The Royal Flying Corps During Operation MICHAEL

By Squadron Leader Phil Clare

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Abstract: The 1918 German Spring offensive, Operation MICHAEL, began on 21 March. The British Third and Fifth Armies that stood in the way were, in many cases, overwhelmed by the speed and ferocity of the initial German attack. For the Royal Flying Corps (RFC), artillery cooperation became difficult due to the disruption suffered by the British artillery. Instead, the RFC found itself outnumbered in the air and having to conduct extensive low-level attacks against German troops moving in the open. Whilst support to troops on the ground may seem perfectly normal today, the RFC lacked the training and equipment to undertake this role and suffered very high casualties in the process. This article explores the RFC's efforts and the criticism from some elements of the British Expeditionary Force (BEF), notably the Artillery, who felt they had been let down by the RFC.

Introduction

'Not content with destroying the enemy in the air, they have vigorously attacked his infantry, guns and transport with bombs and machine-gun fire, and in the fighting south of the Somme in particular gave invaluable assistance to the infantry by these means on numerous occasions.'

Sir Douglas Haig's Sixth Despatch (German Spring Offensives, 1918), War Office, 21st October 1918.

Field Marshal Haig's praise for the RFC in his despatch quite rightly reflects the bravery and dedication of the RFC personnel who supported the Third and Fifth Armies as they attempted to halt the 1918 German Spring offensive.[1] Whilst his description of an air arm conducting low-level attacks in support of troops on the ground may seem nothing out of the ordinary today, in 1918 such operations were out of kilter with the RFC's contemporary doctrine which focused on defeating the German Air Service in the air and on providing photographic reconnaissance and artillery observation. Haig's praise was later tempered somewhat by what Hilary Saunders described as the post-war '*sterile wind of controversy that blew down Whitehall and through the Service Clubs*', which blamed the RFC for missing an opportunity to call down accurately ranged artillery fire against German troops advancing in the open.[2] Reports drawn from Divisional Artillery Commanders over that period are also largely unsympathetic towards the RFC and their perceived inability (or refusal) to support the guns during this critical period.

Political and Military Developments Prior to Spring 1918

The genesis of Operation MICHAEL, and the five other German offensives that would be launched against the British and French armies between March and July 1918, can be traced to 1917 and developments concerning Russia and the United States of America. Although the first Russian Revolution of March 1917 resulted in a gradual reduction rather than a complete collapse in the Russian Army's fighting power, it had nevertheless handed the strategic initiative to Germany.[3] America's entry into the war in April 1917 forced Germany's hand with Ludendorff adamant that Germany had to strike before the American Expeditionary Force grew in number. The armistice between Russia and Germany in December 1917, concluding with the Treaty of Brest-Litovsk in March 1918, meant that by early 1918, Germany had been able to concentrate its strength against the West, forcing the BEF to come to terms with an unfamiliar challenge of having to prepare for a major German offensive.[4]

While global events were beginning to affect the military balance on the Western Front, the BEF was undergoing significant challenges of its own. In November 1917, the Cabinet Committee agreed to prioritise manpower for the Navy and the RFC, shipbuilding, tank production and agriculture ahead of the BEF. This meant that the BEF was forced into a restructuring programme in the Winter of 1917 that resulted in the disbandment of 115 battalions; a process that did not finish until a month before Operation MICHAEL.[5] This reduction in fighting manpower was compounded by the fact that in February 1918 the BEF was directed to take over an additional 20 miles of the front-line previously held by the French.[6] By spring 1918, Germany could field 192 divisions in the west, the French and British only 156.[7] The Germans

possessed a numerical advantage which Ludendorff sought to exploit with a series of offensives against the British and French armies.[8]

Germany's numerical advantage was given real credence by a series of victories in Romania in 1916 and at Riga and Caporetto in 1917 which demonstrated its army's ability to deliver decisive blows on the battlefield.[9] However, a BEF General Headquarters (GHQ) intelligence summary published on 16 February 1918 entitled 'German Methods in the Attack' concluded that '*there was no reason to believe the method of breaking through which was effective on the Russian and Italian fronts would succeed in the face of determined resistance*.'[10] This operational assessment of the BEF's ability to withstand a German assault was overoptimistic to say the least, especially considering the success of the recent German counter-attack at Cambrai less than three months earlier.[11] Tim Travers believes the German counter-attack on 30 November was the most significant part of the Cambrai battles as the BEF could, and perhaps should, have recognised that the German Army was using new offensive tactics.[12] In the eyes of others such as Robert T Foley, Ludendorff was simply restoring the traditional German concept of *Bewegungskrieg* (Manoeuvre Warfare) to his divisions.[13] Whether this was a revival of long-standing German doctrine or a new way of warfare, what is beyond dispute is that on 30 November 1917 the British Third Army lost 7,500 men, mostly as prisoners, and 162 guns.[14] Disruption to the British Artillery was not just felt in losses - only 26 of 203 artillery calls made by the RFC were answered on the day of the counter-attack.[15] It appears that the relevance of the German tactics did not register with GHQ. Six weeks after the battle had ended, General Rawlinson was forced to urge Haig to distribute the 'Lessons of Cambrai Counter Attack' report in the belief that the anticipated German offensive in 1918 would model itself on that attack.[16]

In assessing his defensive options, Haig placed most of his forces to the north of Arras, stretching to Flanders and Ypres, thereby protecting the vital Channel Ports that were the BEF's lifeline. The defensive line that protected these assets was certainly sound, but it lacked depth. Looking further south, Haig knew that Gough's Fifth Army lacked the strength to hold the line around Saint Quentin, but the ground that lay behind the front-line would allow commanders in this area to conduct a controlled retreat before the Germans reached any significant objective.[17] Unfortunately, Haig's assessment appears to have ignored the German success at Cambrai, and it is possible that the BEF's own self-belief may have been laced with a degree of hubris. Their view that the British Army could withstand the German attack would be tested to destruction along the Fifth Army's front.[18] Operation MICHAEL began on 21 March 1918 and, over the next 2 weeks, British forces were pushed back distances of up to 40 miles, losing 1,200 square miles of territory in the process.[19] The gains made by the German Army vastly exceeded the progress made by either side on the Western Front in the previous four years, but the advance was eventually halted outside the town of Amiens.

