The Monstrous Anger of the Guns

The Development of British Artillery Tactics
1914 - 1918

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"What passing-bells for those who die as cattle?
Only the monstrous anger of the guns.
Only the stuttering rifles’ rapid rattle
Can pater out their hasty orisons.
No mockeries for them; no prayers nor bells,
    Nor any voice of mourning save the choirs,-
The shrill, demented choirs of wailing shells;
    And bugles calling for them from sad shires."

from Wilfred Owens
"Anthem for Doomed Youth"
This thesis contains no material which has been accepted for any other degree or diploma, and to the best of my knowledge and belief contains no material previously published or written by another person without due reference.

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ABSTRACT

This thesis examines the development of British artillery tactics on the Western Front and how these developments affected the course of the major British offensives. It also examines why these changes and their significance have not had a central part in the post-war historical debate concerning the conduct of Britain's campaigns on the Western Front. It begins with a review of the Royal Artillery's tactical doctrines, weapons and organizational structure at the outbreak of war. During the course of 1915 all of these would be found to be inappropriate for the conditions of the Western Front. During 1916 the first significant steps towards solving these problems were taken. The centralization of artillery command was begun with the appointment of army artillery commanders, and the formation of heavy artillery groups. Tactical innovations such as the creeping barrage were developed and refined. But none of these improvements brought more than partial success. For the Royal Artillery still lacked a large body of effective long-range heavy artillery pieces that could make a preparatory bombardment effective. During 1917 this body of heavy artillery was finally arriving on the battlefields. Correspondingly, debate amongst the high command of the British Army concerning how best to use them intensified. During the course of the year the Royal Artillery attempted three distinctly different types of artillery preparation, with varying degrees of success. The thesis then concludes with an examination of the role of the artillery in the British offensive of 1918. In this campaign the Royal Artillery, now out-gunning their German rivals in sheer numbers and range, and with greater tactical flexibility and more advanced techniques of gunnery than their rivals, proved to be a decisive force in dislodging the German armies from the Hindenburg line.
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INSTITUTIONS

During the writing of this work I made use of a large number of archives and libraries. I wish to record my thanks to the archivists and librarians and to the Institutions for permission to quote from their documents. In a few cases I have been unable to contact or identify copyright holders and for any infringement I offer sincere apologies. To the Public Records Office, the Australian War Memorial, The Royal Artillery Institution, the Liddell Hart Centre for Military Archives, the National Army Museum, the National Library of Scotland and the Barr-Smith Library, and those institutions’ staffs. I hope you future researchers are less demanding and that respective governments are struck by a sudden desire to properly fund your admirable work.
DEDICATION

Private T. McDermott
20849
Died of Wounds
29th April 1916
2nd Bn. Durham Light Infantry
The protracted and bloody siege that was the Western Front was, after mid 1915, an ever escalating gunnery duel. Both the attacking and defensive tactics adopted by the protagonists were based upon the increasing strength of the long-range heavy artillery that the rival industrial complexes were able to provide their armies with. For the post Second World War generation it is easy to forget that aerial bombardment was of no great military significance in the Great War. This meant that the furthest one could really strike at an enemy was only as far as one’s guns could fling a high explosive shell. Thus the huge armies of the post-industrial revolution Europe had to close up to one another, to bring into play their most powerful and destructive weapons, their heavy artillery. The mass production of the machine-gun has often been blamed by historians since 1918 as the cause of the bitter deadlock of the trenches and close-quarters nature of the fighting. The reality is that it was the heavy guns which determined the shape and nature of the Western Front, and were its greatest killers. Even though the British armies on the Western Front launched offensive after offensive from the spring of 1915 to the spring of 1918, it was not the German machine-guns which wreaked the most terrible damage on the attacking divisions, but the German artillery. Almost 60% of all the casualties suffered by the British Forces in France and Flanders were inflicted by shell fire\(^1\) The great field fortress the Germans dug from Switzerland to the sea was built to protect their defensive armies from the fury of the Allied guns and positioned to enhance the fire of their own defensive batteries and leave the Allied gunners at the maximum disadvantage. To attack these field positions the Royal Artillery was utterly transformed from a force of less than one hundred thousand men, manning one and a half thousand guns, to a force of half a million men controlling a battering train of six thousand guns. Not only did the regiment grow six-fold but it also underwent a transformation of organization and tactical philosophy.

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The story of this transformation, one that had a crucial role in determining the success of various offensives launched by the British Army on the Western Front, has, despite the multitude of volumes written, been largely ignored in the post-1918 debate concerning Britain's part in the Western Front. Part of the reason for this was that many of the changes involved in this transformation were of a complex technical nature, not understood outside the ranks of the gunners. A second reason, and one that Sir James Edmonds the Official Historian has given for including so little in his work concerning the artillery was that artillerymen, absorbed in the calculations and paperwork their task involved, did not leave the great body of war diaries and official accounts that the infantry did. But the third and most crucial reason, and the factor that has distorted our view of the Western Front, was that even before the guns fell silent in 1918's debate about the conduct of the British forces had polarized around one man, Field-Marshal Sir Douglas Haig.

The vast mountain of literature written concerning Britain's Armies on the Western Front, tends to fall into one of two categories. One is hostile to Haig and G.H.Q. The whole Western Front, the trench deadlock, and the vast casualties of Britain's offensives are presented as the result of the mindless conservatism of Haig and his Staff. The reason this costly military fiasco continued so long was only because the French and German military hierarchies were as conservative and callous as Haig. In these accounts there is little need to examine the tactics and techniques of the great bombardments that preceded the British offensives, for they were simply the product of a military command barren in tactical ideas. In the second group, the far smaller number of writers who have attempted to defend Haig and the Staff from this barrage of criticism, the account of artillery development is equally inadequate. In their attempt to portray the British tactics as a successful policy of attrition, the massed guns are reduced to a blunt instrument with which Haig pummelled his unfortunate enemy. To examine in some detail these rival schools of thought, it is best to begin with those who believe, like Churchill, that "all of the great allied offensives of 1915,
1916 and 1917... [were] *needless and wrongly conceived operations of infinite cost*", for these are still in the great majority.

The belief that there was something terribly wrong about the way Haig and the General Staff conducted their offensive operations on the Western Front is one that began during the war itself, particularly 1917, and arose from arguments over tactics between the military and members of the government, and has been much elaborated on and developed since. The view of these critics of the G.H.Q. Staff is well summarised in J.F.C. Fuller’s introduction to Leon Wolff’s "In Flanders Fields"². The thesis rests on a judgement of Haig’s character. Fuller begins by claiming that the years prior to war had seen a technological revolution in firearms which had "rendered the defence stronger than the attack", in particular, the invention of rapid fire machine-guns which had "begot the rifle pit and the trench", and made the rifle bullet the "lord of the battlefield". This important technological advance had passed unnoticed by the G.H.Q. and Haig, for "all this was miles beyond Haig’s mental horizon". "In character he was stubborn and intolerant, in speech inarticulate, in argument dumb"; Haig was a cavalry man when the time for cavalry was past; "he was so unimaginative that he could not see the tactics of the past were as dead as mutton". As a result, the attacks of the British Army under Haig, the Somme, Arras, Passchendaele, were simply "slaughterhouses" where "massed infantry assaults followed by massed cavalry pursuits had floundered in the slough created by his massed artillery bombardments". Having shown how inadequate British strategy was under Haig as commander, Fuller must now explain how only twelve months after the blood-bath of Passchendaele, the British Army would be marching across the Rhine into Germany. Fuller explains that providence had granted the British Army a war-winning weapon, the tank and, in spite of Haig’s opposition, it was finally used in the correct way at Cambrai on November 20th 1917.

"There was no preparatory bombardment; instead 376 tanks led the infantry assault over unbroken ground and through the toughest trench system in France at negligible cost. ... Although lack of reserves led to failure, the battle proved to all who could see that the stalemate was not an insoluble problem, and the answer to the bullet was a sheet of half-inch armour-plate - the solution was as simple as that!" \(^3\)

This solution was finally used at Amiens on 8th August 1918 when the British tank force defeated the Germans, marking the "strategical end of the war"; the rest was "minor tactics". \(^4\)

This critical account of the Staff's tactics, the terrible futility and slaughter of the Somme and Passchendaele, the indignation over Haig's aloof insensitivity and the sudden change in fortunes created by the fortuitous arrival of the tanks, has been echoed by many writers.

Not surprisingly, the explanations which sought to blame Haig and the G.H.Q. Staff for the failures of 1916 and 1917 and deny them any credit for the victory of 1918 were first promoted by the men who had clashed with the military during the war, Lloyd George and Churchill. The animosity that had developed between Lloyd George and Haig during the war is clearly revealed in the Prime Minister's War Memoirs\(^5\) which savages Haig for the casualties sustained on the Somme and in Flanders. Churchill also contributed to this tirade against the "brass-hats" in his work The World Crisis.\(^6\) In it, summarising the view of the Staff critics, he writes:

"Accusing as I do without exception all of the great allied offensives of 1915, 1916 and 1917 as needless and wrongly conceived operations of infinite cost, I am bound to reply to the question, 'What else could be done?' and I answer it, pointing to the battle of Cambrai, 'This could have been done, this in many variants, this in larger and better forms.'\(^7\)

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7 Ibid. Introduction, p.ix.
There was another source which seemed powerfully to support the view that British attacks had been "needless and wrongly conceived". That is the writings of the war poets, together with the multitude of private soldiers' accounts of their war experience that were published during the twenties and thirties. R.C. Sherriff and Vernon Bartlett's Journey's End, which was first a hit play before being published as a best-selling novel in 1930, was typical of these, focussing on the anguish of the young officers in the face of the incompetence and indifference of the Generals.

"What could leisured but fussy old gentlemen in some Chateau miles behind the trenches realise of the agony of mind of some poor devil who had to make a raid through the gap in the barbed wire, upon which, as he knew, the Germans had trained a dozen machine-guns. They weren't fighting the same war, the infantry and these old, porly Generals."  

The war memoirs of Graves, Goodbye To All That, Sassoon's Memoirs of an Infantry Officer, Morris Bretherton's Khaki or Field Grey, the poems of A.A. Milne, Wilfred Owen, Isaac Rosenberg and many others all served to amplify the impression of a war tragically mishandled by the senior officers.

"Good morning, good morning", the General said When we met him last week on the way to the line. Now the soldiers he smiled at are most of 'em dead And we're cursing his staff for incompetent swine. "He's a cheery old card", grunted Harry to Jack, As they slogged up to Arras with rifle and pack,  

... But he did for them both by his plan of attack. 

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8 R.C. Sherriff and V. Bartlett, Journeys End. (London: Corgi, 1969) The original play ran for 594 performances at the Savoy Theatre, and the novel which followed was a best-seller for several years in the late twenties. It has been used as the basis for a number of films since. P. Fussell on p.33 of The Great War and Modern Memory, (London: Oxford University Press 1975) notes that it was possibly the single most influential work in defining the British view of the Western Front.  
9 Sherriff and Bartlett, op.cit., p. 172.  
This view of Britain’s role in the war, supported as it was by eminent figures like Lloyd George and Churchill and the embittered survivors of the "Lost Generation", created a lasting and considerable following amongst historians. The most influential figures in this school of thought have been Liddell Hart and J.F.C. Fuller. Both men served in the war, Fuller being a Major in the Tank Corps and Liddell Hart an Infantry Captain. While it was Fuller who had specialised knowledge of the tank battles that were the key to their interpretation of the war, it was Liddell Hart’s books that served to define their view of the conflict. In 1928 Liddell Hart brought out his extremely controversial Reputations Ten Years After. This was closely followed by The Real War in 1930 and then The War in Outline in 1936 and Through the Fog of War in 1938 followed by A History of the World War 1914-1918 which was, in fact, an enormously expanded version of The Real War. In all of these books Liddell Hart pursued and expanded his account of a war ineptly fought by the British Staff, and in which Britain’s armies on the Western Front were saved from disaster only by the arrival of tanks. Liddell Hart’s influence on British perceptions of the war was extremely widespread; not only were his books popular, he also served as Lloyd George’s advisor on military matters when the Welshman came to write his own memoirs, was military correspondent to The Daily Telegraph and The Times, and found time to write the articles concerning Britain’s conduct of the war for the Encyclopaedia Britannica. While Liddell Hart published voluminously, Fuller remained in the army for some years after the war. But, still frustrated at what he saw as the military’s continued indifference to armoured warfare, he left in 1933 to join Liddell Hart as a full-time writer. The result was a stream of works attacking Haig and what Fuller called the "cavalry clique". The most sensational of these was Fuller’s 1936 Memoirs of an Unconventional Soldier, but probably the clearest

11 B. Liddell Hart, Reputations Ten Years After (London: Murray, 1928).
14 B. Liddell Hart, Through the Fog of War (London: Faber, 1938).
exposition of Fuller’s tank thesis is found in his multi-volume The Conduct of War 1789-1961.17

Thus the British analysis of their offensives on the Western Front became inexorably bound up in the arguments concerning the direction the British Army was to take in the inter-war years, between the advocates of mechanised tank warfare and more conservative tactical theorists. Both Liddell Hart and Fuller wished to draw a distinction between the cavalry-based tactical doctrine that the British had pursued under Haig and which led to the futile blood-baths of the Somme and Flanders, and the modern tank-based tactics reluctantly pursued by Haig in 1918 which brought quick and cheap victory.

The British Army’s experience of the second world war seemed to vindicate everything Lloyd George, Churchill, Liddell Hart and Fuller had claimed about the first. The war was extremely mobile, ranging over countries and continents and, from the German Blitzkrieg to the Normandy break-out, it seemed the tank was indeed the master of the battlefield. Because of this, the views of the Staff critics have gained even wider acceptance since 1945. It is not surprising that A.J.P. Taylor echoes the criticism of Haig and analysis of the war expounded by Lloyd George and Churchill.18 Like theirs, Taylor’s assault on the policies of G.H.Q. is two pronged. His first assertion is that the Western Front was a bad place to launch any attacks at all and somewhere down around the Mediterranean would have produced more profitable results. He advocates what, during the war itself, was called the "eastern" view. The second prong of Taylor’s attack on G.H.Q. is that, even if one granted that there was some merit to attacking on the Western Front, Haig and the Staff pursued the wrong tactics (namely cavalry rather than mechanised), and thus completely bungled their assaults and slaughtered their own men.

In accordance with these views, Taylor argues that victory was not, in fact, a product of the Allied advance of 1918 in France but of Allenby’s successful destruction of the Turkish Army at Megiddo and subsequent occupation of Damascus. Supporting his eastern views, Taylor’s account of the fighting in the west is much like Liddell Hart’s and Fuller’s. In British offensives, claims Taylor:

Masses of men were flung against each other after a preliminary bombardment, and the cavalry waited for the breakthrough which never came.

The only success the British had, late in 1918, was created by ”tanks used in mass formation” and tanks were ”the most remarkable innovation” used in the war.

There have been many post Second World War critics of Haig and the Staff who have addressed themselves to analysing Britain’s offensives in the Great War - too many to examine in detail. Broadly, these works tend to fall into two groups; what we might call ”war history from below", the private soldiers’ experience of the offensives, and more conventional armchair strategy. Writers in the first group have attempted to provide first hand accounts of what it was like to be involved in the futile assault, the masses of men, and mass bombardments. Obviously, the private soldiers knew little or nothing of the general strategies of the British Army, but the writers who draw on their harrowing experiences do not hesitate to extrapolate from their sufferings a contemptuous view of the British Staff and Haig in particular. Without offering any alternatives that the Staff might have followed, they concentrate on the comfort and unreality of the Staff chateaux as contrasted with the horror and sacrifice of the trenches. The most comprehensive of these experiential accounts of the offensives are Lyn MacDonald’s Somme and They Called it Passchendaele.

