of Kut Al-Amara in April 1916, as has been demonstrated, a broad consensus of both popular and academic historians agree that aerial re-supply was both a conceptual and practical failure. A conceptual failure because, they argue, the available technology was insufficient to support the concept, and a practical failure because the capability ultimately failed to relieve the siege of the town and its garrison. Whilst it is fair to say that aerial re-supply did not successfully relieve Kut Al-Amara, it certainly extended resistance and, it is argued, were it not for circumstance, may well have produced a largely successful outcome. The traditional view of aerial re-supply, and indeed the wider aviation effort in Mesopotamia in 1915-16, is thus deserving of review; indeed, surely in terms of aerial re-supply, it should be viewed as a complete conceptual success and a limited practical success.

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