The Question of Doctrine

'*All our thought and training had gone into how to chase and destroy German fighters in the air. Now we were having to carry out very low-flying attacks with bombs and machine guns*.'[20]

As Commanding Officer of an RFC Squadron flying the SE5a fighter, Major Sholto Douglas would not have expected his unit to be taking part in low-level attacks against German troops. Sholto Douglas commanded an Army, or Scout, Squadron, trained and equipped to engage the German Air Services at altitude. Their counterparts, the Corps squadrons, conducted reconnaissance, bombing and artillery cooperation missions, flying in 2-seat aircraft designed to offer stability rather than speed and manouevrabiilty. Sholto Douglas' comments suggest that RFC squadrons during Operation MICHAEL were required to operate outside the parameters set by their training, experience and equipment. Today's British military defines doctrine as something that '*sets out the fundamental principles by which military force is employed*' by drawing upon the lessons of history, incorporating original thinking and from experiences gained from training and operations.[21] Although the First World War predates this modern definition by almost 100 years, it is perfectly acceptable for the purposes of this article. In February 1918, Major General Sir Hugh Trenchard's 'The Employment of the RFC in Defence', released just prior to his departure from France as Officer Commanding the RFC in the Field to assume the position of Chief of the Air Staff, provided RFC commanders with direction and guidance as to how they should operate in the face of the much-anticipated German offensive. Trenchard stated that the RFC's primary role in this instance was to use reconnaissance flights to detect the initial stages of a logistical build-up and then to hamper that build-up through sustained bombing attacks. Once the enemy offensive had begun, the focus should switch to 'rendering our artillery fire effective'. The next priority for the RFC was to attack enemy reinforcements, de-training points, road transport, artillery positions and reserves. Finally, and this is of particular relevance to Operation MICHAEL, it was to send '*low flying machines, on account of their moral effect, to cooperate with the infantry in attacking the enemy's most advanced routes*'. Although this gives the impression that the entire RFC would be given this last task, Trenchard was in fact referring to a flight from each squadron – not exactly a main effort.[22] These activities were to be conducted whilst ensuring the RFC maintained control of the air. In many respects, Trenchard's parting shot does not represent a seismic shift in the roles that the RFC was already undertaking.

Artillery in the Defence

The February 1918 Conference of Army Commanders at Doullens decreed that when used in the defence, artillery should operate on elastic and mobile principles. To do this, the Field Artillery would have to be trained for open warfare and be able to come into action rapidly in the open if necessary.[23] That same month, the Artillery were issued, under Stationery Service (SS) 139/7, Artillery in Defensive Operations. SS139/7 was unequivocal about the importance of artillery stating that it alone was the only weapon that could have a serious and decisive effect on the enemy and '*it must be regarded as the strongest weapon of the defence*'.[24] The document only required three paragraphs to inform the reader, and the RFC, that the aircraft's primary role was to observe for the artillery. RFC Commanders were to '*subordinate everything*' to ensure their Corps aircraft were kept in the air. It may therefore appear that the RFC had little freedom of manoeuvre, but it was in fact a reflection of Trenchard's 'RFC in the Defence' paper.[25] It was the view of the Artillery that if the RFC accorded with these principles,

they would be of far greater assistance to the infantry and artillery than any amount of low-flying or bombing would achieve.[26] Whilst SS139/7 was unequivocal regarding the primacy of the artillery and the supporting role of the RFC, it sent a mixed message on exactly how the artillery was meant to conduct itself if forced to retreat. Talk of adapting to mobile warfare is one thing, but to tell the Battery Commanders that '*the bold policy of holding a battery position to the last will generally pay*' (as it would allegedly buy time for the infantry to advance and assist the guns) is another matter entirely.[27]

RFC and Artillery Cooperation

Prior to the release of the 1918 documents for the RFC and the artillery, the two Arms had been furnished with a series of SS pamphlets that covered in detail either the work of the artillery or the cooperation between the artillery and the RFC. Whereas the RFC had developed from first principles, the artillery entered the war as a long-established element of the British Army. By late 1917, the strength of the artillery was increasingly enhanced by the techniques in aerial observation and ranging that would see prolonged barrages give way to more nuanced techniques such as creeping barrages and predictive fire. The doctrine supporting the artillery and the RFC developed apace as both arms expanded, became more capable and better integrated.

Although the RFC and the artillery enjoyed a close relationship, observation from the air was not the only method available to the guns to register and correct the fall of shot. Sound Ranging, which used an array of microphones to detect the firing positions of enemy batteries, had been used effectively from as early as 1915. In many ways, this technique exemplified how the destructive power of the guns went hand-in-hand with their inflexibility. As important as sound-ranging was, it was clearly a technique developed from (and was ideally suited to) static warfare. At best, the arrangement of microphones and the associated 40 miles of wiring could take 36 to 48 hours to set up.[28] During the initial advance at Cambrai, Sound Ranging Sections took at least 60 hours to come into action.[29] Ultimately, the success of this system required that the vast network of cables between the Sound Ranging Unit, the battery and the observation group remained intact and functioning '*at all times*' (emphasis added).[30] Nevertheless, in terms of accurate and destructive fire, British artillery using sound ranging and flash spotting techniques could target German guns to within 25 yards by 1917. Although Sound Ranging was affected by strong winds blowing into or across the microphones, it could operate both in the hours of darkness as well as in poor visibility – something the RFC could not replicate.[31]

It would be disingenuous to say that fire control for the artillery was *totally* inflexible. The 'Zone Call' system was introduced in 1916 when it was recognised that the artillery and the RFC required a method that would allow them to deliver impromptu or unplanned fires. The system needed the gun battery and the RFC observer to have identical maps overlaid with a grid covering 6,000 sq yards, with the grid lines being drawn every 1,000 yards. The RFC observer could give an initial 'grid' location and then use a series of codes to correct the fire.

One such code, the 'LL call', required all available batteries to open fire against a priority target that warranted a powerful concentration of fire.[32]

The lack of physical movement along the Western Front for much of the War did not mean that the BEF itself was not in a state of flux, as it had in fact experienced significant changes in both organisation and strength. It became clear during the battles of 1917 that the expansion of the Royal Artillery and the RFC incurred unintended negative consequences as both moved units from one command or formation to another. The result was that battery commanders would often find themselves working with newly-arrived pilots and observers who were not fully trained in the work of cooperation or that their own batteries were transferred from one command to another and found themselves working with new squadrons that were often employing different methods and techniques. Lieutenant Colonel Edgar Ludlow-Hewitt, Officer Commanding Number 3 Wing, believed that the relationship would continue to worsen. His solution was to adopt a common process where the aircraft and the battery worked as one, regardless of their location or formation.[33] Adopting a standardised approach within Fourth Army had, throughout 1917, seen the number of rounds fired during a sortie increase from 80 to 200. In December 1917, Ludlow Hewitt's work became enshrined in SS131, 'Cooperation of Aircraft with Artillery'. Although SS131 delivered a common understanding for both the artillery and the RFC, it also served to reinforce the *status quo* of static warfare without exploring the full implications of mobile warfare.