While MacDonald and others tackled the experience of the mass battles of 1916 and 1917, other writers expanded Liddell Hart's claims concerning the crucial role of the tanks in the later stages of the war. Examples of this type include Douglas Orgill's The Tank,\(^{24}\) and Cooper's The Ironclads of Cambrai\(^{25}\) and Tank Battles of World War One.\(^{26}\) In the latter, published 54 years after Liddell Hart's The Real War, we find the same thesis being repeated. Because of the machine-gun, "defence was always stronger than attack"\(^{27}\) but the British Staff did not realise this because the British Generals "still pinned their faith on the cavalry and dreamed of a great sabre-drawn charge through the German lines"\(^{28}\). The result was that the British commanders fought a "reckless war of attrition"\(^{29}\) in which "hundreds and thousands of unprotected troops were mown down in... suicidal attacks"\(^{30}\). This calamity continued until "something could be found to change the pattern. And that something was the tank"\(^{31}\). The tanks duly arrived in the face of opposition from the hidebound Staff and, at Amiens, promptly won the war, Cooper claiming that it was the advance on 8th August, which was "due... to the... contribution made by the tanks" that "proved to the German supreme command that they could not win the war."\(^{32}\)

While Orgill and Cooper explain to us the intricacies of tank tactics, other writers have turned their attention to explaining why Haig had so set himself against change and was so enamoured of cavalry that he was willing to absorb hundreds of thousands of casualties in pursuit of his cavalry dreams. The most recent and detailed of these studies of Haig is the work of Tim Travers in his article, "The offensive and the problem of innovation in the
British military, 1870-1915" and his book The Killing Ground. Travers’ picture of Haig as a dour egomaniac is very much in line with Fuller’s description of a "stubborn and intolerant" man driven by the desire for fame. Travers’ picture of an army fighting with out-dated tactics, and led by a man filled by a notion of his own historical destiny, is contrasted with his portrait of the professional efficiency of the German command. In fact the contrast between German efficiency and British mismanagement is so complete that Travers is forced to make extraordinary claims concerning the end of the war. Travers argues that, even given the advent of the tank, the British military effort was so misdirected that it was only a surfeit of success that brought the Germans to the negotiating table. Travers explains thus:

"initially successful, the German attacks of 21st of March 1918 and those of succeeding months actually led to such difficulties in the German army that an armistice was eventually requested".

Nor is Travers alone in maintaining this apparently implausible position. Paul Fussell, in his work The Great War and Modern Memory agrees with Liddell Hart and Fuller that:

"since the first use of tanks in the autumn of 1916, it had been clear that given sufficient numbers, here was a way of overcoming the gross superiority provided an entrenched enemy by the machine gun".

But Fussell goes on to deny the British Army any credit for winning the war and concludes, like Travers, that "the German army had destroyed itself by attacking successfully."

There is one last group of writers that need to be examined, for they have provided the followers of Liddell Hart and Fuller with much ammunition over the years, and that is the Germans. In the dying days of the war, when the full extent of Germany’s calamitous

36 Fussell, op.cit., p.16.
37 Ibid. p.18.
situation was revealed to an angry Reichstag, von dem Busche, the military spokesman, was called upon to explain how the mighty German Army found itself in such dire straits. Von dem Busche explained that in the last months "the British made use of tanks in unexpectedly large numbers... and solely owing to the success of the tanks we suffered enormous losses in prisoners". Many German historians, particularly those writing during the Nazis’ period in power, harp upon this point. In fact, it became a plank in the Nazis’ claim that Germany had never been truly defeated in the war and that the Allies had won by mere good fortune. These claims have often been used by followers of Liddell Hart and Fuller to support their contention that Haig was an incompetent butcher and that the tanks had brought victory. This thesis has also been taken up by French historians, most notably Marc Ferro, co-director of the influential Annales, who wrote in his single volume history of the war that the Allies "owed victory" to the tanks, later referring to them simply as "the tanks of victory".

The central thrust of all these writers is that the entire military effort of the British Army in the Great War was misdirected, and that the blame for this rests with the Staff Officers who conducted the campaigns, Haig in particular. The evidence for this is to be found in the Somme offensive of 1916 and the Flanders offensive of 1917, which explains why so many of the books by these authors concentrate on these two campaigns. Indeed, 1918 provides these historians with something of a difficulty for, having proved that the British Army was being led by a butcher who stupidly martyred his men in great numbers, they must provide us with some explanation of how the war was won. As I have suggested, the most popular of explanations has been the tank, though other explanations, such as those of Taylor (Damascus) and Travers (German surfeit of success) have been offered. All agree, however, that victory was not won on the field of battle by the British armies fighting on the Western Front.

This general view prevails in many modern histories of the war. We find Leon Wolff describing Haig to us, in his book on Passchendaele, as "a stubborn, fame-hungry, cold-blooded, deceiving oaf" and his campaign a "military abortion unparalleled in the history of the Western world."40 The Who's Who of Military History presents Haig as "irredeemably typecast as a flint-hearted butcher of his own men"41. This condemnation of Haig, together with the ascription of crucial importance to the tanks, is sufficiently prevalent to be described as the orthodoxy.

One would suppose, given the prevalence of this account, that the Staff had never made an attempt to save their reputations or to deny the claim that only the fortuitous arrival of the tanks saved Britain from defeat. But in fact, in the course of the twenties and thirties, the case for the Staff against their critics was developed and finally appeared in the voluminous account of the Official History.42 This, together with the works of a number of influential Staff Officers (such as Charteris43, Haig's intelligence chief and Robertson44, at one time C.I.G.S.) and Haig's own published papers45, constitute the case for the Staff defence. Not surprisingly, they provide us with an entirely different account of the war and how Britain emerged triumphant from it. Some junior officers, who had served on Haig's Staff, also went into print in defence of the Staff, notably Dewer and Boraston in Haig's Command, and in Boraston's edition of Haig's Dispatches46. Nor was it only soldiers who came to the defence of Haig and the Staff - Sir Arthur Conan Doyle's many-volumed The

40 L. Wolff, ibid., p.314.
44 W. Robertson, Soldiers and Statesmen (London: Cassell, 1926).
British Campaign in France and Flanders\textsuperscript{47} presented a very different account of the war to that found in Liddell Hart and Fuller.

While Haig never wrote an official memoir of his command on the Western Front, his wartime papers and his private influence on the official historian and other Staff writers after the war, ensured that his defence of his own actions was widely published. The way Haig wished the British efforts on the Western Front to be remembered is encapsulated in his last dispatch, written with a view to history and in order to explain the sudden German collapse of the summer of 1918, and the conduct of the campaign of the previous years. The victorious advance of 1918 was the \textit{dramatic end [of] the great wearing out battle of the past four years"}, the victory a product of \textit{"the long years of patient and heroic struggle by which the strength and spirit of the enemy were gradually broken down"}.\textsuperscript{48}

In Haig’s account, the Somme and Passchendaele were not tactically inept disasters but an inevitable part of the "wearing out fight", that is, the battles of attrition. However bloody and awful they were, they were a product of a conscious and considered policy of hammering at the German Army until, in 1918, German resources and mental endurance could sustain the pressure no longer and collapsed. The tactics the British employed in these great hammer blows, the mass bombardments and massed infantry derided by the Staff’s critics, were simply the response to a war of vast armies and mass industrial production of munitions.

This interpretation of the Western Front offensives by the British has been taken up by many writers since Haig penned his last dispatch. Most notable of these was Sir James Edmonds, the compiler of the official history. While Edmonds is critical of particular

decisions Haig made during his command, he agreed with the general thesis that the battles of 1916 and 1917 must be seen as necessary attrition battles that wore down German morale and resources, and the victory of 1918 was a direct consequence of them. This is why so much of the volumes concerning the Somme and Passchendaele is concerned with counting the respective casualties of the rival armies. This argument is also pursued by Duff Cooper in his biography of Haig and by John Terraine in his many works on the Western Front battles. They present a picture of Haig, not as a tactical genius, but as a General with an unpleasant and unavoidable task to endure. In the end it was a triumph of the will-to-win by Haig and his troops that first beat down, then crushed, the German Army.

There are great flaws in both of the schools of thought I have crudely outlined. There is much about the British offensives on the Western Front that cannot be reconciled with these accounts and the discussion has not been about what happened but about the correct analysis or judgement about what happened. For the reader of Liddell Hart and Fuller, it is rather disquieting to discover that during the crucial campaign of 1918, the British tank force was virtually destroyed in its attack on the 8th of August, the battle of Amiens. When one then discovers that the remaining battles of the 1918 offensive, which Fuller dismisses as "minor tactics", actually involved massive attacks on the main German defenses, the Canal Nord, and the Siegfried line, and that these succeeded without the aid of massed tanks, his claims concerning the significance of the tanks begins to seem rather overstated. Taylor's claims that the fall of Damascus caused the German surrender is refuted by even the briefest examination of German military documents, for it is evident that the leaders of Germany and her Army regarded the Middle East as a sideshow - their decision to

49 Edmonds, Military Operations in France and Flanders 1917 Vol. II. See the introduction (pp.xi-xviii) and the retrospect (pp.366-87) for Edmonds' most vigorous defence of Haig, and his calculations of the "attrition" or wearing down effect of the Flanders Campaign.
51 J. Terraine, Douglas Haig: the Educated Soldier (London: Hutchinson, 1963). This is perhaps Terraine's most vigorous and direct defence of Haig, but others of his many works have the same theme, such as, The Road to Passchendaele (London: Hutchinson, 1977).
surrender was clearly caused by the spectacle of the British Army smashing through their defences and the complete collapse of their military position on the Western Front.

If one turns from the Staff critics and, instead, takes up Haig’s account of the Western Front fight, it too appears unsatisfactory in its explanation of what happened in the great offensives. If Haig, the official historian, and the other defenders of the Staff are correct, and the Somme and Passchendaele are to be regarded as great "wearing out" battles, why was it then that Haig insisted on an attack on such vast, extended frontages on both 1st July 1916 and 31st July 1917, the opening days of the two campaigns? Why, when these attacks failed with appalling losses, did he throw division after division at unsubdued strong points like Thiepval and the Gheluvelt Plateau, in murderous piecemeal assaults against greatly superior forces? An examination of either attack’s planning immediately reveals why. These were not conscious and considered attempts at attrition, they were unsuccessful attempts to break through the German line and win the war in a single blow.

There is no doubt that the great battles of 1916 and 1917, the Somme, Arras, Passchendaele, inflicted vast casualties on the German Imperial Army and that they seriously weakened Germany’s ability to continue the war. In fact, one can argue that even if the Staff critics are correct and the British did indeed lose more men than the Germans in these huge battles, they may still have been victories of attrition in that Germany could not afford to lose the casualties she did, even though Britain’s were greater. But this does not help the historian attempting to understand what happened on the battle fields of the Western Front. Haig planned for the British Army to be in Bapaume, some eight miles behind the German lines, within a week of the start of the attack on the Somme. Having sliced through the German defences and leaving the trenches far behind, the British were to round up the German armies using cavalry in a vast encircling manoeuvre. Passchendaele also had grandiose objectives, nothing less than detaching the German defences from the Belgium
coast and de-stabilizing the entire northern flank of the German line. It was the lure of these great strategic advances that drew Haig on to commit vast numbers of men and to extend operations well into the winter, when fighting became almost impossible. Having failed to achieve the strategic goals, Haig was forced to turn to the casualties the attacks inflicted on the Germans to justify them to his critics. It was rationalization after the event.

Both the Haig-inspired and the Lloyd George-inspired accounts of the British offensives contain a glaring omission. This is the guns. In Haig’s account, the artillery are merely the weapons of attrition, the hammer with which he beat the Germans relentlessly for three years until they crumbled. According to Lloyd George, the massed artillery used on the Western Front by the British were just another of his pointless devices which led to the even greater destructiveness and futility of the battles, churning the ground to mud and making it impossible to get men or tanks across it. What they fail to note is that the changing power and tactical approach by the British artillery shaped the success and failure of the British offensives on the Somme, in Flanders, and throughout 1918. It is changes in artillery tactics that account for the fluctuating fortunes of various British assaults. It is only through understanding the widely divergent views on artillery doctrine that we can understand why, for example, Plumer’s Second Army could storm the fortress of Messines on the 4th of July 1917, with few casualties and horrendous losses on the German side, yet only six weeks later Gough’s Fifth Army would be repulsed from Pilckem Ridge in a bloody fiasco. The reason that these arguments concerning artillery practice have not received prominence before is that the men who were present in the Staff conferences and who argued vehemently with Haig over artillery doctrine did not, once the war was over, wish to provide the army’s critics with further ammunition to fire at Haig. The most crucial of these was Noel Birch, who rose during the war from a divisional C.R.A. to Major General Royal Artillery, Commander of all artillery. Birch was centrally involved in the planning of all the major offensives launched by the British Army on the Western Front.
By the latter part of 1917 Birch's artillerymen would constitute almost 50% of the personnel in the armies undertaking the great British offensives. He had personally supervised the transformation of the British artillery from a light mobile field force to a predominantly heavy artillery force capable of destruction on an almost unimaginable scale. Yet Birch published nothing of this remarkable story. He died in his London home in 1939 having revealed little of the momentous events in which he had played such a central role. One can only speculate on the reasons for Birch's silence, but perhaps a hint can be found in his correspondence with Edmonds during the thirties when the official history was being drawn up. The story Birch would have had to tell would have contained much that was critical of his Commander-in-Chief and friend, Douglas Haig. It is clear that Haig never understood the significance or nature of the artillery conflict in the great battles of the Western Front, and on a number of critical occasions, ignored or over-rode the directions of Birch, with disastrous consequences. When writing to Edmonds about one such occasion when, before the Somme offensive, Birch tried to convince Haig that it was impossible for the under-powered British to destroy fifteen miles of highly developed German fortifications, Birch asked Edmonds to substitute for the sentence that read "the warning had no effect" one that read "he [Haig] thought otherwise". Birch wished Edmonds to pass over the artillery issue altogether and focus on how Haig was forced to attack by "persistent pressure from Joffre". Birch gave, as his reason for requesting these changes, the wish to avoid providing ammunition for the "vile attacks that have been made on Haig and his subordinates by people like Lloyd George, who only once sat in a trench which was, I think, ten miles from the front line", and the hope that "the world can see how disgracefully the British army at that time, and its leaders, have been treated."52 Edmonds followed Birch's advice, and thus the analysis of the Somme's preparation contains little information on the arguments between

52 Correspondance of Birch to Edmonds, 29 June 1938, Cab 45/132.
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Perhaps it is for similar reasons that no Official History of the Royal Artillery in the Great War was never published. While the role of the Royal Flying Corps (or Royal Air Force as it became) had a multi-volume official account devoted to it and the naval conflict was deemed worthy of an equally lengthy examination and even such subjects as transportation on the Western Front had an official volume, the artillery was ignored. Thus the trials, tribulations and eventual triumph of the Royal Regiment of Artillery on the Western Front has been largely unremembered or forgotten.

2 L. Wolff, In Flanders Fields (London: Penguin, 1979)
CHAPTER ONE

The Contemptible Little Army

"In every respect the Expeditionary Force of 1914 was incomparably the best trained, best organized and best equipped British army which ever went forth to war."

Official history 1914 Vol. 1 p. 101

"In heavy guns and Howitzers, high explosive shell, trench mortars, hand-grenades, and much of the subsidiary material required for siege and trench warfare, it was almost wholly deficient."

Official history 1914 Vol. 1 p. 112
The two statements by Edmonds, that the B.E.F. of 1914 was both the "best equipped British Army that ever went forth to war", and that it was "almost wholly deficient" in the weapons it would most require in its four year struggle on the Western Front, are not irreconcilable. The reality is that Britain had not launched an army into a major European continent conflict for 99 years, and there is no doubt that Sir John French's expeditionary force was a substantially more powerful army than the Duke of Wellington's Army, or the expeditionary forces sent to Crimea or South Africa. The B.E.F. of 1914 were not, however, going to fight the armies of Napoleon, but those of the extremely well equipped German Imperial Army of 1914, so Edmonds' comparison is rather fatuous. The truth of Edmonds' second point was to become brutally clear to all in the B.E.F. in the skirmishes of 1914 and the first British offensives in 1915. It became obvious that fighting on the Western Front did not resemble in the slightest the highly mobile, cavalry-led battles that the B.E.F. had prepared for prior to 1914. For the infantry this meant the adoption of tactics they had never prepared for, as well as techniques of entrenching, raiding, long-range marksmanship, and so on. For the Royal Artillery, this meant not only radical changes in their tactical approach, but also a complete revision of their munitions, for they found themselves with entirely the wrong sort of guns, ammunition and techniques required for the tasks presented to them. The story of 1914 and 1915 for the Royal Artillery was of a gradual realisation that extensive training and tactics developed prior to the war were, in fact, near to useless, and of a struggle to adapt a light and rapid-firing mobile artillery force to the task of dislodging an entrenched enemy in a siege-like battle.

The small regular army of Britain, in its training camps and field manoeuvres prior to war, had practised for a continental war of rapid and sweeping manœuvre, where cavalry would provide a highly mobile attacking force. Mobility, speed and surprise were regarded as crucial factors in determining both the command structure and tactical doctrine of the army. The war, they imagined, would be like the Franco-Prussian conflict of 1870. In light of the four years of siege warfare in which advances of a few kilometres were a major
accomplishment and in which cavalry played no significant part in years of bitter battles, the pre-war training looks inappropriate. What is not often pointed out by those authors critical of the Staff, however, is that the Staffs of Britain’s major ally, France, and her major enemy, Germany, were under similar delusions.3

It is possible for the modern historian to look back, as John Terraine has done in White Heat4, and see precursors to the Western Front trench deadlock in the Crimean War and American Civil War, and suggest how industrialisation and mass populations made such a deadlock possible. But before the event, the Staffs of the major combatants in the war never contemplated such a possibility. The Staffs of Germany and France, as well as Britain, had drawn from their analysis of wars like the Franco-Prussian conflict of 1870 exactly the opposite conclusions. The fire-power of modern small arms, of the new breech-loading rapid-fire artillery, convinced the various European military establishments that battles would be bloody but brief, because of the sheer killing power of the modern weapons.