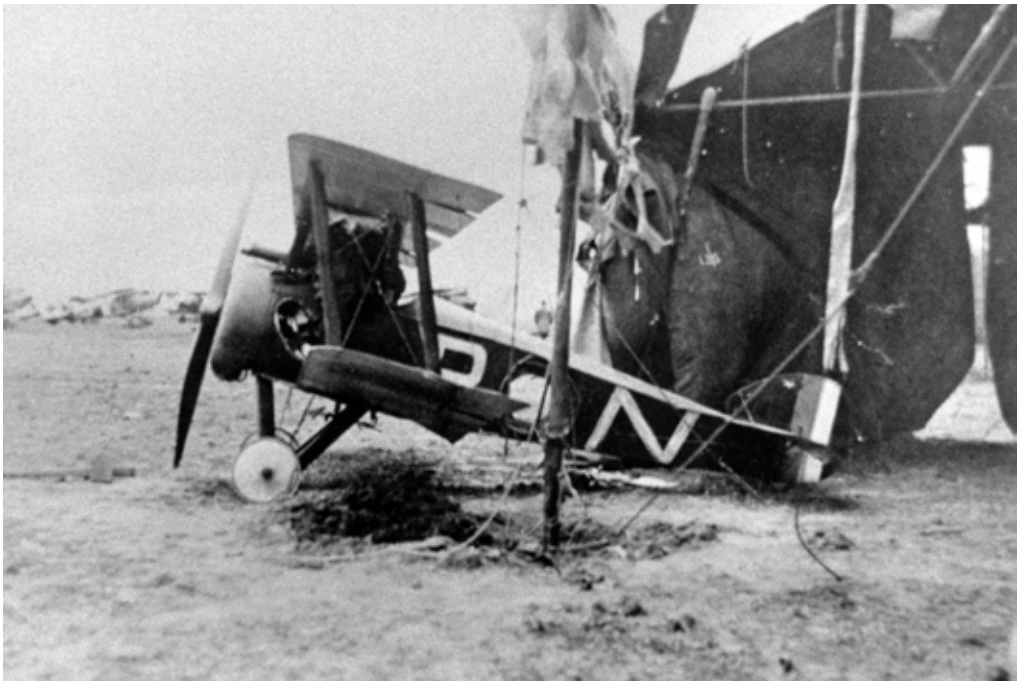
Although SS131 recognised that the ability for personal interaction and liaison between a Corps squadron and an artillery battery was becoming difficult, it nevertheless recommended that a new RFC observer should spend two or three days with a battery before they flew on artillery cooperation missions. On a similar note, it also stated that artillery officers should, if possible, '*spend a few days with their Corps Squadron and Balloon Company*'.[34] Although such interaction was clearly encouraged, it appears that not everyone was a willing participant or indeed saw the benefit. Flight Lieutenant Macfarlane, 35 Squadron, remembered hosting groups of infantry officers for three or four days during the winter of 1917/18 and he also recalled attending a course at an artillery school near Abbeville for about a week but said that he could '*not remember deriving much benefit from it*'.[35] Flight Lieutenant Bell of 69 Squadron also recalled that measures were taken in late December 1917 and January 1918 to encourage a close liaison with the Army whereby officers were sent from the squadron to the infantry and artillery for two to four days. The Squadron in turn supported a programme of visits from artillery and infantry officers, generally eight at a time, who stayed for a period of four days. Interestingly, Bell considered that better liaison was usually achieved through sport and guest nights than by formal exchange visits.[36] The artillery's perception of what the RFC had to offer was dealt with in a rather trite manner via the guidance issued to young officers from the heavy and siege batteries which, in a single paragraph, merely asked: '*Are you in close touch with the R.F.C., the Kite Balloon Section, the Topographical Section, and the nearest Field Company? All these people can help you with your work.*' By comparison, the same document dedicates 23 paragraphs to Stable Management for Horse Drawn Batteries.[37]

Ultimately, it would seem that Weber's view holds sway that the three previous years of static warfare had produced a sensation or appearance of cooperation that was not backed up with sufficient commitment from either side.[38] Although the doctrine was in place, as was the direction from the commanders, the real difficulty for the artillery was that the gunners of 1918 were not as well imbued with the principles of open warfare as their predecessors.[39] At Cambrai, neither officers nor men were well trained in mobile warfare; in fact, General Farndale was of the view that they were not trained at all.[40] Ultimately, it was a lack of movement on the Western Front that meant that the artillery suffered from a process of ossification that, as 1917 ended, would hamper its ability to respond to the re-emergence of mobile warfare. The Field Artillery on the Western Front had, in Weber's view, abrogated its mobility and its tactics were those of siege warfare with only a minority of the Royal Horse Artillery (RHA) training for mobile operations.[41]

Control of the Air

'*The primary objective of all operations…was to secure air superiority over the battle line, to enable our reconnaissance and artillery aircraft to carry on their work.*'[42]

Underpinning the whole of Trenchard's paper on RFC in the Defence was the need to maintain sufficient control of the air to provide freedom of movement for the RFC's own Corps Squadrons as well as the BEF's infantry and artillery below. At the outset of the campaign, the RFC could muster 31 squadrons to support the Third and Fifth Armies. As impressive as this sounds, the 579 British aircraft were outnumbered by the German Air Service, which had 730 machines at their disposal. This meant for the first time during the war, the German air concentration on the Western Front was greater than that of the RFC.[43] However, the speed and reach of air power meant that no RFC machine on the Western Front was more than 90 minutes flying time from any part of the Third or Fifth Armies' areas. However, this speed of movement could not prevent the German Air Service from gaining the ascendancy during the early stages of Operation MICHAEL, where the combination of German numbers and the speed of their advance meant that RFC operations were certainly disrupted. As early as 1100 hrs on 21 March, Number 8 Squadron (FK8), based only four miles behind the front line at Templeux, was ordered to relocate to their alternate airfield at Chilpilly. By the time this order was received, British guns were already firing from the edge of their airstrip. The airfield was taken by the Germans only four hours after the last squadron vehicle had left.[44] It was a similar tale for Number 5 Squadron RNAS (DH4), which had only transferred from the Dunkirk area on 18 March. Just like Leigh-Mallory's 8 Squadron, they were forced to set fire to buildings and hangars before abandoning their airfield. Goble, their Commanding Officer, remembers that just before the evacuation took place, he received a message from HQ RFC that provided instructions on how to construct cold frames to allow the growing of vegetables over the coming months – an irony that was not lost on Goble or his fellow pilots. The German Air Service, according to Hoeppner, found themselves in the ascendancy on 23 March when their pilots were presented with ample opportunities to target British formations that were crowding the roads approaching the front-line. Nevertheless, by 24 March, German formations



Sopwith Camel of 70 Squadron after being abandoned, Marieux, March 1918

RE8 aircraft of 15 Squadron RFC during the retreat caused by Operation MICHAEL, 25 March 1918

were beginning to complain about hostile air activity. Hoeppner's earlier statement that the German Air Service's choice not to challenge the RFC in the air in the run up to Operation MICHAEL was part of a wider deception plan does not tell the whole story. Truth be known, the German Air Service had lost its ability to challenge the RFC for absolute control of the air. The technical edge they possessed in April 1917 had evaporated. Not only were the British aircraft such as the SE5a, Bristol Fighter and Sopwith Camel a match for German designs such as the Albatross D.V, Pfalz III and Fokker Triplane, they were being produced in greater numbers. The German fighter aircraft also possessed a limited endurance. Whilst this was not a factor when these aircraft were defending their own airspace, as was the German preference, a lack of range limited their ability to loiter over the British lines when the offensive was launched.[45] As Operation MICHAEL progressed and the amount of territory captured increased, the short-ranged German fighter force struggled to find undamaged former RFC airfields from which to operate. They were also facing an opponent that had recovered from the shock of the initial advance, had been re-equipped from a highly efficient logistics system, was now operating from newly-established alternate airfields and had been reinforced by Wings from neighbouring areas.[46] Whatever the shortcomings of the German Air Service at this critical time, the fact their ground forces were feeling the effects of British air power was because, after only four days of battle, the RFC were able to assign 27 squadrons to ground attack duties.[47] The original role of the SE5a-equipped squadrons was to engage and destroy German fighter formations, but the character of the air war had changed. Combat reports from 84 Squadron on and after 18 March recorded offensive patrols being flown at altitudes of 8-18,000 feet, but from 22 March the reports recorded initial bombing missions followed by air-to-air combat taking place at an average height of 3,000ft.[48] By 29 March, the German offensive had virtually ground to a halt. Two days later, British pilots struggled to find any meaningful opposition with only 3 combats being fought.[49] The RFC had regained control of the air whilst, at the same time, in the face of extant doctrine, using its Corps and Army squadrons to provide additional support to the BEF whenever and wherever possible.[50]