Two crucial factors had been overlooked by the General Staffs. The first was that those same modern weapons had rendered useless the only rapidly mobile battlefield force the Generals had at their disposal, the cavalry. The sheer size of a body of horse-men made them an unmistakable and almost certain target on battlefields covered by machine-guns and rapid-fire artillery pieces. The second factor, and one that was a consequence of the first, was that as the absence of the cavalry made a swift and decisive victory impossible, the rival powers were able to mobilise conscript armies of unprecedented scale.

The role of the artillery, in the pre-war conception of battle, was clearly outlined in the field-service regulations and reinforced during training manoeuvres which, in the artillery, were conducted every summer and had just finished when mobilization was called.5 The Staff considered the artillery had three tasks of varying importance for which it had to prepare. The primary task was the support of the infantry and cavalry in attack.
For various reasons, Staffs of the German, French and British armies had all concluded, from their assessment of recent wars and their studies of the battles of the great Napoleon, that attack was far preferable to defence and far less likely to incur heavy casualties. While the British tactical approach never became as blindly offensive as that of the French, attack was still considered the most important element in training and preparation. In attack, the role of the artillery was to provide close-range fire as the infantry and cavalry drove forward. In the event that the enemy got their attack launched first, the artillery’s second role was to act as a shield for the infantry, throwing up a curtain of fire while the British forces prepared their attack. The third, and distinctly less glamorous task, was the shelling of fixed positions, forts, and entrenched enemy defences.

To accomplish these tasks the Royal Regiment of Artillery was divided into three sections, the Royal Horse Artillery, the Royal Field Artillery and the Royal Garrison Artillery. The Horse and Field artillery provided the battlefield support. Their guns were light and designed for speed of movement and rapidity of fire. The Garrison artillery, who were armed with heavier calibre guns, manned the coastal forts that defended crucial ports and, of course, had more interest in weight of shell and accuracy, their guns being in fixed emplacements. The garrison artillery also manned the few heavy batteries the British had in their field army.

The guns and munitions the Royal Artillery took to war in August reflected the General Staff view of the nature of the forthcoming European war. Not surprisingly, the best and most modern weapons were those of the Royal Horse and Field Artilleries. The majority of these batteries were armed with the 18-pdr. Q.F. (quick-fire) gun, Mark 1. The 18-pdr. Mark 1 was the ideal weapon for the sort of war the Staff envisaged the artillery would be involved in. It was light, manoeuvrable and could, if handled well, fire twenty rounds a minute and had a range of 6,500 yards. The field artillery were also armed with howitzers, the 4.5-inch Q.F. Mark 1. This too was a light weapon with a range of 6,500 yards, designed for close in-fighting. Each division was also allotted a battery of the 60-
10,300 yards. Some units of the Garrison Artillery were armed with the even more antiquated 6-inch B.L. howitzer with a range of only 5,200 yards.7

In sheer numbers, the Royal Artillery was a tiny force compared with the vast artillery mobilized by both France and Germany. At the moment of mobilization the German Government was able to put into the field 87 well trained divisions, the French 62, Britain only 6, the same number as Belgium. The 6 regular army divisions had approximately 45,000 men, and the Royal Artillery force had 492 guns and a small stockpile of ammunition to support them.

<table>
<thead>
<tr>
<th>No. of guns</th>
<th>Ammunition Stockpile</th>
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<tbody>
<tr>
<td>Type of Gun</td>
<td>No. of Batteries</td>
</tr>
<tr>
<td>18-pdr.</td>
<td>54</td>
</tr>
<tr>
<td>13-pdr.</td>
<td>6</td>
</tr>
<tr>
<td>4.5-inch</td>
<td>18</td>
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<tr>
<td>60-pdr.</td>
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The field artillery batteries’ 18-pdrs., the real fighting force of the artillery, were armed exclusively with shrapnel. This was because the artillery’s primary task was killing enemy infantry and for that shrapnel was the most effective weapon. Shrapnel is, of course, useless if it merely plunges into the ground and explodes: it has to be fused such that the shell explodes just before arriving at the target, spraying it with the metal pellets in the shell case. In 1914 the only way to do this was by hand, a great deal of experience and skill being required to adjust the fuse to the correct timing of burst.

Firing shrapnel into the enemy ranks as the infantry and cavalry attacked was the primary task for which the gunners trained and practised. The procedure was outlined in the training manual. It was assumed that on arriving on the battlefield the rival forces would be out in the open, the enemy infantry and artillery units clearly visible to the gunners. The British guns would also be in exposed positions with perhaps sandbags or a shallow gun-pit
for protection. From here the guns could spray the enemy infantry and gun-positions with shrapnel, the fire being coordinated by the various battery commanders who occupied observation positions forward of the guns. These O.P.s could not be too far forward of the guns as the battery commander had to communicate the corrections of range by voice. Experiments had been tried using a telephone line from the O.P. to the guns, thus allowing the guns to be sited further back, but the unreliability of the telephones meant that control by unaided voice was regarded as more effective. When a battery commander identified a target he would first bracket it, that is, use two guns to establish its range. After the two guns’ fire had been progressively corrected until they were spraying the target, the rest of the battery’s guns would join in, using the settings on the sights of the first two guns to establish the range. In the last stages of attack the batteries were to close up to the enemy to the point where ranging was unnecessary when they would fire over open sights (i.e. aiming down the barrel as if one were firing a huge rifle). This was what the artillery had been thoroughly trained to do.²

The command structure of the R.A. reflected the nature of the tasks the Staff believed it would have to perform. The field artillery (consisting of the R.F.A. and R.H.A.) was controlled from the divisional level, low down the chain of command. The division was the primary attacking unit of the army and, as the field artillery were an infantry support weapon, its control was best achieved at lower levels of infantry command. There was, it was believed, no need for a super-structure of officers above the divisional level, because it was thought the gunners would never have tactical considerations that were independent of the divisions they supported. The effective controllers of the artillery were the Commanders Royal Artillery (C.R.A.), the senior officers at divisional artillery H.Q. The C.R.A. had as his assistant a Brigadier-Major (B.M.R.A.). Above the C.R.A.s there were Brigadier-Generals R.A., but these merely acted as advisers to Corps Commanders and held no effective power. Above the Corps Artillery advisers there was Major-General T.P. Du Cane, artillery c to G.H.Q.. Du Cane, like the Corps advisers, was not a commander,
and while he could proffer ideas to C.R.A.s, they received their orders from the Major-
General commanding the division to which they were attached.

As has been mentioned before, the British Staff were not alone in their belief that a
great continental war would be brief and mobile. This view was shared in varying degrees
by the Staffs of both France and Germany. Of the two, France’s Staff were the more
extreme in the advocacy of light, mobile forces, particularly a school of military
theoreticians led by Colonel de Grandmaison, whose catch-cry of “offensive à l’outrance”
came to symbolise the philosophies of the school. Like the British artillery, the French guns
reflected this presumption that artillery forces would need to be light, mobile, quick-firing
infantry support weapons. The result was the almost complete concentration of effort by the
French artillery to its production and training on one gun, the 75-mm. Poteaux field gun.
The 75, often called "God the father, God the Son and God the Holy Ghost" by its French
gunners, was indeed the pre-eminent light field gun of the rival armies. An experienced
crew could achieve 25 rounds per minute with the piece, and its light manoeuvrability meant
it could be brought into action extremely rapidly. By the outbreak of war the French Army
had 3,800 of these excellent guns. Unfortunately, the extremist advocates of de
Grandmaison’s views actively opposed any moves to create a force of heavy artillery pieces
to complement their field gun. We know from Joffre’s Memoirs that followers of "offensive
à l’outrance" argued that production of heavy howitzers and long-range heavy guns simply
wasted resources that could be used to build more 75s. It meant that when war broke out,
France had only its ageing 155- and 120-mm. guns, both designed in the 1880s, in its heavy
artillery force of 220 guns.

The German artillery were quite different in both the arsenal of artillery pieces and
the sheer numbers in its artillery force. The German artillery began the war with 848
modern heavy weapons. Many of these were the 150-mm. built by Krupp, regarded by
many as the outstanding artillery piece of the war. The 150-mm. outranged the French
120-mm. and 155-mm., and the British 60-pdrs., and its modern hydraulic recoil meant it
could maintain a high rate of accurate fire for a heavy weapon. But the German heavy artillery was armed not only with the 150-mm.; they had an array of monstrous heavy howitzers and mortars produced in great secrecy in Krupp's workshops. The largest of these were the 420-mm. mortars whose shell weighed over a ton. The Germans also had a 380-mm. gun, a 210-mm. and 130-mm. weapons giving their heavy artillery force great flexibility.\textsuperscript{11} The advantage this gave the German forces at the outbreak of war was not confined to the sheer number of guns. The Germans began the war with a pool of experienced heavy artillery officers, advanced techniques in the specialized area of long-range gunnery, and excellent gun designs. It was only in the area of light field pieces that the French and British out-ranged and out-fired their German counterparts. This is not surprising considering that they had poured almost all of their respective artillery resources into their light guns, the 75-mm. and 18-pdr.

One should not assume, however, that because the Germans entered the war with a comparatively highly developed force of heavy artillery, they anticipated the artillery-dominated trench warfare of 1915 - 1917. Bruchmüller, the outstanding German artillery officer, in his introduction to "Die Deutsche Artillerie in den Durchbruchschlachten des Weltkriegs", describes the rivalry between the heavy (fuss) and light (feld) elements of the artillery.\textsuperscript{12} The reasons why the field guns did not come to dominate the German artillery in tactics and numbers were complex, but two were crucial. The first was that while the German Staff believed that the war would be fast and mobile, their Schlieffen plan required a number of assaults on heavily fortified positions, namely the Belgian forts like those around Liege. There were also a number of border forts in France, like Verdun, that would have to be subdued. It was to destroy these that the huge 420-mm. had been built and the German campaign heavy pieces were to be part of the heavy artillery hammer which was to destroy the defences of Belgium and France.

The other crucial factor in the predominance of heavy guns in the German artillery force was the influence of the armament giant, Krupp of Essen. The influence of Krupp's
management on the military doctrines of the German Staff is hard to quantify, but the company’s leaders were closely interwoven with the Imperial Government. Krupp was, without doubt, the pre-eminent heavy artillery designer and manufacturer in the world. It regarded, as a matter of company prestige, that the largest guns in the world should be Krupp’s and, not surprisingly, the company’s management advocated a tactical approach based on the destructive power of its products.13

The general philosophy adopted by the German Staff was, however, based like that of France and Britain, on the training and preparation for a war of rapid manoeuvre and decision. The influence of Krupp and the need to develop heavy weapons to destroy the Belgium fortress, however, meant that heavy artillery training and development was never ignored in the way it was in the French and British armies.

*   *   *

"There were few, if any, notable developments of artillery tactics during 1914. "14 So wrote General Rawlins, a senior artillery officer and Chief of Staff to Birch, who after the war drew together the various Staff notes on artillery, together with his own personal observations, to produce an account of the Royal Artillery’s tactical development during the war for the benefit of future Royal Artillerymen. There were certainly no developments in offensive artillery tactics, for the B.E.F. fought an extended retreat in 1914 in the face of the overwhelming onslaught of Von Kluck’s army. The retreat of 1914, and the subsequent manoeuvring that foiled the Schlieffen plan and left the Germans entrenched from Switzerland to the sea, did however reveal to the British artillery some of the fatal inadequacies of their tactical approach to battle and the weapons they had to pursue their tactics with.

At Mons and Le Cateau, the two major engagements in the B.E.F.’s retreat, the gunners of the Royal Artillery found that their German counterparts were making good use
of the superior range of their heavy artillery, particularly the 5.9, the British term for the 150-mm. gun. In both of these engagements, British infantry and artillery batteries came under fire from German 5.9-inch batteries that the British artillerymen could not even see. At ranges of 5,000 to 6,000 yards these batteries were not only hidden from the vision of the battery commanders in their O.P.s, but even if they were visible they were well beyond the range of the 18-pdrs. to hit. The accuracy of fire from these long-ranges staggered the officers of the R.A., as revealed in the diary of an artillery officer’s account of the fight at Mons. "W[est] Kents, Middlesex and Northumberlands [were] decimated by shell fire". The only explanation for the accuracy of the German batteries who were at great range and completely invisible to the Royal Artillerymen was, "there is no doubt that it was mainly due to the amazingly efficient Secret Service of the enemy." The accuracy at long range demonstrated by the German artillery at Mons and Le Cateau was not, in fact, the product of a fantastically efficient spy service, but of careful training and consideration of the best use of heavy artillery in the field by the German Fussartillerie school. Bruchmüller, who would during the course of the war rise to become Ludendorff’s artillery c, attributes the great superiority of the German artillery in the techniques of long-range fire using large calibre field guns almost entirely to one man, General Steinmetz, the founder and long-time commander of the school. It was at this school, which concentrated solely on training and techniques of heavy artillery and had no equivalent in either the British or French military structure, that the methods used by the German heavy batteries at Mons and Le Cateau had been developed. The essential problem of long-range fire was, of course, observation. It was simple to site guns back from the battlefield away from the destruction wrought by the enemy’s guns, but how could the deep-set guns fire on the battlefield accurately when they could not see it? The most obvious method, employed by the Germans, was the use of F.O.O.s (forward observation officers) sited in some forward position, a roof-top, tall building, a hill or ridge-top. This observer called his corrections of range back to a battery via a long telephone line. If there was one outstanding observation post, like the spire of Le Cateau Church, observation work would
be coordinated through the one observer calling the range for a number of batteries. To assist the ground observers the Germans produced a technique that caught the British entirely off guard, the use of spotters in the air for long-range guns. German artillerymen were flown over the battlefield of Le Cateau and, after observing a few shots, flew over their batteries dropping messages in bags, or signalling via semaphore to the batteries below. The British did not realise for some time what these German planes, slowly traversing the battlefield, were doing and, when they did realise, they found that with no fighter planes, nor anti-aircraft guns, there was nothing they could do to stop the airborne observers.

What the Germans were employing were techniques of indirect observation as opposed to the direct observation employed by British battery commanders. The Royal Artillery found itself in 1914, lacking not only the heavy guns the Germans were employing to such great effect but also the methods which made the use of the weapons possible.

Steinmetz' Fussartillerie school had not confined its study to the techniques of indirect fire at great range; it had also examined the tactical control of the artillery, and the reforms introduced gave a very different command structure to that employed by either the French gunners or the Royal Artillery. German artillery command was both more centralized and more independent of the infantry. The crucial element in this was that the senior artillery officer at Corps level was a commander, not merely an advisor.

The Corps artillery officers in the German Army held a much tighter control over their forces than the C.R.A.s of British divisions because of the use of centralized observation positions and the inter-connection of battery headquarters by telephone lines. While British batteries were tied to particular battalions, the German divisional artillery commander, or Corps commander, could wield his force as a unit, irrespective of the infantry considerations. This was shown at Montay Spur at Le Cateau, where the guns of many German batteries were combined to crush British resistance, with the heavy, medium
and light guns controlled by the Corps artillery officer, directed by the observation post in
the Church spire, to great effect. Some entire batteries, like the 37th and 52nd, were
destroyed and the Germans captured 40 British artillery pieces.18

The early engagements of the war also revealed to the Royal Artillery that their
almost exclusive use of shrapnel shell was not suitable in dealing with the German Army.
When the German forces were brought under shell fire they, not surprisingly, dug
themselves in. Rather than simply surrounding their guns with sandbags as the British did,
the German batteries not only tended to fire from greater range but dug their guns into "gun
pits" which were reinforced with sandbags and wood. The German infantry, it was rapidly
found, dug trenches when brought under shell fire and once they were in even shallow
protection the shrapnel of the British guns simply whizzed harmlessly overhead. The British
also discovered that German artillery, particularly their heavy guns like the 5.9, used high
explosive shell almost exclusively. A few sandbags or a shallow trench were not protection
from H.E. shells and at Le Cateau and Mons the British artillery and infantry suffered
heavily as a result.