Artillery Cooperation

'About 200 bosche are in front of BOUCHOIR but wez cannet be certain if they our people or the enemy as they are lying doggo.'[51]

The same unit from 61st Division that received this message from a passing RFC crew also cites a separate instance on 22nd March when they tried to contact the RFC to report German infantry massing near Vaux that could have been wiped out if an aircraft had given immediate indication as to their whereabouts.[52] The problems encountered by the 61st Division were not unique. The ferocious German barrage in the early hours of 21 March had targeted known battery positions as well as communication cables; if gun positions were not themselves coming under direct fire, their ability to react and respond to events was severely curtailed. Only those batteries held in reserve or the 'silent batteries' that had been instructed not to open fire in the preceding weeks proved to be the most use as the Germans had been unable to target them.[53]

The speed and ferocity of the German offensive found the Third and Fifth Armies' defensive plans wanting. Edmonds describes the battle as one fought by battalions and small bodies of men, assisted by the divisional batteries and that the first information many of the heavy artillery batteries received was from infantry units who were retreating through their own positions.[54] Where the British were able to mount counter-attacks, they were invariably small affairs with artillery support – where it existed – provided by a few guns firing over open sights.[55] The fog on the morning of 21 March was so thick in places that it prevented artillery observers from seeing the red flares that were sent up by the infantry to call for immediate support.[56]

It was not just the Field Artillery that was engaged at close quarters. Number 33 Siege Battery Royal Garrison Artillery came under such heavy machine gun fire that it suffered 75% casualties. By 1700 hrs on 22 March, the battery had fired 3,000 rounds – that is to say 36 tons of ammunition - in 36 hours. The two guns that had been towed away on the evening of 22 March when German infantry were only 500 yards away, were in action again that same night.[57] The bravery of the artillery crews was not in doubt. As Haig stated in his Dispatch of 21 July, 'The loss of artillery in the series of battles, though considerable, might well have been much greater but for the courage, skill and resource displayed by all the ranks of the artillery, both heavy and field.'[58] As if to reinforce Haig's words, the German attack on Fort Vendeuil that was carried out on the afternoon of 21 March was met with direct fire from guns of A and B batteries from 82 Artillery Brigade. By nightfall, 82 and 83 Artillery Brigades had lost 31 guns between them.[59] It should be remembered that 'Artillery in the Defence' put significant emphasis on 'bold policy of holding a battery position to the last'.[60]

The first few hours of Operation MICHAEL had, in effect, dismantled the complex yet fragile communications structure that the British artillery relied upon so greatly. Any fixed wires that did survive were invariably overwhelmed by a multitude of users – Griffith cites as many as 13 Divisional Headquarters using a single line. It was not just fixed communications that suffered; 40 pigeon lofts also fell into German hands.[61] As if the speed of the German advance was not enough, a thick mist meant that the vast majority of the RFC's Corps aircraft from III Brigade were unable to take off and provide aerial observation for the guns or indeed to discover the German progress.[62] A solitary RE8 from Number 59 Squadron was able to monitor and report on the German advance for an hour before it was shot down.[63] If the Third Army was finding it difficult to see, the Fifth Army was blinded, losing the services of the RFC in their entirety until 1600 hrs on 21 March.

Although Edmonds is generally supportive of the RFC's efforts, he is quite correct to point out that ground observation could not detect the advance of reinforcements or the assembly of troops behind the line and the loss of communications between the RFC and the Artillery meant that great opportunities for doing damage were therefore lost.[64] Not every instance of lost communications was as a result of the German barrage. Batteries were continually on the move and when they did halt, they did not always put up their masts (albeit these were masts

that Moore refers to as 'clumsy').[65] Some antennae were designed and built to be portable, but even before the offensive began, Salmond believed that these (and the less mobile variants) would be, in his words, 'an embarrassment'.[66] Even when masts were erected, the operators were often unaware of the particular zone that was now covered by the guns. Ultimately, most of the Zone Calls sent by the RFC in the first days of battle went unanswered.[67]

The Third Army report, drafted after the operation, specifically cited severance of telephone communications and a failure to receive wireless messages on battery masts as the main reasons as to why communication between the artillery and RFC failed. The artillery only too often failed to erect aerials that allowed air-to-ground messages to be received, or the aerials were erected within the gun line so as to make reception extremely difficult.[68] Both the care of wireless equipment whilst on the move and directions on the construction of RFC wireless posts were detailed in the respective SS Leaflets and were known to the Battery Commanders.

In the confusion and reality of retreat, Major Leigh-Mallory, Commanding Officer of Number 8 Squadron, clearly felt that a minority of the Zone Calls being placed by his crews were being answered. On the morning of 22 March, he sent his Squadron Wireless Officer to locate IV Corps' batteries and re-establish air-to-ground communications. The officer was unable to find a single battery that had an aerial erected and was of the view that 'As soon as the retreat started, all idea of cooperating with the aeroplanes seemed to have been abandoned. Many batteries had simply thrown their wireless equipment away and under these circumstances little use was made of zone calls.'[69] Such behaviour was not new. Major General Game, Chief of Staff at HQ RFC, found that a pre-arranged shoot had failed to go ahead in April 1917 because the battery commander had failed to establish a radio section, having ordered the ground wireless operator to leave his apparatus on the roadside.[70] Leigh-Mallory's and Game's findings are backed up by Brigadier General Charlton, Commanding Officer 16th Divisional Artillery, who acknowledged that his Brigades should have erected their wireless masts directly after they had moved and that this was often forgotten.[71]

The distance that the artillery was forced to move was a critical factor. In SS139/7, the artillery was given direction and guidance on how to operate when undertaking defensive operations but the document gave little indication of what 'movement to the rear' consisted of. The rule of thumb, according to Marble, was that if the front moved faster than three miles per day, the heavy artillery could not play a useful role as they required too long to pack up and move to new positions.[72] Whilst such a distance may have been in line with the GHQ February Intelligence Summary as well as Haig's assumption of a gradual withdrawal, it was badly out of touch with the reality of Operation MICHAEL. On 23 March, units of the Fifth Army retreated at an average of four to six miles.[73] It was not just the distance involved: the frequency of moves was also a critical factor. 107 Brigade Royal Field Artillery (RFA) moved location on ten occasions over a three-week period and did not come to a halt until 10 April when it went into a 4-day long refit programme.[74] It was not just the Field Artillery that was forced to constantly relocate. Between 21 and 27 March, 138 Battery Royal Garrison Artillery moved a total of 65

miles and found itself coming into action from seven different positions.[75] The rate of movement did not merely impact the artillery's ability to provide coordinated and accurate indirect fire, it meant that the basic building blocks of ground-to-air communication had broken down at a very early stage.

Corps squadrons supporting the Third Army launched their first missions by noon on 21 March when four aircraft from 59 Squadron (RE8) sent several Zone Calls for counter-battery fire but all of them were ignored. A total of eight calls were made in 20 minutes, including a high priority LL call to target two battalions of German infantry moving along the Pronville-Queant road, but that too was ignored. Instead, the crews fired at the advancing Germans from 900 feet and dropped their 25lb bombs before returning to base, via IV Corps HQ, where they dropped a message bag reporting the location of the German troops. In the Fifth Army sector, crews from 82 Squadron (FK8) were unable to get airborne until 1600 hrs and, although they could see sunken lanes packed with German infantry as well as batteries firing in the open, were unable to get a response for their own LL calls.[76]

The rate and frequency of movement within the Artillery not only made the role of sound ranging and flash spotting techniques redundant, it meant that in extremis, the Zone Call system also became ineffective. Marble maintains that those Artillery Brigades that retained their wireless sets could continue to work with aerial spotters but this fails to acknowledge the weakness of the Zone Call system when faced with large scale movement.[77] What the system had not taken into account was that the movement of the batteries may be so great that the zone grid upon which the calls were based no longer bore any resemblance to the new location of the battery. The retreat and confusion caused at the start of Operation MICHAEL meant that British batteries were unable to relate their locations to the grids that had been drawn up to support the planned 'gradual withdrawal'. When a battery commander *did* have the opportunity to do so, he was often unware of which zone his battery was now meant to cover.

27 March was, according to Farndale, 'a good day for the guns'. Coordination was returning and communications were re-established and, at last, the value of overwhelming concentrations of artillery on men exposed in attack was being realised.[78] In fact, 39th Divisional Artillery reported that all of its batteries were in action by 26 March and that all communications were fully established.[79] That is not to say that all was well; conditions on the ground continued to confound the RFC's efforts to conduct artillery missions. On 25 March, a RE8 from 59 Squadron reported large numbers of German infantry east of Bapaume and requested artillery fire. However, the crew were unaware that much of the sector had been taken over by French troops and no battery answered the call.[80] If cooperation between the RFC and the British Artillery was proving problematical, performing artillery fires for newly-arrived French reinforcements was unlikely to bear fruit. The fact remains that much of the long-range destructive potential of artillery against troops in the open was not put to use by British artillery during the first few days of the German offensive.[81] It was said that the RFC had missed

a wonderful opportunity; well-directed artillery fire might have so disconcerted the enemy as to have thrown his attack into confusion or even halted it. The initial efforts of the RFC did not necessarily attract universal praise with some officers from the hard-pressed Fifth Army remarking that abandoned airfields were the only evidence they saw of British air power.[82] The Commander of the 66th Divisional Artillery reported that 'for the majority of the retreat, no calls were received from the RFC due to the fact that their aircraft were too busy dropping bombs – which is wrong'. He also believed the presence of a contact artillery machine on each Corps front could have brought down a significant amount of firepower against targets that were hidden from ground-based observers.[83] What the artillery commanders were unaware of was that the RFC had tried to support the guns with little success, and had consequently turned their attention on delivering Trenchard's final priority for air power in the defence – low level attacks.

Low-Level Attacks

'Strafen' – a German verb meaning 'to punish.'[84]

At the outbreak of the First World War, the RFC's contribution to the land battle was limited to one of observation, liaison and reconnaissance. For the next 18 months, the emphasis would be improving aerial photography and cooperation with the artillery. At Neuve Chapelle, several bombing (interdiction) missions were flown against railway stations as well as a suspected German headquarters, but the RFC was some distance away from developing a close air support capability over the battlefield itself.[85] The first experiments were conducted by numbers 12 Squadron (FE2b) and 60 Squadron (Nieuports) during the Battle of Arras.[86] Two months later, 14 pilots were brought together from six Army squadrons to conduct roving missions to attack enemy troops behind the lines at the Battle of Messines.[87] It was during the Ypres offensive that the British first used ground-attack aircraft in a pre-determined and organised manner when three aircraft from each of the four Army squadrons were tasked with attacking enemy airfields and other targets of opportunity. Each engagement brought about new discoveries and opportunities to refine tactics and techniques, but the RFC's development of what we would now recognise as close air support can be viewed as nothing more than experimental.[88]

Further developments took place ahead of the Cambrai offensive when Prettyman's III Brigade allocated four squadrons to specifically conduct low-level attacks. He also made provision on the training programme for the pilots to practise dropping bombs from low level. Number 64 Squadron (DH5) had already undergone low-level flying training in England and once in France they were able to practise formation flying at low level.[89] It is important to note that preparations for Cambrai were not the norm, to the extent that pilots discovered carrying out this type of flying only a few weeks earlier were likely to be court-martialled.[90] A lack of practice for the pilots is mirrored by the guidance provided by the February 1918 edition of 'Fighting in the Air' which states that although bombing at low level had been used with 'very considerable success', it also admits that individual pilots would have to find out 'by experiment

exactly how far ahead they should aim' – not exactly a glowing tribute to the RFC training methods in use at the time.[91] The four Army squadrons allocated to low-level work were seen by the Third Army as being particularly effective against concentrations of infantry, enemy airfields and artillery batteries.[92] However, despite the additional training for the crews, losses to ground fire and aircraft accidents were significant and, in some instances, unsustainable. For example, repeated attacks against German positions in Bourlon Wood involving up to 50 aircraft from three different squadrons resulted in losses of 30%.[93] Nevertheless, the overall assistance provided by the four Army squadrons both in the attack and ensuing German counter-attack convinced GHQ that low-level attacks had proved their worth in helping them win battles; the earlier 'experimentation' of 1917 was beginning to pay dividends.[94]

Even if the progression towards conducting low-level attacks had been supported by bespoke training regimes, RFC commanders still had the concerns of the aircrew to consider. There was very much a sense that when carrying out trench strafing, pilots felt that their skill, experience or boldness counted for nothing and that their survival was left to chance. Pilots from Army squadrons carrying out a low-level attack would often be unaware whether they had done any damage and the sensation of delivering a successful attack against a ground target did not equate to the sensation of claiming a downed aircraft.[95] There is also the matter of anti-aircraft fire: gaining control of the air at 3,000 or 13,000 feet was of little importance to a pilot having to sideslip his aircraft to avoid ground-based rifle and machine gun fire. Lee, a Flight Commander with Number 46 Squadron (Camels), had taken part in 45 combats between May and November 1917, during which time his entire Flight had only suffered two fatalities and only one of these was from enemy action. In seven ground attack missions during the Cambrai offensive, Lees was shot down three times and the squadron suffered seven fatalities, four of which were from his Flight.[96] Lee's views on the dangers of low-level attacks are mirrored by those of Squadron Leader Andrews of Number 70 Squadron (Camels) who stated that his unit abandoned offensive patrols over German territory in favour of low-flying attacks on troops. According to Andrews, the Squadron suffered very heavy casualties, his own Flight 'disappeared' and new pilots rarely survived more than one or two sorties (new pilots unfamiliar with the terrain would invariably 'pop up' to gain their bearings only to be brought down by ground fire). The threat posed by the German Air Service seems minimal in that Andrews says he never saw a German aircraft and rarely a British one as he spent his time flying as close to the ground as possible.[97]