The defensive battles of 1914 and early 1915 revealed that the Royal Artillery had
entered the continental conflict with inadequate resources, and inappropriate training. Even
these first clashes with the Germans showed that the R.A. required effective large-calibre
long-range weapons, high explosive shells, and communications equipment such as
telephones. Brigadier Noel Birch, who in 1914 was a senior C.R.A., recalled the early days
in a letter he wrote to Edmonds, the compiler of the official history, "in truth the problem of
semi-siege warfare and the large concentrations of gun necessary for the work had never
been studied by the General Staff in peace, nor by any of the leading gunners or gunnery
schools."19 There had been no equivalent to the Steinmetz school's careful study of the
power and destructive potential of large-calibre weapons employing H.E. shell. As all of
the major British offensives for the next four years on the Western Front were, in fact,
based on the destructive power of artillery fire, this would prove to be an incredibly costly
Birch recalled that before the war, not all had been so blinded by the vision of rapid cavalry manoeuvre and open field warfare. He recalled visiting the engineers’ headquarters at Chatham and hearing a talk by an officer who had returned from the Russo-Japanese war. The lecture proved to be a prophetic vision of the Western Front, referring to trenches, deep dugouts, the use of barbed wire, and most importantly, the overwhelming power of heavy artillery using H.E. shells.

"If only the teaching of Chatham had been absorbed by the General Staff and they at the same time been understood the gunnery problem that the sapper demonstrated had been absolutely necessary, thousands of lives would have been saved and the war shortened by some years.

Perhaps you think I am overstating the case, but I am perfectly certain I am not."

Birch asked Edmonds not to include this in the official history, or if he did, to have it "much toned down, so as not to bludgeon the General Staff". Perhaps this explains Edmonds’ rather curious analysis of the original B.E.F., as both the best equipped army Britain ever produced, yet lacking the very forces that were to be essential to its future offensive - heavy artillery armed with high explosive shells.

The first British offensive on the Western Front was the battle of Neuve Chapelle, an attack conducted by Douglas Haig’s First Army between the 10th and 12th of March 1915. The problem facing the First Army, and essentially the problem facing the British Army for the next four years, was that of assaulting German forces who had carefully entrenched themselves along a ridge of high ground, allowing their machine-gunners and artillery observers a clear view over the assembly positions and approaches to their position. The desperate actions of the Allied armies on the Marne and Aisne rivers had seen the Schlieffen plan thwarted. Despite their advantages in heavy artillery and despite the years of careful planning that had gone into the great German wheel through Belgium, the task had proved too much for the German field army to accomplish. They had failed to knock France out of the war in a single campaigning season and now faced their worst strategic nightmare which the entire Schlieffen plan had been developed to avoid, namely war on two fronts. They
were forced to abandon their vast offensive in the west and dig in from Switzerland to the sea, to face the inevitable attacks from the French and British armies who closed up on their armies along the entire frontage.

The great advance of 1914, though it failed in its primary objective, had brought the German command one considerable advantage. Having occupied the majority of Belgium and a substantial part of Northern France, the German Staff could choose where they would make their stand, while the Staff pondered how to achieve what the Schlieffen plan had failed to deliver. For the German Staff, the sacrifice of a few hundred yards, even a few miles of occupied territory was immaterial and thus the German line of resistance was sited to give the maximum benefit to the defenders and place the maximum obstacles before the attacker. In this matter, artillery observation was crucial. From a ridge, hilltop, or even slight high ground, a forward observer could survey the British or French forces below him with comparative impunity. His guns, behind him in the valley, were invisible to the enemy observers. Before the German observer would be the infantry trenches and machine-gun nests, dug in to protect them from British and French shell and rifle fire, and before the infantry, bales of barbed wire to impede any sudden infantry attack. It was essentially this combination of problems that presented itself to Douglas Haig's First Army at Neuve Chapelle and would face every British assault until 1918. At Neuve Chapelle Haig proposed to apply to this problem essentially the same tactical principles that had guided Britain's pre-war preparations. While the experiences of the defensive battles of 1914 had revealed that much of that preparation had been inappropriate, and that the R.A. lacked the heavy guns and H.E. shells the Germans had used to such effect at Mons and Le Cateau, evidently Haig still believed that surprise and rapid movement were at the very heart of successful attacks. The experiences of 1914 had served only to change the techniques and methods by which one achieved those goals.

Haig's First Army faced the forces of the German Sixth Army, commanded by Crown Prince Rupprecht of Bavaria. The forces of the German Army were stretched
extremely thin, having to provide both a defensive shield on the West and also provide forces for a counter-offensive against Russia in the east. Facing the entire six corps of the B.E.F. were only three and a half corps of Rupprecht’s Sixth Army. The Sixth Army had, however, chosen their defensive position with care along Aubers Ridge, which ran north-west between the river Lauve and the Haute Devle Canal. At one point, however, the Sixth Army’s defensive line left the ridge top to include the village of Neuve Chapelle, creating a small salient. It was here that the First Army decided to attack, for the village was on the forward slope to the British and its defences were particularly visible to British observers. Because the defences of the village formed a salient protruding into the British position, it was possible to fire from three sides, and employ enfilading fire (ie. down the length of German trenches). What Haig proposed to do was “to surprise the Germans, carry them right off their legs and push forward at once to the Haute Pommereau - Aubers Ridge”.22

Obviously, the extensive barbed wire obstruction before the village and the Germans’ occupation of trenches meant the First Army could not simply march up to the defences, bayonets fixed, and charge them. Haig wished the artillery to remove the wire obstructions, knock down the German trenches and stop any reserves rushing to the village’s aid. Their preparations for these tasks was to be discreet and gradual, so as not to imperil the surprise of the assault. Once the village had been rushed, the cavalry could be pushed through and the forces would employ the tactics of open field warfare again.

The winter months of 1914/15 had seen the Royal Artillery strengthened by the arrival of new guns, produced by the return of batteries from colonial postings and the recommissioning of various older weapons which had been handed down to the territorial divisions by the R.A. and, with the territorials’ arrival in France, brought back into service. There were also a number of improvised pieces, and new weapons barely out of their testing programs but rushed into service in light of the artillery’s obvious lack of heavy weapons. The First Army had as its total artillery resources, 530 guns and howitzers.
Guns and Howitzers

<table>
<thead>
<tr>
<th>Type</th>
<th>No.</th>
<th>H.E.</th>
<th>Shrapnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-pdr.</td>
<td>60</td>
<td>-</td>
<td>36,000</td>
</tr>
<tr>
<td>18-pdr.</td>
<td>324</td>
<td>4,000</td>
<td>128,840</td>
</tr>
<tr>
<td>4.5-how.</td>
<td>54</td>
<td>10,500</td>
<td>1,000</td>
</tr>
<tr>
<td>60-pdr.</td>
<td>12</td>
<td>2,400</td>
<td>3,000</td>
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</table>

These were the standard guns of the British regular divisions. The overwhelming majority of the shell stockpile was shrapnel, even for the heavy gun, the 60-pdr., there were more shrapnel than H.E. shells. But, added to these were the new additions to the R.A.'s arsenal.

<table>
<thead>
<tr>
<th>Type</th>
<th>No.</th>
<th>H.E.</th>
<th>Shrapnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.7-inch</td>
<td>32</td>
<td>3,700</td>
<td>10,300</td>
</tr>
<tr>
<td>6-inch how.</td>
<td>28</td>
<td>6,000</td>
<td>2,000</td>
</tr>
<tr>
<td>6-inch gun</td>
<td>4</td>
<td>500</td>
<td>1,100</td>
</tr>
<tr>
<td>9.2-inch how.</td>
<td>3</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>Pack2.75-inch</td>
<td>12</td>
<td>-</td>
<td>6,000</td>
</tr>
<tr>
<td>15-inch how.</td>
<td>1</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

The 4.7-inch gun had been decommissioned and handed down to the territorials a number of years before. It had a number of design flaws, was of an extremely obsolete pattern, and its stockpile of shells was faulty. Lacking a hydraulic recoil, it moved about in the gun pit after each round and the thin copper driving band used on its shells proved to be too weak, making for erratic flight. The 6-inch howitzers and guns were improvised weapons. They had been taken from the coastal forts, cut down, and given extemporized carriages to make them into field guns. Having come from fixed positions, these too lacked a recoil system and had to be chocked into place after each shot. Their rate of fire was slow, their range limited, and the cutting down of the barrel had rendered them extremely inaccurate. The Pack 2.75 guns were too small in calibre to do any damage; they could not even cut wire. The 15-inch gun was a naval gun mounted on a railway car and commanded by a retired Admiral, Sir Roger Bacon. As its ammunition was found to be faulty and it had
only 40 rounds anyway, it made no contribution to the attack. There was also one 3-gun battery of 9.2-howitzers. This was a new howitzer that had been in construction just as war broke out. The original prototype had been sent to France for its testing trials but the desperate need for heavy guns had forced it into immediate action. Two more had been completed by spring of 1915 and they joined the original to form the only battery of modern-designed heavy guns, having hydraulic recoil and firing only H.E. shells.25

The winter months had not only allowed the R.A. to re-arm with the motley collection of guns that had been brought from the old forts and gun parks around the country, but also to absorb some of the techniques they had observed their German counterparts using. The most notable of these was the creation of the H.A.R., the heavy artillery reserve. When the heavy guns, improvised and hurriedly completed in Britain, arrived in France they had not been simply added to various divisions but held back under army control. To these had been added, in the early spring of 1915, the 60-pdrs. and 4.7-inch howitzers, leaving the C.R.A.s of the divisions with the 13- and 18-pdrs. and the 4.5-inch howitzers. This division of the heavy from the field guns was to enable the British to use their heavy guns in concert, as they had observed the Germans do at Le Cateau.

The artillery also hurriedly introduced both F.O.O. and the telephone communications systems that made forward observation possible. Fortunately for Britain, her advanced telephone system meant that there was a ready supply of trained telephonists and an existing manufacturing capacity that enabled her to provide the equipment rapidly. The first artillery telephone systems were introduced in December 1914, connecting F.O.O.s to batteries. Lines were then developed that connected batteries to divisional H.Q. and then from division to corps H.Q., to facilitate artillery coordination.26

After the surprise of the German use of artillery observers in planes, immediate steps had been taken to use this form of aerial observation. The first attempts to make a start on this problem had been made on the 1st of September when two R.F.C. subalterns,
Lieutenant James and Lieutenant Lewis, directed artillery fire from the south of the river Aisne onto the German units on the far side of the river. On the 14th, the first aerial photographs were taken by the British, again to try to find out the location of the troublesome German batteries on the far side of the Aisne. By the spring of 1915 there were a pool of artillerymen who had transferred to R.F.C. and were able to provide the sort of ranging information the batteries on the ground required. One such officer was Captain H.C.T. Dowding, who in the second world war commanded Britain's fighter force in the crucial early years of the war. Early in 1915 Dowding developed the first clock code for aerial spotting. Clearly a uniform system for calling ranging information down to batteries was required. Dowding produced a template that was placed over the map, with concentric rings marking various distances from the target. The observer, seeing the shot fall wide, could simply call back two references, "12 o'clock, 500 yards," and so on. The clock code, although greatly refined, remained the basis of aerial ranging throughout the war.

A further addition to the ranging services provided to the artillery was the Ranging Section, R.E., which arrived in France in December 1914. When a battery was unable to directly observe its target from its F.O.O. and could not get aerial ranging, it fired by the map, or as the artillery termed it, "blind". The battery commander estimated the range and direction of his target by reference to his map, set his sights accordingly, and blazed away. As pre-war tactical planning had assumed that targets would, in fact, all be within the visible range of the observation officers, not much preparation or training had gone into this particular method of firing. With the advent of the trench war, however, with the Germans occupying hidden positions at great range, the need for such fire was obviously great. The artillery had rapidly discovered that the maps provided by G.H.Q. were hopelessly inaccurate for such purposes. Most were, in fact, based on civilian touring guides and had no accurate scale at all. To this end the Topographical Section G.H.Q. began the process of producing an accurate scale map of the First Army's area. The ranging section was also formed to assist the gunners use the maps and fix enemy positions on it. They did this by flying over German lines and detonating smoke charges as they passed over certain German
emplacements. The results of these flights were then compared to aerial photographs of the positions and to the maps, in an attempt to produce an accurate scale picture of the German lines. It was with the assistance of these new trench maps that the various artillery commanders of the First Army came together, to decide how to satisfy Haig's request for a quick, yet destructive surprise barrage to be put down on the defences of Neuve Chapelle.

The deficiencies in the artillery command structure were revealed even in this very first attack the British were to make. The conferences were held by a host of officers, with none in actual command of the proceedings. The two H.A.R. commanders, and the two senior C.R.A.s from the two attacking Corps, the IV. and the Indian, were the men nominally charged with organizing the bombardment. But, in addition to these four, the conferences were also attended by the other battery commanders, the corps artillery advisers, and the army artillery advisor. Rawlins, who was himself present at a number of these obviously crowded meetings, recalls that they were "marked by long discussion, sometimes amicable, sometimes heated, between a host of independent artillery officers". These meetings revealed a deep divide that had emerged in the tactical thinking of the C.R.A.s. The issue over which they were divided was to be central to artillery tactics for the entire war in the west. It was the question of the length of barrage needed to achieve the ends set for the artillery. The debate over this question was both crucial and revealing.

Two of the officers, Franks and Uniacke, the heavy group commanders, argued that it would take three days of shelling to destroy the German position. If they were given three days, these commanders argued, they could reduce the German trenches to ruins and smash any reinforcements which were sent in. A shelling of such duration would, of course, concede any element of surprise, but, it was argued, this would be more than compensated for by the effect of such a sustained shelling on the defenders. In fact, they believed there would be hardly any survivors of a three-day barrage and the infantry would simply march over and occupy the ground the artillery had cleared of defenders.
The other C.R.A.s, Holland and Scott, agreed with Haig that a barrage of three days' duration would rob the attack of any real possibility of a great strategic advance. The barrage would signal British intentions clearly to the Germans who would bring up reserves around the battlefield and limit any advance the British could make. These officers proposed a shelling of three hours' duration, which they thought would be long enough to destroy the German positions, yet not enough to give the Germans too much warning. What these acrimonious debates quickly revealed was that for all their pre-war training, the C.R.A.s involved had no idea of how long or how many guns it would take to accomplish the tasks they had been set. It was clear that, since estimates of how long it would take simply to cut the wire varied from over a day to less than an hour, the officers involved were merely guessing.31

British lines engineers created a portion of German line, complete with 15 yards of wire. Batteries brought out of the line then fired an attack on the mock position under the watchful eyes of the C.R.A.s and a number of senior battery commanders. To everyone's surprise, the batteries were able to scythe away the wire in a mere thirty-five minutes using shrapnel shells fused by an expert battery commander. The experiment was a great triumph for the advocates of the short, surprise barrage, who promptly set thirty-five minutes as the length of shelling needed for the assault. Haig, who supported the short-barrage proponents because it was only with a short barrage that the British could hope to make a deep and strategic advance, ordered that thirty-five minutes would be the duration of the shelling and that every effort be made to exploit surprise.

These artillery experiments having determined the tactical approach the British would take in their first major attack, preparations began in earnest. Secrecy was of the essence. For the infantry, concealing their assembly for attack was not tremendously difficult. By transporting troops at night and hiding them in dugouts or deep trenches by day, G.H.Q. were able to keep their infantry brigades out of the view of the German observers. For the artillery, however, the accomplishment of secrecy was much more taxing. There was the
problem of registration. While batteries could be brought up to the line discreetly, each battery had to range its guns to the targets allotted to it in the artillery timetable. If dozens of guns began bracketing important positions in their defences, it would not have taken the Germans too long to realise that the British were preparing an assault. The British batteries had to register in sequence, with only a few guns registering at any one time so that the Germans would not notice any general increase in shelling. Registering in this manner took many days, as each of the batteries was ranged on to its particular target. The problems of organising this program of registration were heightened by the lack of an overall artillery commander. As with the arguments over the length of barrage, the C.R.A.s in the battle had to come to some sort of agreement on when each battery was allowed to fire. Each believing his own guns had the most crucial tasks, each competed for more time for his own batteries in the limited registration program.

Registration was not the only problem the gunners faced in their preparations. Obtaining good observation positions was to prove even more difficult and again the lack of unified command heightened the problems. As has been noted, the German line around Neuve Chapelle, and in fact all along the front, occupied the high ground, while the British held the slight valley before it. While the British now had an adequate supply of telephones and lines, there was a dearth of observation positions from which the forward observers could see the targets on which their guns were to register. Two towers, or crow’s nests, were built, but these had to be at least a mile back from the front as, if closer, they would simply provide targets for German field artillery or snipers. Closer to the front, haystacks were discreetly hollowed out and observers placed within. But the crow’s nests and haystacks commanded only a limited view of the German position around the village. There was only one place where a clear view was obtainable, the ruined houses of Port Logy, which the British had incorporated into their front line.

Again, the lack of a central artillery command produced competition and confusion as each battery tried to have its individual observers in the best position, Port Logy. The
ridiculous situation arose whereby observers contested for the few good positions available in the houses. The telephone lines, which were simply unrolled over open ground from the battery to the observer, became tangled and confused. At one point there were thirty observers in just one of the Port Logy houses.\textsuperscript{32}

Another problem in the preparation for the assault, again attributable to the lack of a unified command, was the non-arrival of two batteries of heavies, 6-inch siege battery guns. The artillery timetable issued by Haig’s army H.Q. outlined what each battery was to fire at, for how long and with how many shells. But, because it was not any individual’s responsibility to supervise this program, it was not checked whether all the guns allotted to these tasks were actually there on the field. Only on 5th March, when each battery was supposed to have completed its registration, was it realised that two entire batteries were missing. Enquiries established that they were, in fact, still in England, delayed by transport problems. They were rushed across the Channel and arrived at the British positions on 9th March, the day before the attack. With their guns still unanchored, with no registration, maps or preparation, these batteries were flung straight into the battle. Their contribution was minimal, for they simply blazed off their quota of shells with only a rough estimate of range on which to set their sights, and with each shot the guns slewed around in the mud from the recoil. In the event, their ineffectiveness had some serious consequences.\textsuperscript{33}

At 7.30 am on 10th March, the bombardment which the British had prepared suddenly opened on the German position. For all the problems of organisation, the British had in fact achieved the element of surprise that was at the heart of their plan. The Germans had not observed the build-up of troops and guns, nor noted the registration of the British batteries on their positions. They had not strengthened their position, nor brought up reserves. The first phase of the attack proceeded quite smoothly. In the opening minutes of the attack, the 18-pdrs. swept away the German wire while the howitzers smashed the German trenches. The infantry crossed no-man’s land while the German defenders were sheltering from this fire, and when the British guns lifted their range to deeper targets, the
infantry occupied the remnants of the German front line. The assault went almost entirely to plan - but not quite. The only place the assault failed was the section of the line allotted to the two batteries which had been delayed. Here the German trenches received no shelling and the defenders were able to drive off the British with machine-gun and rifle fire.34

It was the Middlesex regiment that marched into this disaster. The destruction of the Middlesex' first wave was so complete that the regimental officers thought that the attack must have been a success as no men were falling back. It was only when the second wave of Middlesex men advanced and were cut down that the officers realised the situation and ordered the attacks halted while a new shelling was organised.

Apart from the hold-up with the Middlesex regiment, the first phase of the attack was a complete success. Most of the German front line and the village were in British hands. But, for the artillery, the success was not so complete; there remained one of the four tasks they had been given before the battle, the neutralisation of the German artillery. The aerial photographs taken before the battle had revealed a number of German gun positions behind the German lines. The task of firing on these had been given to the largest of the British guns, for only they had the range to reach the German gun pits. With targets so deep, there was no question of the British being able directly to observe their targets to register their fire, so the British counter-battery guns fired from the map. This meant that they attempted to estimate the position and range of the German guns by combining their aerial photographs with small-scale maps of the German position. Unfortunately for the British, this proved to be an extremely difficult task for, obviously, an error of mere millimetres on the map translated into misses of hundreds of metres on the ground. The evidence of the lack of effectiveness of this counter-battery became clear when, shortly after the British infantry jumped off, the Germans began to shell the British positions with heavy guns. This shelling not only inflicted casualties on the British infantry units in the attack, but it also created chaos in the British communications system - the telephones.
The entire British position was criss-crossed with various lines linking batteries to observers, infantry to their headquarters, battalions to divisional command. These lines were laid over open ground and the German shelling quickly began to sever the crucial lines of communication that allowed the British Staff to control the attack. British infantry units waited in vain in the German trenches for the order to continue the advance, while the British Staff attempted to analyse what had happened in the initial rush. The news of the Middlesex debacle had reached Rawlinson, the commander of IV. Corps, and he feared that the Middlesex objective, a position called 'the orchard', contained a sizeable force of Germans. He ordered the advance halted until it was certain that the orchard had fallen. In fact, the orchard had fallen, and had been found to contain only a small force of defenders. But, with the breakdown of the telephones, this news did not reach headquarters until 1.15 in the afternoon. The failure of the telephone lines also had a disastrous effect on the gunners. Forward observers were cut off from their guns, whose fire became erratic and ineffectual without directing of their shot. Observers, in desperation, resorted to semaphore signalling from the roof-tops of the Port Logy houses. Standing on the roof-tops, waving flags, in full view of the enemy, obviously invited hostile fire, and casualties among observers were very high. In 45th Brigade, for example, every single observer was either killed or wounded.

When the British launched the second phase of their attack, the effects of this breakdown were clear. Some infantry units had received the order to move on; some never received it, so the infantry attacks were piecemeal and disorganised. The British artillery, whose tightly organised shelling had protected the infantry in the first assault, were now unable to support the infantry’s assaults with any effective fire. The result was that by night-fall the British had advanced only a few hundred yards from the positions they had taken in the initial rush.

When darkness fell, the British had advanced approximately 1,200 yards on a frontage of 2,200 yards. They occupied the village and the old German front line but had
failed to take the second line or the crest of Aubers Ridge, the objectives of the afternoon
assaults. During the night, the balance of power on the battlefield altered dramatically. The
Germans’ reserve artillery batteries, which had been rushed to the battlefield the moment
that news of the attack was received at German H.Q., arrived and debouched from their
trains. Eight field and two heavy batteries had been sent and were in position by morning,
with five more batteries still in transport. Eight brigades of infantry were also rushed to the
threatened area. The result was that the overwhelming superiority in sheer numbers that
the British had held when the attack was launched had disappeared in a mere 24 hours. But
it was not only in numbers that the British Army’s advantages had been eroded; the
effectiveness of the British attacking force had also diminished. The infantry, after a day of
violent activity, had spent the night without food in the remnants of the old German
trenches, harassed by German fire and unable to rest. The artillery, who had been so
prepared 24 hours before, were now entirely disorganised. The infantry advance had taken
the field guns to the limit of their range and past the point where their remaining observers
could see. If they were to carry on the attack, the field guns would have to be moved
forward to new positions.

During the night the gunners tried to drag their guns forward to new positions and
build gun pits in what had been no-man’s land. Morning found them unprepared to
provide, organised support for an attack. There had been no time to find new observation
positions, which was impossible to do at night; the guns were not anchored down properly;
there were no orders giving targets and timetables; in fact, none of the conditions that had
made the first bombardment such a success obtained on the day after. The success of the
initial assault destroyed the very things that had made the attack succeed, the surprise of the
attack and the careful preparation and ranging of the artillery. By the next morning, all
surprise was gone and the rapidly strengthening German defence was ready and waiting to
receive any assault. The British guns, which had been so well prepared on the 10th, were
by the 11th unable to provide effective fire to continue the attacks. Their batteries’
communications had been cut; they did not know their targets; they had no registration;
their ammunition supplies could not get through, or find their batteries when they did get through; and many of the experienced observers had been killed. Not surprisingly, when Haig ordered the attack resumed on the 11th, the Germans drove off the piecemeal assaults with little difficulty.

By the 12th, the German force around Neuve Chapelle had grown to such an extent that they launched a counter-attack, attempting to regain the village. The German artillery, which had only a short time to prepare for this assault, had little information as to where the British units were and their shelling was not very effective. The counter-attack was driven off with hand-to-hand fighting in the tangled remains of the village and the former German front line. The extent to which commanders on both sides were misinformed about the situation on the battlefield is fully revealed by the events of this fighting. With almost all telephone lines cut, runners were the only source of information for the rival Staffs. Runners were, of course, extremely vulnerable to enemy fire and messages were lost, never arrived, or at best took hours to get back to headquarters through the tangled battlefield. The depth of Haig’s misunderstanding was obvious when he ordered the British attacks to resume on the 12th when the German attack was driven off. On hearing that the German attack had collapsed, Haig ordered “Information indicates that enemy on our front are much demoralised. Indian Corps and IV Corps will push through the barrage of fire regardless of loss”. The troops to which Haig referred were in no position to attack, nor were the artillery able to provide any fire to help them into the German line. The attacking infantry had been fighting for almost three days and were so tired that they fell asleep in their trenches despite orders to attack. One officer reported that he could not attack because his men had to be awakened by force and, since the trenches were filled with corpses which were hard to distinguish from sleepers, this might take some time. The 7th Division was unable to pass on the order to attack as it did not know where its various units were. Battery commanders reported that they could not support the attacks because they had run out of shells and did not know their own location, nor that of the enemy. When these reports arrived at army H.Q. during the night of the 12th, the attacks were called off and
orders issued simply to consolidate whatever ground had been taken and reorganise the British forces.

In the artillery notes drawn up by the G.H.Q. artillery after Neuve Chapelle, the gunners examined in detail why the attack had broken down after such an apparently promising start and had not, as the C-in-C wished, carried the Germans "off their legs" and off the ridge entirely. The notes concluded that the multiple artillery command of the attack was "unsound, and did not work well". It also pointed out that the British artillery had failed to suppress the fire of the German artillery batteries and that this had grave effects on the success of the infantry advance, and that "artillery communications generally broke down under the enemy's shell fire". The reason that the German batteries had been able to mount such a devastating bombardment and the British attack had broken down once it passed beyond the protective range of the 18-pdrs. was that the work of the heavy guns at distant targets had been poor. "There was a considerable amount of unobserved fire from the big Howitzers, due to fog and mist." The poor visibility had kept the few R.F.C. artillery observers on the ground.

"When the fight developed and confusion began to arise and communications to be cut, the heavy batteries and Howitzers resorted largely to shooting by the map. They had to choose between this method and remaining silent, and it is not possible to blame them for their choice, ... but the result was undoubtedly a very large expenditure of ammunition of the heavier natures, much of which was unobserved and the effect therefore doubtful."

"Negligible" would perhaps have been a better description.

The failure of the heavy guns to achieve their allotted tasks, and the consequent breakdown of the assault, did not deter the Staff of G.H.Q. from preparing another assault against the ridge. Nor did it shake their belief in the value of surprise and the short barrage. It was hoped in the next assault, planned for the 9th May, that by reinforcing the attacking infantry units and strengthening artillery communications, breakthrough might still be achieved. The battle of Aubers Ridge was, however, to prove a bitter disappointment.
For the attack at Aubers Ridge, the British command made few modifications to the scheme they had used at Neuve Chapelle. The modifications that were introduced were to the second stage of the attack, the exploitation phase, in an attempt to eliminate the confusing breakdown that occurred in the afternoon of Neuve Chapelle. To this end, selected groups of infantrymen were given mortars, rifle grenades and bags of hand-grenades. These "bombing parties" were to assist the infantry in any encounters with German strong-points that had either been missed by the artillery or were beyond their range. To try to avert the complete breakdown of telephone communication that had occurred in the afternoon of Neuve Chapelle, three planes were fitted with radios (a considerable technological achievement in 1915). The planes were to report the progress of the assault back to headquarters. It was hoped that this would avoid the sort of confusions that had arisen over the orchard at Neuve Chapelle.\(^{40}\) The only modification to the artillery’s instructions was that in the event of the Germans using cloud gas as a defensive measure, all guns were to focus their fire on the cloud in a bid to disperse it. Other than these minor differences, the attack was an attempt to duplicate Neuve Chapelle.\(^{41}\) The British attack force was assembled at night, the three infantry corps quietly filling the forward trenches to avoid observation. The 518 field guns and 121 heavy guns the British had at their disposal were brought up during the previous evenings and registered in sequence during the days so that the Germans would not be alerted by an increase in shell fire. When the moment for attack came, the guns would fire a furious barrage for forty minutes before the troops attempted to rush the German trenches.

When, just after dawn on the morning of 9th May, the British gun batteries opened up, they each fired their shells at their allotted targets. The 18-pdr. batteries tackled the wire, each battery being allotted a certain section to destroy; the medium guns and smaller howitzers shelled the German trenches, while the heavies concentrated on known German headquarters, communication positions and hostile German batteries that had been noted by forward observers. After forty minutes, the infantry attempted to climb out of their trenches
and rush the German position. Many did not even get out of the trenches for, the moment the shells stopped falling on the German front line trenches, German machine-guns opened up, raking the British lines. The barrage had left the German defences almost undamaged; the wire remained intact along much of the frontage; the German trenches had been crushed in only a few places and in the remaining parts, German riflemen added to the hail of fire coming from the many German machine-guns that had obviously survived the shelling.\textsuperscript{42}

The attack failed immediately and completely. Troops of the East Lancashire regiment were under shell fire from German artillery even as they formed up in their own trenches. The forty-minute barrage was refired in the early afternoon and the assault troops attempted to advance into no-man’s land again. Despite the second shelling, the German defences remained intact. The second assault found itself still confronted by uncut wire, numerous hostile machine-gun positions, and heavy barrages from German field and heavy artillery. British losses in these two assaults totalled over 11,000 men, with some of the assault battalions losing up to 60\% of their men.\textsuperscript{43}

Attempts to avoid the breakdown in communications between Staff and the forward attacking units also failed. Heavy German shell fire had cut telephone cables and observers in the radio equipped planes found it impossible to distinguish friend from foe, or in fact to distinguish any events in the smoke-shrouded and misty battlefield.\textsuperscript{44} The other modification introduced by the Staff to the plan used at Neuve Chapelle, the infantry bombing-parties, had no opportunity to display their usefulness, for none of the assaults reached the German trenches.

The reason the attack at Aubers failed was not because it did not achieve the surprise on which the plan was based, but because the forty-minute preliminary bombardment did not achieve any of the three crucial tasks it had been set in the attack plan. The 18-pdrs. had not cut the wire sufficiently; the German machine-gun positions had evidently survived the trench bombardment, and the German defensive artillery had remained active and
accurate throughout the abortive assault. At Neuve Chapelle, the artillery had at least accomplished two of these - cutting the wire and crushing the front-line trenches. Its complete failure at Aubers had led to the breakdown of the assault, with heavy losses and without an opportunity for the assaulting infantry to engage the German defenders. The reasons for the failure of the barrage at Aubers were threefold.

The first, and possibly most crucial, of these reasons was that the Neuve Chapelle assault had awoken the German Staff to the idea that the still comparatively small British Army was capable of launching offensive operations. Before Neuve Chapelle, the German Staff had not regarded the British Army as an offensive threat on the Western Front. Because of this, the 21 miles of frontage the British occupied had not been extensively developed by the Germans. After Neuve Chapelle they threw the great majority of their labour battalions and their defensive resources into strengthening the line that the British occupied. The area attacked by the British at Aubers showed the full benefits of this labour. The sandbagged parapet of the trenches was increased from up to 15 to 20 feet across and up to 7 feet in height. The depressions created to fill the sandbags were filled with wire which, being below ground level, was almost impossible for British shrapnel to cut. Into their great parapet the Germans had inserted machine-gun positions protected by heavy steel plates which only a direct hit by a heavy artillery piece could silence. Dugouts that could survive direct hits were built to house the infantrymen and each position was protected by huge bales of barbed wire. There was a saying in the German Army that sweat saves blood. At Aubers the Germans expended a great deal of sweat and saved themselves a great deal of blood.45

But these German preparations do not entirely explain the complete failure of the attack. The barrage also exposed some crucial weaknesses in the British artillery. The regimental histories of the German units involved reveal that it was not just the brevity of the British barrage that was at fault, it was the inaccuracy of those shells that were fired.46 Although the British had a program for the shelling of known German strong points and
headquarters, not one of them was hit. German histories report that the front line defensive trenches remained relatively untouched.47

The great inaccuracy of the British shell fire had a number of causes. Just as they had at Neuve Chapelle, a number of British guns unable to get direct observation of their targets were forced to shoot from the map. Just as at Neuve Chapelle, this proved to be simply a waste of ammunition, for the British maps still lacked the detailed accuracy to make this type of ranging possible. The inaccuracy of the British bombardment was also a product of the weather. The British artillery’s ignorance of the techniques of indirect, long-range fire was revealed in the barrage at Aubers Ridge by the oversight of a factor crucial in determining accuracy of fire. As they had done at Neuve Chapelle, the British guns registered in sequence in the days before the attack. While they were doing this, the weather was cold with wet, heavy mists swathing the battlefield, but during the night of 8th May, the skies cleared and 9th May, the morning of attack, dawned hot and sunny. The change in the barometric pressure and the amount of moisture in the air had profound effect on the flight of the shells that the British were firing into the German positions, a fact of which the British gunners were entirely ignorant. The registration done in the cold, wet days preceding the attack was useless, so the barrage of 9th May went entirely astray.48