It was not just the RFC's training programme or the psyche of its pilots that were not necessarily in tune with low-level attacks. The aircraft that equipped the RFC had been developed to support Trenchard's directive whereby Army Squadrons would contest and win control of the upper airspace which would allow the Corps aircraft to provide artillery cooperation and photo reconnaissance. Any suggestions that low-level attacks were central to the RFC's doctrine need to be examined in more detail in light of this equipment programme. The power required by aircraft such as the SPAD and SE5a to enable them to operate and manoeuvre at height meant that these aircraft were fitted with heavy engines that made

them unsuitable for diving attacks at low level. Equally, the inherent stability of Corps aircraft such as the RE8 that made them such excellent observation platforms also meant they lacked manoeuvrability. That said, this stability also brought with it a degree of ruggedness and toughness that allowed these aircraft to accept a fair degree of damage compared to their more thoroughbred and fragile Army counterparts. One particular aircraft that found itself operating in an unfamiliar low-level role was the DH5. According to Lee, this aircraft was only chosen for this role as it was 'deemed to be of little use for anything else'.[98] Lee's view is mirrored by Lieutenant Commander Goble, who believed that the aircraft was only able to operate at such low levels thanks to the general confusion and congestion over the battlefield.[99] The Sopwith Camel had been used as a makeshift ground attack aircraft with some success at Cambrai but the heavy losses suffered by these squadrons could not be sustained. Whilst extremely manoeuvrable, the flying characteristics of the Sopwith Camel meant it was not necessarily best suited to ground attack missions but the fact it was being replaced in the Scout role by the SE5a meant the Camel was becoming available for this type of work. The range and type of aircraft available limited the RFC's choice of aircraft for ground attack missions and brings into question any suggestion that this was a core role. The Air Ministry had in fact placed a design specification with Sopwith in January 1918 to produce an armoured aircraft designed for low-level ground attack missions, but the resultant Sopwith Salamander would not see service until October 1918. In the meantime, two squadrons of Camels were fitted with armour which afforded a limited amount of protection.[100] This was not the equipment programme of an air arm that had a doctrine of low-level attacks at its core.

Hallion's statement that by March 1918, British Air Doctrine called for 'the mass employment of close air support aircraft' may be overstating the case somewhat as the actual position was not so clear cut.[101] As late as February 1918, 'Fighting in the Air' stated that RFC reconnaissance machines 'should not, as a rule, carry bombs as the attention of the observer should be concentrated solely upon reconnaissance' because the 'opportunities for accurate bombing will be very small and the loss of such opportunities will be offset by the improvements in reconnaissance reports.[102]

Even amongst those Army squadrons that had gained some experience of low-level work, the notion of standardised tactics and procedures is a little misleading. Crews from 54 Squadron (Camels) found that 'flying in formation of five or six machines was found to be far too many as aircraft were just as likely to hinder each other, we therefore decided to work in pairs'. Conversely, 84 Squadron (SE5a) came to the opposite conclusion that attacking in flight strength gave the best results.[103] For their counterparts in the Corps formations, low-level work was an entirely new skill that had to be learnt very quickly. Many British pilots were learning the task of ground strafing almost from scratch and were devising their own tactics; there was no manual to consult. *Ad hoc* tactics, a lack of a dedicated ground attack aircraft and the absence of a formal training system for low-level attacks; at no point does this situation indicate that close air support was embedded in the RFC's doctrine of early 1918.

The weight of effort placed on low-level attacks grew at an exponential rate from 24 March. On that day, every available RFC aircraft was ordered to attack German ground units. The war diary of one German Grenadier Regiment stated that, whilst assembling near Athiers, their unit was attacked by British aircraft and within a matter of seconds had lost eight officers and 125 men. The 8th Grenadier Regiment reported that they were attacked whilst crossing the Somme by 20 British aircraft that appeared to be flying no more than a metre above the ground. The 52nd Reserve Regiment diary reports hostile airmen being present 'in droves', stating that in excess of 30 British aircraft were overhead at any one time with pilots coming down to as low as 20 metres before releasing their bombs. One Regiment suffered so many casualties from air attack that it became non-effective and had to be withdrawn.[104]

On 25 March, Salmond gave an order to the Commanding Officer of IX Brigade that in many ways was the RFC's very own version of Haig's 'Backs to the Wall' order of 11 April:

'*I wish as soon as you can after receipt of this, to send out your scout squadrons…on to the line Grevilliers-Martinpuich-Maricourt. These squadrons will bomb and shoot up everything they can see on the enemy's side of the line. Very low flying is essential. All risks to be taken. Urgent.*'[105]

The fact that Salmond could commit an entire Brigade to shore up the defence of the BEF after four days of intense air fighting is testament to the RFC's ability to re-assign formations from other parts of the front at short notice. One of Salmond's more significant and earliest decisions was to increase the establishment and number of Reserve Lorry Parks (RLP). By March 1918, there were five RLPs available, capable of supporting the move of up to 30 squadrons at any one time.[106] The movement of squadrons during Operation MICHAEL also required the RFC logistics system to react and keep pace so that the operational tempo was not interrupted. Brooke-Popham decided to dispense with the long-established demand-led supply system whereby squadrons would request spares and stores and replaced it with a 'push' model to ensure petrol and weapons were either pre-positioned or delivered to each airfield. The latter was certainly less efficient but proved to be a highly effective solution in the circumstances.[107] Whereas the German Air Service was struggling to operate in forward locations, the RFC's logistic support was more than coping. The German advance was threatening Number 2 Aeroplane Supply Depot (ASD), responsible for supporting III and V Brigades. The ASD began moving from Fienvillers, 15 miles north west of Amiens, on 25 March and completed the 40 miles move to its new position at Verton, near Etaples, on the 27 March,[108] a major undertaking in itself, but one made all the more impressive in that it took place as the squadrons were engaged in some of the most intense flying activity the RFC had witnessed.[109] Von Kuhl's statement that enemy air activity had accounted for 'one half of all casualties suffered' is a source of debate amongst writers, but his comments do imply that the RFC caused a significant degree of damage and disruption.[110]

That the RFC was able to achieve a significant effect on the battle can in some ways be put down to the fact that they had learnt some limitations regarding low-level attacks from the

Cambrai campaign; notably, that that a 25lb bomb was unlikely to damage an artillery piece and it was far better to machine gun the crews and horses.[111] The RFC were targeting what was the Achilles Heel of the German Army during Operation MICHAEL – its mobility. As Foley points out, the German army of 1918 was short of horses, was being forced to advance over extremely poor terrain and therefore could not manoeuvre to the extent required by Ludendorff's approach.[112] Finally, a word on losses is appropriate. Salmond knew that his orders of 25 March would result in heavy casualties amongst his pilots.[113] The loss rate at Cambrai had been a warning and the pattern was to continue during Operation MICHAEL. It is certainly difficult to accept Wise's view that 'as tragic as retreat was to other arms, to the RFC it was something of a picnic'.[114] Total RFC losses over the period 21 to 31 March amounted to 478 aircraft lost, either as a result of combat or having been abandoned by retreating units. By 29 April, the figure had risen to 1302.[115] This represented the worst attrition ever suffered by the RFC – including Bloody April – with the 478 aircraft being equivalent to over 70% of the front-line strength.[116]