The other factor that contributed to the inaccuracy of the barrage was the declining condition of the British guns. The British artillery had prepared, as we have seen, for a short, sharp war, one in which a campaign of manoeuvre would end with a single climactic battle. But by Aubers Ridge, the British guns had been in constant use since Mons and most had fired hundreds of shells. The result was that many gun barrels were becoming worn, their rifling eroded by constant firing. The guns lost muzzle velocity and therefore range and the lack of spin made the shells’ flight erratic and unpredictable.49 This problem was heightened in the 4.7-howitzers by poor quality ammunition. For many types of guns, the pre-war stockpiles of ammunition had been consumed and the gun batteries were now receiving shells manufactured in great haste since the outbreak of war. This was
particularly true of the howitzers whose expenditure of shell had surpassed any pre-war predictions. These new shells lacked consistency in size and weight and this aggravated the problem of barrel-wear, the misshapen shells gouging out the rifling as they accelerated to the muzzles. In the case of the 4.7s, this often resulted in the driving band being ripped off the shell as it left the muzzle, causing the shell to turn end-over-end in flight. Obviously, accuracy was impossible with guns in this state, with the shells tumbling out of the guns and often landing only a hundred yards in front of the battery. The official history reports that fire from 4.7s landed 500 yards behind the British infantry position.50

The third reason that the Aubers Ridge barrage failed so completely was that Britain's stockpile of shells, low when the conflict had broken out, was by May 1915, almost entirely consumed. The rate of fire and the number of engagements in which the artillery were firing were beyond any pre-war estimates. When the battle concluded, there remained only 3,000 18-pdr. rounds in the armies' stockpiles, enough to sustain the armies for only a few days of defensive fighting.51 If the Germans were to launch an attack, it was possible that the British artillery would fall silent simply through lack of shell. During the attempt to refire the Aubers Ridge barrage, in order to rectify the situation in the afternoon of the 9th, many of the batteries could not fire for the lack of shell, or fired at reduced rates to conserve their ammunition. Having consumed the pre-war stockpile, the artillery were now constrained to fire at the rate at which shells were being constructed and shipped from Britain. It was this shortage of shell, rather than the inaccuracy of the fire or the strength of the German fortifications, that both the First Army commander, Haig, and the Western Front correspondents focussed on in explaining what had happened on Aubers Ridge. The Times headline of 10th May stated that "British soldiers died in vain on the Aubers Ridge on Sunday because more shells were needed".52 The result of these reports was the galvanizing of the government's efforts to construct munitions, and a public outcry at what was characterized in the Northcliffe Press as the 'shell scandal'. This would lead to the creation of the Ministry of Munitions, which took over all aspects of gun and shell production, and to a steep increase in the rate of shell production. The panic that Aubers Ridge created,
however, meant that most of the shells produced in this period would prove to be near useless, as all quality control and testing were abandoned for the sake of quantity, the results of which will be examined in the next chapter.

The failure on Aubers Ridge not only had dramatic effects on the home front, it also caused Haig and the First Army Staff to reconsider the role of the artillery in attacks on the entrenched German positions. It is clear from the further attacks launched by Haig’s First Army in 1915 that the army commander realised it was not simply the paucity of shell that had caused the attack on Aubers Ridge to fail, but also the brevity of the preliminary bombardment. The small number of effective weapons at their disposal, and the inaccuracy of fire meant that the R.A. could not, in thirty to forty minutes, cause enough damage to the German defences to cut the wire, crush the machine-gun nests and silence the defensive artillery in a given portion of German line. At Neuve Chapelle the Staff had attempted to apply their pre-war tactical doctrines to the problem of dislodging the entrenched German defenders before them. After Aubers Ridge, surprise was increasingly abandoned in favour of longer, more destructive preliminary bombardments which, while giving the Germans increasing time to prepare for the coming assault, allowed the R.A. a greater chance to complete its crucial preparatory bombardments.

What Aubers Ridge marks is essentially the end of the Staff’s clinging to its pre-war tactical doctrine, particularly in artillery. The long barrage philosophy that emerged and which was used in every major attack after Aubers Ridge until the end of 1917 has often been mistakenly ascribed by the Staff’s critics to out-dated and reactionary tactical thinking. The failure of the long barrages, particularly the dramatic failures on the Somme in 1916, were not a product of obsolescence, rather the reverse. It was the sudden abandonment of pre-war tactics and the adoption of radically new ones - for which the army was unprepared - in its weapons, administrative structure and training, that in no small part accounts for the terrible disasters of 1916 and for the administrative and Staff chaos that characterized the 1916 campaign.
What drew Haig and the First Army Staff away from the short, surprise barrages used at Neuve Chapelle and Aubers Ridge was not only the failure of the latter, but also the success the French were having in their assault on Vimy Ridge. In their initial attacks of the war the French, like the British, had pursued the pre-war doctrine of sudden overwhelming infantry assaults preceded by little artillery preparation. The results had been catastrophic and French casualties had numbered hundreds of thousands by the spring of 1915. By May, the French were willing to try something new. Aubers Ridge was but one half of a joint Anglo-French offensive, the French part being an attempt to take the commanding and crucial high ground of Vimy Ridge. In the French artillery there were heavy-artillery commanders who, just as Franks and Uniacke had done before Neuve Chapelle, argued that, given more time, their heavy guns could smash the Germans' entrenched defences and save the infantry from slaughter at the hands of the German machine-gunners and artillerymen.

In their attack on Vimy the long-barrage artillerymen were given their chance. The French abandoned any attempt at surprise and instead drew every available gun they had to the Vimy area and began a heavy sustained bombardment of the German position. For six days before the attack, the French guns pounded the German positions, using 780 field guns firing almost two million shells and 243 heavies firing almost 350,000. This new, methodical destruction of German positions had its disadvantages, which became rapidly clear. With shells raining down on Vimy Ridge, the Germans could be under no illusions as to what the French were planning and, not surprisingly, responded by pouring reserve artillery units into the defence. Most of these reinforcing units were held back from the actual battlefield to keep them out of the reach of the French barrage, but close enough to respond when the attack was finally launched. When the French began their barrage, four German divisions held Vimy Ridge. By the time the barrage finished, six days later, there were thirteen German divisions in the defence.
When the French did finally launch their infantry it seemed that, while they had conceded any element of surprise, they had been amply compensated by the destructive effects of their six-day shelling. The German position was left in ruins by the two million shells the French fired at them, and when the French infantry advanced they found little left of the front-line defending force. On a frontage of four miles, the French advanced about two miles, pushing to the crest of Vimy Ridge. Here they met strong resistance from German units which had been beyond the range of the catastrophic barrage and, after bitter hand to hand fighting, the Germans reclaimed the crest of the Ridge. French reserves and artillery were slowed in bringing up support by having to cross the wasteland created by the barrage, while the German reserves were near at hand and ready. Eventually the French abandoned their attempts to get to the top of the Ridge. But in spite of its failure to reach its ultimate objective, the French attack was certainly more successful than that of the British. It was the relative success of the French, compared to the total failure of the British short barrage at Aubers Ridge, that led the British gunners to abandon surprise as a tactic and move toward a longer more destructive preliminary barrage.

With this change came a revision of the role of the artillery in the composition of an attack. Rather than being seen as support for the infantry, the artillery became the prime weapon of destruction. This change involved a recognition that success meant the destruction, not only of enemy soldiers (the task of the infantry hitherto seen as central), but of their physical defences. The consequences of this revision of tactics were profound. The nature of the huge offensives launched in 1916 and 1917, the most controversial of the battles the British undertook, the Somme, Arras, Passchendaele, the so-called 'attrition battles', was shaped by the change in artillery tactics that occurred because of the failure at Aubers Ridge and the partial success of Vimy Ridge. The significance of the Aubers Ridge experience is overlooked by Staff critics, who claim that the tactics of the Somme were products of pre-war military philosophy. In fact, the battles of 1915 led the British Staff to place their faith in the heavy artillery and the belief that it could smash the German defences completely, allowing the infantry to march over and occupy territory the guns had won.
After Aubers, attempts by the British Army to attack German defences would become largely an artillery exercise and increasingly a duel for control of the battlefield with the German artillery.

The role into which the artillery now found itself thrust, far from being a product of pre-war thinking, was in fact one for which it was entirely unprepared. As we have seen, the major body of the R.A.'s guns were light manoeuvrable pieces like the 18-pdrs. and 4.7-howitzers and much of the munitions consisted of shrapnel, unsuitable for the destructive work required by the new approach. The heavy siege-guns had long been neglected by the R.A., the few batteries were armed with old models of guns and there had been little training in the specialist techniques needed to use the huge long-range weapons. This was in addition to the existing and, after Aubers Ridge, the well-known problem of lack of shells. Despite these serious handicaps, the British attempted to put their new tactics into practice in a series of small attacks from May to August.

Having recognised the need to fire an overwhelming destructive barrage before committing the infantry, the R.A. found that it could accumulate enough guns to provide a barrage for only a very narrow frontage of attack. By concentrating their few batteries of heavy guns on a length of a mile or so of German line, the British could achieve satisfactory destruction of the German trenches and flattening of the wire. The new approach was first tried at Festubert, begun on 15th May. The British brought together 433 guns and began a sixty-hour barrage on the German positions. Haig, writing about Festubert in his diary, shows that he had perceived the connection between the length of barrage and the problems of accuracy the British had encountered in previous attacks. The highly developed defences the Germans had constructed required "accurate and so fairly long" bombardment with observation of "each shot". During the longer bombardment there was time for careful registration of each gun rather than the limited registration possible with the surprise barrages. Despite careful preparation, however, the attack on Festubert was not a success. Warned by sixty hours of bombardment the Germans brought reserves into the threatened
area, particularly extra artillery batteries which were hidden on the flanks on the reverse slopes of hills or in slight valleys. When the British infantry attacked, these flanking batteries dropped a heavy defensive barrage, assisting the surviving machine-gunners to drive off the attacks. The German batteries that caused the hold-up of the attack proved extremely difficult for the guns of the R.A. to silence. The most that British observers could see of the hostile batteries was the brief gun flash as they fired. With nothing but this momentary flash to guide range and direction, and unable to see the actual fall of shell and thus correct errors, the British were unable to hit more than a few of the many German guns that ringed the defences. At Givenchy the British tried again with a barrage of 48 hours, shorter than Festubert because of the chronic lack of shells. The shell shortage was so great that even the 48 hour bombardment was not continuous. Not surprisingly, this attack was rebuffed, like that at Festubert, by a combination of machine-gun fire and heavy German barrages from artillery on the flanks of the attack.

Further British attacks, Bellewaarde on 16th June and Hooge in late July, simply confirmed what had been revealed at Festubert and Givenchy - that Britain did not have the heavy guns, the high explosive shell, or the techniques of gunnery to launch successful attacks on the Western Front. This was the conclusion arrived at by the conference at Boulogne, attended by French and British government ministers and senior soldiers. Yet, shortly after the conference, the British Army began preparing its largest attack of the war so far, to be called the battle of Loos. How it was that the respective governments and senior army officers all agreed that further attacks were imprudent, and then turned around and launched their greatest assault thus far, deserves some examination.

Beginning on 9th June, various French and British government ministers and senior soldiers had been meeting in the Hotel Dervaux at Boulogne to discuss munitions and artillery, and in general to consider the ramifications of the two armies’ experiences so far. Analysing the attacks the two armies had launched, they rapidly came to the conclusion that the only successful method of attacking the German defences on the Western Front was that
employed by the French at Vimy Ridge. That is, the infantry advance must be preceded by a massive bombardment by heavy artillery. Further, such attacks would have to be launched on extremely wide frontages, thereby eliminating the problems posed by German flanking artillery encountered at Festubert and Givenchy. The conference then examined the resources the Allied armies had at their disposal and found that their armies, built to fight a fast, mobile war, were in no position to launch the sort of attacks that all agreed were the only ones likely to bring success. The conference heard that the Germans had over 10,000 artillery pieces of which 3,300 were heavy guns or howitzers, a ratio of roughly 2:1 in field pieces to heavy guns. The French artillery had a ratio of 4:1, while the British had one of 20:1. As against Germany’s 3,300 heavy pieces, over 6 inches in calibre, the British had less than 100 in total. In munitions, the situation was similar, with the Germans producing 250,000 rounds per day while France produced 100,000 and Britain, despite her massive manufacturing industry, only 22,000. Haig’s report to the conference was brutally frank on this issue. Britain, he declared, could not consider attacking on the Western Front with any real prospect of success with a force containing fewer than 1,000 heavy guns, each supplied with a huge ammunition stockpile. The implication was clear - Britain could not really resume the offensive for at least a year, possibly two, while the British factories now being converted to wartime production created a suitably equipped artillery force. Yet, three months later, Britain launched her armies at the German lines again and, not surprisingly, suffered a reverse. Three factors combined to bring this attack about: two were political and the third an illusion that the British weakness in artillery could be overcome by the new weapon, gas.

The reason most commonly proffered by the British Staff at the time for the attack at Loos was that it was needed to assist the Russians who were crumbling in the face of the better armed and better coordinated German Army. Whether the assault at Loos could have accomplished this, even if it had succeeded, is debatable, but there is no doubt that the imminent collapse of the Russian Army seemed to impel the Allied command to do something. The second factor, one less commonly mentioned at the time, was the pressure
that the British Commander-in-Chief felt from his younger, ambitious subordinate, Douglas Haig. Mounting British losses and the evident failure at Aubers Ridge and Festubert had placed Sir John French in a perilous position. He needed a success to ensure his position as Commander-in-Chief and thus felt impelled to attack. This pressure from Haig was reinforced by Joffre’s determination to attack and to have his British allies attack with him. The planning of Loos again shows how the offensive posture adopted by the British Army early in the war, when it was clearly unable to carry out an attacking strategy, was partly a product of its subordinate role in the land war to its much larger ally, France.

Pressure from the French commander, Joffre, was also placed on Kitchener during a three-day visit to the French commander, from the 16th to the 19th of August. Joffre wished the British to launch a major attack with all their resources in the area of Loos, to support a proposed major French offensive. Kitchener went so far as to promise the French commander that Britain would continue its offensive policy on the Western Front despite the conclusions reached at Boulogne.

The most compelling reason, however, for the apparently incomprehensible decision to mount the attack at Loos was that many in the British command believed that by using gas, as the Germans had done at Ypres on the 22nd April, the British deficiency in heavy guns could be overcome. Immediately after the Ypres attack, the British, whilst roundly condemning the German tactic as barbaric, began investigations into their own capacity to launch a gas attack. It was established that Britain did in fact have supplies of chlorine and, after some hasty experiments under the command of Colonel Jackson of the R.E., it was decided to use the gas at the first opportunity, which was to be Loos.59

In spite of the limited resources at its disposal, the British artillery’s organisation for Loos showed a marked improvement over that of earlier battles. After much dispute and internal bickering, corps artillery commanders were appointed and given the title Commander Corps Royal Artillery (C.C.R.A.). In the two Corps, I. and IV., which were
to fight the battle, the senior C.R.A.s were appointed to this new rank - these were
Brigadier-General Birch and Brigadier-General Budworth. Now, at least, there were two
men coordinating the artillery’s work in the battle rather than five or six. The two new
C.C.R.A.s approached their tasks very differently.

Birch at once exerted his control over his C.R.A.s, breaking up their batteries and
redistributing the guns. He grouped the artillery into five sections, three containing only
18-pdrs. and the light 4.5-inch howitzers, and the two remaining having all the heavy
artillery. This meant that the five C.R.A.s could concentrate on the tasks their type of gun
was allotted, the field guns on wire cutting and infantry support, the two heavy groups on
smashing trenches and counter-battery fire.60 Budworth, on the other hand, did not
reorganise the batteries, leaving each C.R.A. with a mixed group of guns their associated
variety of tasks. Budworth also decided that once the battle started he would revert to being
simply C.R.A. of 1st Division and that "group commanders will allow sub-group
commanders the greatest latitude in carrying out their tasks".61 Unlike Birch, Budworth
did not issue a comprehensive fire-plan or timetable, leaving that to group or sub-group
commanders. Budworth’s actions exhibit the entrenched resistance to centralized control
that existed even at this stage. Birch, an advocate of centralized control, used his new-won
power to organise the guns into a rational system, while Budworth, although appointed
C.C.R.A., abdicated the power he had been handed. Farndale claims that Budworth was
trying to avoid offending his fellow C.R.A.s yet it was to override such petty jealousies that
the post of C.C.R.A. had been created.

The extensive correspondence on these issues of Major-General Du Cane, the
artillery c at G.H.Q., reveals the deep divide even amongst the senior artillery officers on
the creation of corps artillery commanders. Du Cane wrote of the appointment of Birch and
Budworth that the artillery advisers at corps

"brought into our system an element of friction and discord. If they are
energetic and pushful, they are apt to infringe on the prerogatives of
The M.G.R.A. of the Second Army, Major-General J.E.W. Headlam, put forward his opinion of the new position,

"Taking all such matters (professional efficiency and the rank of Corps artillery advisers) into consideration, it seems probable that there will not be many occasions on which the artillery advisers of Corps will be called upon to assume the post of artillery commander."

Headlam entirely misjudged the direction the war was to take. Birch, by contrast, had no doubt that the artillery force would continue to grow in size and complexity, arguing throughout these exchanges of letters for the creation of permanent corps artillery commanders to replace the artillery advisers, and suggesting that, in future, army artillery commanders would be needed. Despite the difference between the two first C.C.R.A.s, the creation of the position marked an important step down the long path toward complete artillery centralization.

Unfortunately for the two new artillery commanders, the task before them was an impossible one. It had been recognised by the British Staff that attacking on narrow frontages was bound to lead to failure as the German artillery on the flanks could concentrate heavy barrages on the attack. Thus it was decided at Loos to attack on a broad frontage of about seven miles so that the centre of the attack would be free from flanking fire, but this very long frontage served only to exacerbate the British Army’s lack of heavy guns and shells. While the two French attacks at Champagne and Artois were supported by 47 and 35 heavy guns respectively per mile of frontage, the British had only 19 heavy guns per mile for their assault. The lack of shells meant that even this meagre force could not be kept in action continuously, each gun being rationed to a certain number of rounds per day: for the heavy guns, the limit was ninety rounds per day for the four days of the barrage. The British still had a great number of problems with accuracy, for the wearing of barrels and poor munitions that had plagued the Aubers Ridge attack still hampered the gunners'
efforts to bring their fire on to targets. While great strides were being made in the area of aerial spotting, the increasingly erratic fire of the guns made ranging difficult. This inaccuracy was noted by the German regimental histories of the units occupying the Loos area, which also found that the 25-foot deep dugouts the Germans had constructed were completely immune to the British shell-fire, even when hit. Lieutenant-General Schwarte’s history of the German defence reports that the barrage was so light that the Germans did not even realise it was a prelude to an attack, concentrating their efforts against the French sectors.63

That over 250,000 shells could be fired at a defensive position yet the defenders not realise that an attack was being prepared, may strike the reader unaccustomed to the staggering weight of shell used in the battles of the Western Front as incredible. But seen in comparison with those of other battles the lightness of the Loos barrage becomes apparent. At Vimy Ridge, on a similar frontage to that of the Loos attack, the French had used nearly two million shells, of which 350,000 were from heavy guns. At Messines in 1917 the British used over three million shells with 940,000 being heavy calibre. At Messines the shells were not even the primary method of destroying the German trenches; this was left to the million tons of high explosive the British had tunnelled under the German position. Such comparisons help explain how the 22,000 heavy shells scattered erratically over the Loos’ defences failed to alert the Germans to the fact that an attack was in preparation.

The British artillery commanders, fully aware of the weakness of the barrage, were, like the rest of the Staff, relying on the effect of the gas to complete the job that the artillery had only begun. But the British Army’s gas attack was a very different venture from the Germans’ gas-based attack at Ypres. There the Germans had used no preliminary barrage, nor brought up reserves; they had simply given the gas to the troops holding the position and waited for a favourable wind. The British had committed themselves to the 25th September date by bringing up their attack troops, firing the four-day barrage, and, most importantly, agreeing to coordinate their assault with the two French attacks which were in
train on the 25th. The British Staff had created an alternative plan for the eventuality of the wind not being appropriate, one in which the British artillery concentrated on a small area, and only two divisions attacked. But, despite this plan, the British guns had been spread evenly along the seven-mile frontage, so it was impossible for the back-up plan to be put into action. In fact, the British had taken a gamble on the wind by creating a battle-plan that relied on gas and was committed to a particular timing. Unfortunately, the appropriate wind did not arrive.

On the morning of the 25th, it was left to Haig to make the crucial decision. The wind was extremely slight and gusting in different directions. At 5.15 a.m., after observing the smoke from a cigarette and the apparently increasing breeze in the poplar trees, Haig decided to go ahead with the assault. A few minutes later, when the breeze died, Haig asked if the order could be recalled and was informed that the messages had already gone out and could not be reversed without extreme confusion - the army was now committed. The gas was released from cylinders in the front-line trench and soon formed a huge yellow cloud. On the right wing of the attack, that of IV. Corps, the cloud slowly rolled over no-man’s land and into the German position. On the left, for I. Corps it was barely disturbed by the breeze and hung like a pall over no-man’s land, through which the attacking troops had to pass. In some places the gas actually rolled back into the trenches of I. Corps, inflicting horrible casualties in the trenches packed with men for the assault. Even amongst the divisions of IV. Corps, whose gas had travelled well, there were some who found as they advanced into no-man’s land that the inadequate barrage had failed to cut the wire all along the front (fatal proof of the fact that gas was no substitute for artillery). Instead of the entire British force moving forward as one, the attack broke up into a series of piecemeal rushes. Where the gas rolled back or hung in no-man’s land, or where wire cutting had been inadequate, the attacks failed, often with heavy losses. Where the gas blew across well and the wire cutting had been accurate and well controlled, the attackers got through to the German trenches and bitter hand-to-hand fighting ensued. To chronicle the woes of the attacks that failed would show nothing new, for they were simply a repetition of the
slaughter of Aubers Ridge. For the units held up in no-man’s land by wire or a wall of their own gas, there was no amount of bravery or special tactics they could employ to save themselves; they simply provided targets for the machine-guns and artillery of the German defence.66

By night-fall the positions of the attacking divisions were varied. Of Gough’s I. Corps, two divisions had managed, despite the gas, to enter the front lines of German defences and capture a number of strong points, the Hohenzollern Redoubt amongst them. The 3rd Division of I. Corps had failed to advance at all, the attack broken up by gas. The divisions of Rawlinson’s IV. Corps had also had mixed results. The ruins of the village of Loos, which had been converted by the Germans into a redoubt in their front line, had been overrun, but Hill 70, a crucial artillery observation position behind the village, had resisted all attacks. The second line of German defences was sited on the reverse slope of Hill 70 and, with uncut wire and machine-gun positions still intact, presented an insurmountable obstacle to the assaulting divisions. The most successful of the assaults was that by the 1st Division, the left-hand division of Rawlinson’s IV. Corps. Along a frontage of approximately half a mile, the 1st Division had reached the German second line, the only attack to do so.67

For the artillery supporting the successful divisions, the problems encountered at Neuve Chapelle emerged again. The German second line was beyond the range of the British field guns and invisible to F.O.O.s. To make any further advance possible or to protect the advanced troops from counter-attack, field batteries would have to advance and new observation positions be established. The smoke, dust and gas shroud over the battlefield made ranging from the air impossible. The rapid deployment of the field batteries into no-man’s land, the supply of those batteries with ammunition, and the establishment of new forward observation positions proved, as it had done at Neuve Chapelle, impossible.
Richard Hilton was one of the observation officers who had advanced with IV. Corps into Loos village and towards the German second line abreast Hill 70.68 Loos was a coal mining town in more peaceful times and the huge pit-head just outside the village attracted Hilton’s attention. The pit-head, Hilton recalls, was a

"... massive steel girder work construction which rose high above the village and its surrounding undulations and dominated both the British and German trenches for many miles to north and south. It was an obvious place for artillery observation posts to establish themselves and many FOOs made a bee-line for it as soon as its base was over-run by our infantry."

Hilton, wanting to get even further forward, advanced to the top of Hill 70, the very limit of the British advance, but found

"the hill was no place from which to conduct artillery observation. The only way to remain alive was to lie low in a shell crater or, if one had to move, to do so by crawling like a worm. Any attempt to raise the head for a look around instantly drew machine gun fire from the slag heaps and pit heads to our right."

Hilton crawled back to the tower and found that "many other FOOs had installed themselves already in the best seats so I had to take what was left". By climbing to the top of the pit tower Hilton was able to find a position and begin to direct his battery. Each observer had his own telephonist to relay messages to batteries and to repair the lines when they were cut. Cutting was very frequent as the many lines hung down from the tower in bundles and then ran across the open ground. W.J. Kemp, a telephonist in the battle, recalls the confusions and the home-made equipment used to remedy them.

"All telephone lines at that time were Earth returns and to tap in our line, which was labelled to distinguish it from a dozen others which may or may not have been on the same route and lined up with it, we had a D/3 telephone, a short wire for the line with a safety pin attached to pierce the battery line - you hoped it was your own line and that it was not cut in any other place - and for the earth we had a short wire, a 303 bullet, and so we made contact with our battery or OP. All lines were labelled by units but it was found that a unit was not above nipping a bit of your line to mend their own, leaving our labels still on the line - this confusion I’ll leave you to sort out ..."69
Kemp and his fellow telephonists attempted to maintain the lines under the constant shell fire the Germans flung at the tower from "every kind of artillery". Although the tower was struck many times, it withstood the fire and Hilton made contact with his guns. The guns that raked the British position were still beyond Hilton’s view, although the machine-guns that pinned down the infantry on Hill 70 were clearly visible. They were, however, beyond the range of most of the British artillery; only those batteries which had got forward could bring effective fire to bear and the few batteries that had advanced in the face of the German barrage and tangled battlefield struggled to get ammunition up to the guns. The few guns that Hilton could get to fire on the German positions were obviously lacking the accuracy to hit the machine-guns.

"Up to the limits of our meagre ammunition supply, we did our best to crush the machine guns which were lacerating the bare slopes of Hill 70."

After two hours, the Germans launched their counter-attack at Hill 70. The British artillery being unable to bring fire onto the attacking Germans, the tower position had to be abandoned in great haste.

When evening fell, the attacking British divisions had lost over 15,000 men as casualties, one in six of the assault troops. The only reserves available were the Cavalry Corps, and XI. Corps, the General Reserve, which had been held back some eleven miles from the battlefield. Only a strenuous route march would bring the XI. Corps to the battlefield by mid-morning of the 26th. The Germans were able to bring 22 battalions of reserves to their threatened positions during the afternoon and early evening of the 25th. It was these reserves who had driven Hilton from the tower. They had also driven the 1st Division from their precarious hold in the second line and had manned the second line such that when the British reserves arrived, the position was, in fact, held in greater strength than the original attacking force had faced the day before. Against these, the forward troops, exhausted by a day of fighting and a night in trenches under constant German shell fire, and the footsore troops of the reserve were flung during the afternoon of the 26th. Artillery
support was virtually non-existent. The 15th Division attempted to capture Hill 70. For their preparatory bombardment they had only the services of the field guns of their own divisional guns. Of these, only four batteries had managed to get forward by the time of attack. The bombardment was of one hour’s duration but one battery of howitzers ran out of shells during even this brief period and its guns were abandoned. The attack failed. The reserve Divisions, the 21st and 24th, attacked with no preparatory barrage at all. These attacks also failed with heavy losses. By the 27th and 28th, the German defences had received further reinforcement, including elements of the Guard Corps. These led a series of counter-attacks which recaptured the significant first line redoubts lost to the British, the entirety of Hill 70, Fosse 8, and the Hohenzollern Redoubt.

The First Army continued to make piecemeal assaults against the ever-strengthening German position, the last of these on 10th - 13th October, in desperate attempts to recapture the Hohenzollern Redoubt. The shortage of shells was by now so acute that the bombardment was a mere two hours, fired by 426 guns, of which 54 were heavies. The wire remained uncut, in fact only four small gaps had been created. The 1st Division’s men, crowded in them, were cut down by German machine-guns. The division lost 1,200 men in the assault. It was to be the last attack of the Loos offensive. Although Haig continued to prepare for a further attempt on 4th November, the increasingly bad weather brought the campaigning season of 1915 to an end. British losses from 25th September to 16th October in the battle of Loos were over 50,000. British losses for 1915 were over 285,000. In the disappointment felt by all in British politics and the army, Sir John French was sacked and Haig appointed to replace him. 1915 had indeed been a brutal baptism of fire for the B.E.F.

During the course of 1915 the British armies on the Western Front had launched four major attacks against the German defences, Neuve Chapelle, Aubers Ridge, Festubert, and Loos. They had also launched a number of smaller assaults, the most notable a series of
actions attempting to capture Givenchy. They had also fought a number of defensive actions, primary amongst which was the German gas-led attack of Ypres.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 10-13</td>
<td>Neuve Chapelle</td>
</tr>
<tr>
<td>March 22-May 25</td>
<td>German attack on Ypres</td>
</tr>
<tr>
<td>May 9</td>
<td>Aubers Ridge</td>
</tr>
<tr>
<td>May 15-25</td>
<td>Festubert</td>
</tr>
<tr>
<td>June 15-16</td>
<td>Attack against Givenchy Ridge</td>
</tr>
<tr>
<td>Sept 25-Oct 8</td>
<td>Official battle of Loos</td>
</tr>
<tr>
<td>October 13-19</td>
<td>Final failed attempts at Hohenzollern Redoubt bring Loos in reality to end.</td>
</tr>
</tbody>
</table>

The four attacks launched by the forces of Sir John French had seen major, indeed fundamental, changes in the tactical approach to artillery work and the entire offensive tactics of the British Staff. At Neuve Chapelle, the British attacked on a 1,450-yard frontage with 530 guns in support. Of the 530, 66 were heavy guns but half of that number were near useless, being obsolete or improvised pieces. Because the entire approach to the battle was based on surprise, the preliminary bombardment was a mere thirty-five minutes. At Aubers Ridge the artillery resources were greater, 637 guns, with 121 being heavies, but the frontage was also greater, 3,900 yards. The plan was again based on surprise and the preliminary bombardment was again thirty-five minutes. The result of spreading so few guns over such an extended area of defence was catastrophic. The German defences remained intact and the attack was a complete failure.

The surprise bombardment strategy was abandoned at Festubert. The bombardment was slow, deliberate and concentrated. The assault took the form of twin attacks, with the I. and Indian Corps attacking on a frontage of approximately 2,400 yards, and 600 yards to the south the IV. Corps attacking on a constricted frontage of 850 yards. To support these assaults, the British used 433 guns with 141 of these heavies. But the number of heavies was again rather misleading. Of the 141, 54 were old 4.7-howitzers, 20 more were obsolete 5-inch howitzers, and the force also included 36 6-inch guns converted from coastal forts. Ranging was conducted without any attempt at deception over a period of days, and the bombardment itself lasted sixty hours and consumed 101,366 rounds of ammunition. The depth of the attack was limited to 1,000 yards, to concentrate further the bombardment.
which was, therefore, confined to the first line of German defences. As a result of this fire, the attacking infantry were able to enter and occupy many of the German trenches they assaulted. However, the narrowness of the attack frontages, combined with the ample warning a two-and-a-half day bombardment gave the defenders, meant that German artillery batteries which had been positioned on either flank of assault were able to inflict heavy casualties on the attacking units. The attacking infantry also discovered that the Germans, rather than simply cowering in their trenches under the British bombardment, had in fact constructed a second line of defence, out of the vision of the artillery observers and beyond the range of most of the British guns. Attempts to advance into this second line failed. Without artillery support, and facing coordinated salvos from German artillery and many hostile machine-gun positions, casualties rose rapidly. The 21st Queen’s Own suffered losses of 21 out of their 22 officers and 433 out of 773 rankers in such an attempt. When the British artillery attempted to assist the infantry, the great range and lack of observers made their fire as much a threat to the British infantry as to the Germans. The Royal Scots Fusiliers suffered heavy casualties and their attack failed completely as they were shelled by British guns of the 7th Division. After several days of trench fighting and intense counter-attacks by German forces, the British retained only a few hundred yards of the German front line. Total casualties reached over 16,000.

Having consumed the great majority of their ammunition stockpile, the British were confined to minor attacks. The IV. Corps attacked at Givenchy, again on a narrow frontage of approximately 800 yards and preceded by a fifty-hour bombardment. As at Festubert, the Germans had reinforced the threatened area and progress was limited. The British infantry found that the Germans’ use of their high powered 'stick bomb' grenade, which the British had no effective answer to, meant that even small gains were difficult and costly to retain. Efforts to continue the attack the next morning, after a two-hour bombardment, failed completely. Other minor attacks, such as those at Bellewaarde and Hooge, followed the same pattern. The results of these first attempts at the long-barrage strategy was to force the British command to abandon the narrow frontages they had previously used. At Loos the frontage was 11,200 yards, more than 10 times longer than in their previous largest
assault. By spreading the attack, the British hoped to push the defensive flanking artillery of the Germans away from the centre of the attack, allowing the British infantry to cross no-man's land and engage the defenders unmolested. Unfortunately for the British, this also spread the British guns along a wide frontage and they had only a handful of guns more than they had used at Neuve Chapelle, 110 heavies and 841 field guns. This force fired over 233,000 shells from the field guns and 22,000 from the heavies, over a four-day bombardment. The fire was spread over such an area and was so ill-directed that the Germans were not alerted to British intentions. Cloud gas proved that it was no substitute for heavy artillery when the attack failed along most of the extended frontage. In the few attacks that did make some progress, the German second line of defences again proved insurmountable. Beyond the range of both observers and most guns, British assaults against the second line were inevitably met by well organized counter-attacks and failed without exception. British casualties were over 50,000.