Conclusion

'*Although the infantry were not always conscious of it, the assistance received from the RFC during the 1918 offensive was probably one of the most valuable and effective contributions made by the air arm during the whole war. The endeavour and sacrifice of the airmen in March 1918 has rarely been equalled.*'[117]

The same day that Salmond issued his 'all risks to be taken' order to IX Brigade, he is said to have overheard a phone conversation in GHQ where Brigadier Dill, Haig's Deputy Chief of Operations, had said that the RFC had temporarily 'frozen up' the German attacks in the south.[118] Low-flying aircraft certainly harassed the advancing Germans and in some instances had a decisive effect. GOC V Brigade sent a message to his squadrons stating it was mainly due to their efforts that the gap near Roye was held on 26 March.[119] The inability of the RFC to provide support to the artillery has been criticised by some almost as a dereliction of duty. In a mobile battle, the techniques of sound ranging and flash spotting were made redundant, making aerial observation even more critical. The frequency that batteries were required to re-locate was clearly a factor, but by abandoning the aerial masts, many batteries had removed their most effective way of communicating with the RFC. The failure of SS139/7 to adequately deal with the real possibility of retreat was a major failing. Whilst the batteries firing over open sights inflicted significant casualties on the German army, they were operating in a way that, except for a small number of RHA formations, they were not trained to do. The RFC itself was also struggling to operate in accordance with its doctrine. Outnumbered by the German Air Service and forced to operate from a series of relief landing grounds, the RFC initially lost control of the air and would not regain it for several days.

Although the RFC had conducted several low-level operations during the battles of 1917, the *ad hoc* tactics adopted by both Army and Corps squadrons during Operation MICHAEL and the fragile nature of their aircraft stripped away any semblance that such missions were

a core role of the Service. Had better training and a dedicated, perhaps armoured, aircraft been in service, the RFC's impact on the German advance in March 1918 could have been even greater.

Two weeks in any timeline of the First World War is but an instant. But thanks to the actions of the aircrew and groundcrew, the commanders and the logisticians of the RFC, Op MICHAEL should be remembered as a pivotal moment in the history of British air power. The effort of the air arm is made all the more poignant considering it was made over the final days of the organisation's existence.

Notes

[1] For simplicity, the term 'RFC' as used in this article includes those Royal Naval Air Service squadrons assigned to support the RFC.
[2] Hilary St J Saunders, *Per Ardua – The Rise of British Airpower 1911-1939* (Oxford: Oxford University Press, 1944), p.163.
[3] Gary Sheffield, *Douglas Haig: From the Somme to Victory* (London: Arum Press Limited, 2011 [2016]), p.265.
[4] Ibid, p.265.
[5] Brigadier General James Edmonds, *Military Operations France and Belgium, 1918 Volume 1* (London: MacMillan and Co, Limited, 1935), p.55.
[6] HA Jones, *The War in the Air, Being the Story of the Part Played in the Great War by the Royal Air Force: Appendices* (Naval and Military Press reprint of 1937 original), Appendix XLIII p.162.
[7] Gary Sheffield, *Forgotten Victory*, (London: Headline Book Publishing 2001 [2002]), p.223.
[8] David Stevenson, *With our Backs to the Wall – Victory and Defeat in 1918* (London: Allen Lane, Kindle for PC Edition, 2011), Chapter 1, Preparations, Paragraph 12.
[9] David Zabecki, *The German 1918 Offensives A Case Study in the Operational Level of War* (Abingdon: Routledge, 2006), p.27.
[10] Jim Beach, *Haig's Intelligence - GHQ and the German Army, 1916-1918* (Cambridge: Cambridge Military Histories, 2013), p.288.
[11] Ibid, p.302.
[12] Tim Travers, *How the War Was Won – Command and Technology in the British Army on the Western Front, 1917-1918* (London: Routledge [1992] 2003 Kindle for PC Edition), Ch1, para 25.
[13] See Denis Showalter, *Instrument of War: The German Army 1914-1918* (Oxford: Osprey, 2016), p.245. Foley's first name is rendered incorrectly on this page.
[14] Travers, *How the War*… Ch1, para 36.
[15] The National Archives (TNA) WO158/316 – 'Third Army (Cambrai) Narrative of Operations and Lessons Learnt Nov 1917'.
[16] Travers, *How the War*, Ch1, para 39.
[17] Peter Hart, *1918: A Very British Victory* (London: Weidenfeld and Nicholson, 2008), p.39.
[18] Edmonds *1918 Volume 1*, p.117.
[19] Brigadier General James Edmonds *Military Operations France and Belgium, 1918 Volume 2* (London: MacMillan and Co, Limited, 1935), p.489. The figures refer to German operations

21 Mar to 4 Apr.
[20] William Sholto Douglas (84 Squadron), *Years of Combat* (London: Collins, 1962), p.263; Hart, *1918*, Chapter 5 para 24.
[21] Joint Doctrine Publication 0-01 (JDP 0-01) (5th Edition), dated November 2014, DCDC Shrivenham.
[22] Jones, *The War in the Air*, Appendices, Appendix XIV, pp.444-446.
[23] TNA WO158/311 'General Information by GHQ to Army Commanders Apr 1917-Nov 1918'.
[24] Stationery Services Pamphlet SS139/7, 'Artillery Notes No. 7: Artillery in Defensive Operations', February 1918.
[25] 'RFC in the Defence' states that 'Once an enemy offensive had begun, the principal duty of the RFC was to 'render our artillery fire effective'.
[26] SS139/7 – Alongside the three paragraphs given over to cooperation with aircraft, eight paragraphs were dedicated to dealing with enemy tanks.
[27] Ibid.
[28] Sanders Marble, *British Artillery on the Western Front in the First World War* (London: Ashgate, 2013), pp.168-169 and (40 miles) SS552 pp.5-6.
[29] TNA WO158/316, 'Third Army (Cambrai) Narrative of Operations and Lessons Learnt November 1917'.
[30] Stationery Services Pamphlet SS199/1, 'Ranging with Observation by the Field Survey Company', May 1918.
[31] Shelford Bildwell and Dominick Graham, *Firepower – British Army Weapons and Theories of War 1904-1945* (London: George Allen and Unwin, 1982 [1985]), p.110.
[32] Stationery Services Pamphlet SS124, 'Notes for Artillery Officers on Shoots With Aeroplane Observation', May 1916.
[33] HA Jones, *The Great War in the Air, Being the Part Played in the Great War by the Royal Air Force*, Volume 4, (Oxford, Clarendon Press, 1934), pp.214-218.
[34] Stationery Services Pamphlet SS131, 'Cooperation of Aircraft with Artillery' December 1917 (there had been previous iterations of this pamphlet in December 1916 and August 1917).
[35] TNA Air 1/2388/228/11/88.
[36] TNA AIR 1/2388/228/11/78.
[37] Stationery Services Pamphlet SS592, 'Catechism for Heavy and Siege Artillery Subalterns', October 1917 Issued by the General Staff.
[38] Lt Col WHF Weber, 'With the Field Artillery from Trench to Open Warfare on the Western Front', *Journal of the Royal Artillery*, XLV (1918-19), pp.358-361.
[39] General Herbert Uniacke, 'Actions Performed by the Artillery of the Fifth Army', *Journal of the Royal Artillery*, XLV (1918-19), pp. 255-282.
[40] General Sir Martin Farndale, *History of the Royal Regiment of Artillery Western Front 1914-18* (The Dorset Press, 1986), pp. 257-258.
[41] Weber, 'With the Field Artillery,' p.357.
[42] Wing Commander J C Slessor, *Air Power and Armies* (Oxford: Oxford University Press, 1936), p.2.
[43] Edmonds, *1918 Volume 1*, p.118.
[44] TNA AIR 1/2388/228/11/80.

[45] Peter Hart, *Aces Falling – War Above the Trenches, 1918* (London: Orion Books, Kindle Edition, 2008), Chapter 4 (Impending Storm), paragraph 5.
[46] Ernst Hoeppner, *Germany's War in the Air – the Development and Operations of German Military Aviation in the World War* (London: The Battery Press, 1921 [1994]), pp.148-149.
[47] Hart *Aces Falling*, Chapter 5 (Götterdamung on the Somme), paragraph 96.
[48] TNA AIR 1/1227/204/5/2634/84.
[49] Saunders, *Per Ardua*, p.170.
[50] S F Wise, *Canadian Airmen and the First World War* (Toronto: University of Toronto Press, 1980), p.492.
[51] TNA WO 158/343 Report on the Retreat of the Artillery March 1918 as reported by 61 Divisional Artillery.
[52] TNA WO 158/343 Report on the Retreat of the Artillery March 1918 61 Divisional Artillery.
[53] Marble, *British Artillery*, p.217.
[54] Edmonds, *1918 Volume 1*, p.167.
[55] Marble, *British Artillery*, p.219.
[56] It is not to say that the infantry was not using their rifle grenades to call for urgent artillery support. By 29 March Third Army reported that stocks of SOS rifle grenades had actually run out and would be replaced by green and red very lights – TNA WO 158/252 Fifth Army Operations Nov 17 to Jul 1918.
[57] Farndale, *Royal Regiment of Artillery*, p.264.
[58] Sir Douglas Haig's sixth Despatch (German spring offensives, 1918), War Office, 21st July 1918.
[59] Jerry Murland, *Retreat and Rearguard: Somme 1918 – The Fifth Army in Retreat* (Barnsley: Pen and Sword, 2014), p.48.
[60] SS139/7.
[61] Paddy Griffith, *Battle Tactics of the Western Front – The British Army's Art of Attack, 1916-1918* (Yale: Yale University Press, 1994 [2000]), p.173.
[62] Farndale, Royal Regiment of Artillery, pp.262-263.
[63] Robert Jackson, *Army Wings – A History of Army Air Observation Flying 1914-1960* (Barnsley: Pen and Sword, 2006), p.38.
[64] Edmonds, *1918 Volume 1*, p.169.
[65] William Moore, *See How They Ran – The British Retreat of 1918* (London:Sphere Books Limited, 1975 [1970]), p.94.
[66] John Laffin, *Army Wings – A History of Army Air Observation Flying 1914-1960* (Barnsley: Pen and Sword, 2006), p.102.
[67] Edmonds, *1918, Volume 1*, p.168.
[68] Saunders, *Per Ardua*, p.163.
[69] TNA AIR 1/2388/228/11/80.
[70] Jones, *The War in the Air…* Volume 4, p.213.
[71] TNA WO 158/343 Report on the Retreat of the Artillery March 1918.
[72] Marble, *British Artillery*, p.218.
[73] Hart, *A Very British Victory*, p.142.
[74] TNA WO 95/2197/4.

[75] Uniacke, *Artillery of the Fifth Army*, p.274.
[76] Wise, *Canadian Airmen*, p.491.
[77] Marble, *British Artillery*, pp. 219-220.
[78] Farndale, *Royal Regiment of Artillery*, p.274.
[79] TNA WO 158/343 Report on the Retreat of the Artillery March 1918.
[80] Jackson, *Army Wings*, p.40.
[81] Wise, *Canadian Airmen*, p.492.
[82] ER Hooton, *War Over the Trenches – Air Power and the Western Front Campaigns 1916-1918* (Hinckley: Midland 2010), p.211.
[83] TNA WO 158/343 Report on the Retreat of the Artillery March 1918.
[84] David Ian Hall, *Strategy for Victory: The Development of British Airpower, 1919-1943* (Westport: Praeger Security International, 2008), p.20.
[85] David Jordan, *The Army Co-Operation Missions of the Royal Flying Corps/Royal Air Force 1914-1918* (Unpublished PhD thesis, University of Birmingham, 1997), p.210.
[86] Ibid, p.224.
[87] Arthur Gould Lee , *Open Cockpit - A Pilot of the Royal Flying Corps* (London: Jarrolds, 1969 (kindle edition 2012)), Ch 14, Paragraph 15.
[88] Hall, Strategy, p.6.
[89] Jones, *The War in the Air*… Volume 4, p.234.
[90] Lee, *Open Cockpit*, Ch 14, paragraph 19.
[91] Jones, *The War in the Air… Appendices*, p.99.
[92] Saunders, *Per Ardua*, p.157.
[93] Jones, *The War in the Air*… Volume 4, p.247.
[94] Lee, *Open Cockpit*, Ch 14 paragraph 14.
[95] Lee, *Open Cockpit*, Chapter 14, Paragraph 31.
[96] Ibid, Chapter 14, Paragraphs 1-2.
[97] TNA Air 1/2388/228/11/91.
[98] Lee, *Open Cockpit*, Chapter 14, Paragraph 18.
[99] TNA Air 1/2388/228/11/68.
[100] TNA Air 2/1027.
[101] Richard P Hallion, *Strike from the Sky – the History of Battlefield Air Attacks 1911-1945* (Shrewsbury: Airlife, 1989), p.23.
[102] TNA AIR 1/675/21/13/1422.
[103] Hart, *Aces*, Ch 5 (Götterdamung on the Somme), paras 46-48.
[104] Jackson, *Army Wings*, pp.40-41.
[105] John Laffin, *Swifter Than Eagles: The Biography of Marshal of the Royal Air Force Sir John Maitland Salmond* (Edinburgh: Blackwood, 1964), p.107.
[106] Peter Dye, *Air Power's Midwife – Logistics Support for Royal Flying Corps Operations on the Western Front 1914-1918* (Department of Modern History College of Arts and Law., University of Birmingham, 2013), p.230.
[107] Dye, *Logistics Support*, p.242.
[108] Ibid, p.241.

[109] Over 40,000 hours were flown during March – a total exceeding any previous month in the war, including Arras and Third Ypres. Dye, *Logistics Support*, p.239.
[110] Wise, *Canadian Airmen*, p.507.
[111] Lee, *Open Cockpit*, Chapter 14, Paragraph 23.
[112] I am grateful to Dr Robert T Foley for this information.
[113] Laffin, *Swifter Than Eagles*, p.108.
[114] Wise, *Canadian Airmen*, p.493.
[115] J.F. O'Connell, *The Effectiveness of Airpower in the 20th Century: Part 1 (1914-1939)* (New York, iUniverse Inc, 2007), p.8.
[116] Dye, *Logistics Support*, p.239.
[117] Moore, *See How They Ran*, p.91.
[118] Hooton, *Trenches*, p.211.
[119] TNA WO 158/343 'Report on the Retreat of the Artillery March 1918'.