Tactically, 1915 had seen enormous changes to the British artillery and the attacking strategy of the British Army. After the failure of the short, sharp surprise barrage, they had adopted the long methodical bombardment. This, in turn, had led to the adoption of greatly extended frontages. What Loos revealed was that, given that the great majority of British guns were light field pieces, and given the limited supplies of ammunition, particularly the vital high explosive shells, the Royal Artillery were unable to produce the sort of destructive bombardment over several miles of German defences that the new strategy required. Despite the repeated failures, however, 1915 had seen various improvements in techniques and organization as the artillery attempted to come to terms with the new tasks confronting them.

Great strides had been made in the independence and centralizing of artillery command. At Neuve Chapelle, five C.R.A.s and a multitude of battery commanders fought and bickered over artillery arrangements. By Loos, the C.R.A.s had been put under the control of corps artillery officers and the artillery command was in the hands of two men.
Heavy artillery groups had been formed, the H.A.R.s, and the independence and crucial significance of the role of the heavy guns were recognized. In the vital matters of long-range observation and accuracy, many steps had been taken to overhaul the great lead held by the Germans. F.O.O.s and telephone communications had been introduced, and by Loos their work was recognized as being of such significance that, despite the labour involved, each F.O.O.’s telephone line was buried six feet deep to avoid its being cut by German shell fire. At Loos, IV. Corps buried 600 miles of cable in its section alone. The survey and ranging sections had come into existence, one attempting to produce accurate small-scale maps of attack areas, the other attempting to develop methods to fix the location of the artillery’s most troublesome target, hostile German batteries. Attempts were also made to duplicate the Germans’ use of airborne artillery observers. By Loos, ten squadrons of the R.F.C. were devoted entirely to assisting the artillery. The primitive nature of the radios used, which jammed each other to such an extent that only three could be used at any one time, the difficulties of actually observing anything on smoke-and-dust-shrouded battlefields, and the lack of any effective communication system other than radios, made their contribution minimal. The airborne observers, however, provided some sort of solution to the constant problem of fighting enemies who were well dug in on the reverse slopes of hills or rises, and thus obscured from the view of the F.O.O.s.

The most fundamental problem that faced the Royal Artillery, however, and one to which there was no quick solution, was that it simply lacked the guns and ammunition to pursue the long bombardment strategy that provided the best results. At Neuve Chapelle, the Royal Artillery had 530 guns, of which 66 were heavies. By Loos, this had risen to an attack force of 951 guns, with 120 heavies. But these 120 still included a large proportion (over 50%) of guns that were either obsolete when war broke out (like the 4.7-howitzer) or were improvised from other sources (such as the 6-inch guns). The adoption of the long bombardment approach had also worn the guns beyond any pre-war estimates. The small forces of heavy guns had been in almost constant action since the beginning of the year and, as the bombardments grew longer, they fired day and night - at Loos for four days on end.
This not only caused barrel wear and thus loss of muzzle velocity and accuracy, but rapidly consumed the entire stockpile of shells. When Loos ended, almost every battery’s lines of communication were starved of shell, and the army, as a whole, had only enough shells to sustain one week’s fighting. During Loos itself, batteries had been rationed with shells. To make the inadequacy of British resources in heavy guns even worse, the great majority of shells which arrived during 1915 to fill the stockpiles were shrapnel, not H.E., which is what the heavy guns required for their destructive tasks. Shrapnel shells were the only ones Britain’s shell manufacturing plants were able to produce at short notice, being already tooled up for the job. For reasons examined in the next chapter, H.E. shells had proved impossible to produce in any quantity.

Thus, at the end of the bitter year of 1915, the artillery found itself faced with a situation in which the Staff had abandoned all the precepts taken as axiomatic when the artillery had prepared for war. Rather than firing short, sharp bombardments in a war of rapid manoeuvre and constantly changing position, the gunners were asked to produce long, methodical, accurate and extremely destructive bombardments from entrenched positions. Unfortunately for them, the great majority of guns they brought to war, the 18-pdrs. and 4.5-inch howitzers, and the shrapnel ammunition they fired, were entirely unsuited to accomplishing the tasks now required. The result was that British attacks were repeatedly repulsed by the German defenders, with heavy losses. No matter how the British changed the frontages of attack, or improved the structure of command, the simple and glaring fact was that in 1915 the British Army did not have the artillery resources to launch successful attacks on the Western Front. The major challenge facing the British in 1915, and indeed in 1916, was not primarily a tactical one, it was a manufacturing problem. While the army had been battling in the trenches, another equally crucial battle had been occurring in the factories and furnaces across Britain, and in the offices of the newly created Ministry of Munitions. It was the battle to extemporise the great munitions manufacturing industry from the ground up and build a great force of artillery with which the British could tackle
the German defences. And on the success or failure of that battle would hang the future of the entire British military effort in the Great War.
2 Ibid. p. 11.
7 G. Bruchmüller, Die Deutsche Artillerie beim Angriff in Stellungskrieg (Charlottenburg: Offene Worte, 1926) chap. 1.
10 These engagements are reviewed by Anstey and Rawlins. The artillery, and indeed the entire B.E.F. were so disorganized by the retreat and pressure of the offensive action that no 'artillery notes', which would be issued after all later engagements, were produced.
11 Quoted in J. Terraine, Mons (London: Pan, 1972) p. 73.
12 See chap. 1 of Bruchmüller, Die Deutsche Artillerie in den Durchbruchschlachten des Weltkriegs (Berlin: Mittler, 1922) chap. 1.
13 M. Farndale, History of the Royal Regiment of Artillery 1914-1918 (Dorchester: Dorset, 1986) p. 51. Farndale reviews the shelling of British batteries and concludes that because the Germans could "concentrate masses of guns onto a single target" that they had "won the day on the Montay Spur".
14 Correspondence of Birch to Edmonds, 8 July 1930. Cab 45/132, PRO.
16 Figures based on 'Weekly Returns' for guns and ammunition, papers collected by the army quartermaster and sent off to Whitehall, and now collected in Mun. 4, PRO. It is on these figures that Anstey, Farndale and Edmonds draw their figures for all the analyses of artillery.
17 Weekly Returns.
18 Detailed analysis and the history of each of the ordinances can be found in the Historical Records sequence of Mun. 5. A condensed analysis is given in History of the Ministry of Munitions, vol. 1, chap. 3, part 2.
While they installed the telephone system, the British also experimented with a variety of other communication systems, the most notable being varieties of signalling via earth currents. This was, in fact, wireless, where the message travelled through the earth rather than the atmosphere. The power buzzer was the most effective of these. The problem of the Germans intercepting the messages was, however, never overcome. Even the telephone lines, unless well insulated, proved to be susceptible to German eaves-dropping. Mun. 7/320.


Ibid. p. 342.


Rawlins, op.cit., p. 95.

As no minutes of these disputes was kept, it is impossible to study directly the arguments and eventual resolution. Fortunately, Rawlins (who was present at them) and Anstey (who discussed the disputes with the major participants) left accounts of preparation for Neuve Chapelle. See Rawlins, op.cit., pp. 91-6 and Anstey, op.cit., Chap. III.

Edmonds, Military Operations France and Flanders 1915, vol. 1, p. 84, footnote.

Edmonds explains how this administrative foul-up occurred.

As with all the engagements on the Western Front, Edmonds provides a detailed account of the infantry assault. See Edmonds, Military Operations France and Flanders 1915, vol. 1, chap. VI. For an account of the attack written at the time, see Butler’s review of the battle and its problems, ‘General Principles for the Attack’, 13 April 1915, General Lord Rawlinson of Trent Papers, 5201/33/67, NAM.

Rawlinson Diary, 10 March 1915, Rawlinson Papers, 5201/33/26.

Farndale, op.cit., p. 90.

Der Weltkrieg, op.cit., vol. 1, 1914, p. 100. The figures are used in Edmonds, Military Operations France and Belgium 1915, vol. 1, pp. 116-7, note.

Haig’s wireless message quoted in Edmonds, Military Operations France and Flanders 1915, vol. 1, p. 143. The British Army was so small, and orders so brief that Edmonds is able to reproduce as appendix almost all the significant orders issued during the attack.

Artillery Notes: Neuve Chapelle, Rawlins Papers, MD 1162.


First Army Operational Order No. 22, 6 May 1915, WO 158/182 PRO.


The improvement in the German defences facing the British forces is reviewed in Edmonds, Military Operations France and Flanders 1915, vol. II, p. 15.


As IV. Corps attacked and the German front line trenches were supposedly under intensive fire, IV. Corps’ troops could see German bayonets in the front line positions. Edmonds, Military Operations France and Flanders 1915, vol. II, p. 33.


Virtually every type of gun or howitzer used by the British was by this time suffering from barrel and recoil problems because of over use. The multitude of problems was placed in the hands of the Director of Gun Design in the newly formed
Ministry of Munitions. DDGD Mun 4. These papers, and the problems, are reviewed in the History of the Ministry of Munitions, vol. X, chaps. 1-5.

53 How French tactical thinking changed from reliance on rapid infantry assaults to long, preparatory bombardments is well characterised by Foch. Foch, who before the war was one of the most extreme advocates of short, sharp bombardments, having experienced the catastrophe of the first French assaults, reversed his views rapidly. It was his Tenth Army which launched the attack in Vimy, the first long, sustained bombardment of the war. He explained his thinking in a long paper to Joffre, reproduced in Foch, op.cit., pp. 212-3.
55 It is difficult to measure the direct effect of the Vimy attack by the French on British tactical thinking. Du Cane, the artillery advisor to G.H.Q., has left no record of examining Vimy, nor were any 'artillery notes' drawn up for either Vimy or Aubers Ridge. But the effect of Vimy is, I believe, clear in that the next attack launched by the British, Festubert, saw the abandonment of surprise in favour of the long bombardment. The effect on Haig of the success of the French bombardment is noted in his diary (10 May 1915, WO 256) and by Edmonds, who corresponded with Haig for his analysis of the change in tactics. It was only after examining Vimy that Haig altered the plans for Festubert, from another attempt at surprise to a longer, methodical bombardment. Edmonds describes this as "the French method", Military Operations France and Belgium 1915, vol. 2, p. 47.
56 Haig Diary, 10 May 1915, WO 256.
60 I. Corps Artillery Instructions, 18 September 1915, WO 158/182.
61 Farndale, op.cit., p. 120.
62 The correspondence between Du Cane and senior artillery officers is reproduced in Anstey, History of the Royal Artillery, Appendix One: Command and Staff.
64 IV. Corps Memorandum, 21 September 1915, WO 158/182.
67 Ibid.
69 Ibid.
71 The Loos File, WO 106/390, contains reports from all senior Staff Officers concerned with the late arrival of the reserves at Loos. The matter was analysed in some detail, for it led to the dismissal of French and the promotion of Haig.
74 Ibid. pp. 391-3.
75 Ibid. p. 61.
CHAPTER TWO

THE PRICE OF UNPREPAREDNESS

"I feel bound to look upon my department as the custodians of the interests of the army as regards the safety and quality of the munitions supplied by the Ministry, and in consequence, it is necessary for me to press from time to time for modification of design. I may say, however, that I am as fully imbued as anyone in the Ministry with the necessity for increasing output to the utmost, and that the policy of my department is governed by this motive."

General Du Cane 7.2.16
Director General
Munitions Design

"I was told to leave the dug-out and run after the German in front of me, whilst another followed behind. I was running for a long time and climbing over huge shells that had not exploded. I must have seen hundreds of them. Duds.

Pte. F. McLaughlin
Captured on the Somme
During the course of 1915 British artillery tactics had undergone a revolutionary change, a change brought about as a consequence of the great difference between the war Britain had prepared for and the reality of the Western Front. After Aubers Ridge, and the change to long, destructive, methodical bombardments, using massed artillery in great numbers, it was recognized by both the G.H.Q. Staff and the Government of London that the mobile, rapid-firing, but largely small-calibre guns the British had built before the war were not suitable for the task of massive and long-range destruction now required. The ammunition stock-pile was inadequate and consisted largely of shrapnel rather than H.E., which would have been far more effective in the work of destruction. The galvanizing of British munitions production from mid-1915 was a stupendous task, undertaken almost entirely under the agency of the Ministry of Munitions and its energetic Minister, Lloyd George. Created during the "shell scandal" that erupted after Aubers Ridge, the Ministry quickly absorbed all of the munitions-making facilities of the War Office and grew to control a vast empire of shell factories and gun-making plants. It bought en masse the entire British output of steel, iron, non-ferrous metals, glass - in fact all the raw materials of mass production. It became Britain's largest trading enterprise as it placed huge orders for guns and shells with manufacturers in America and Canada. Perhaps the most remarkable feature of this growth in munitions-making capacity was that almost the entire industry was extemporized from the ground up in the space of two years, 1915 and 1916. The outbreak of war had found Britain with very little munitions-making capacity, lacking many of the raw materials and techniques of production, and with no contingency plans for a rapid expansion. When this hasty improvisation is taken into account, the disastrous teething problems of the new industry and the sometimes costly effects of its deficiencies become understandable.

The Problem
Before the effort to produce a great artillery force is examined, it is necessary "... to realise clearly the nature and limits of the preparatory measures which had been taken and the complete collapse of the whole doctrine upon which these preparations were based", as the author of The History of the Ministry of Munitions wrote. The doctrine that the writer refers to was the British General Staff's view that any European Continental war would be short and highly mobile, and would involve only the regular armies of the combatant nations. As we have seen, the Staff's preparation for this war had led the Royal Artillery to arm itself with light, mobile field guns using mainly shrapnel shells. The retreat of 1914 and the first efforts to attack the German defensive line led to a rapid and complete reappraisal of the nature of Britain's military effort. The pre-war doctrine envisaged a British army of six divisions, about 450,000 men fighting on the continent, while the territorial divisions, 250,000 strong, assumed responsibility for home defence. The army had, by November 1914, grown to 1,000,000 men, by July 1915 to over 2,000,000. Even by the end of 1914 the British Staff were planning for an army of 50 divisions, but the sheer increase in the size of the army was not the only facet of the war that the Staff had failed to anticipate. As we have seen, the British artillery doctrine underwent a complete reversal during the early months of 1915. The lack of heavy artillery armed with high explosive shells was recognised as crucial by all in the British Army Staff. Thus the challenge to British manufacturing industry was not only to provide guns for the divisions being rapidly created by the expansion of the army in response to Kitchener's appeal, there was also the need to create a force of heavy guns and shells to provide the artillery with greater destructive force and range. The effort to meet this challenge can be divided into three areas: gun production and design, shell production, and the problem of building effective fuses.
Guns

It is worthwhile to review, at this point, British artillery resources at the outbreak of the war. The standard equipment taken to the Continent by the six regular divisions reflects the prevailing emphasis on lighter weapons and small stockpiles of ammunition.

<table>
<thead>
<tr>
<th>Number of Guns</th>
<th>Ammunition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Gun</strong></td>
<td><strong>Batteries</strong></td>
</tr>
<tr>
<td>18-pdr.</td>
<td>54</td>
</tr>
<tr>
<td>13-pdr.</td>
<td>6</td>
</tr>
<tr>
<td>4.5-in.</td>
<td>18</td>
</tr>
<tr>
<td>60-pdr.</td>
<td>6</td>
</tr>
</tbody>
</table>

The artillery of the regular army was not all that Great Britain had at her disposal. In addition there were the weapons attached to the forces of the Empire, those of the training schools and those with their battalions in distant Colonial postings. When these are taken into account the totals become:

<table>
<thead>
<tr>
<th>Type of Gun</th>
<th>No. of Guns</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-pdr.</td>
<td>996</td>
</tr>
<tr>
<td>13-pdr.</td>
<td>185</td>
</tr>
<tr>
<td>4.5-in.</td>
<td>144</td>
</tr>
<tr>
<td>60-pdr.</td>
<td>38</td>
</tr>
</tbody>
</table>

This was the sum total of the standard equipment at Britain’s disposal to arm the expeditionary force. In reserve was that of the territorial army consisting of obsolescent hand-me-downs from the regular army which, though officially discarded, Britain would be forced to consider bringing into use. Of those, many were found to be beyond repair so that
the number of guns theoretically available and those actually capable of employment differed as follows:

<table>
<thead>
<tr>
<th>Type of Gun</th>
<th>In Existence</th>
<th>Actually Employed</th>
</tr>
</thead>
<tbody>
<tr>
<td>O.F. 15-pdr.</td>
<td>85</td>
<td>20</td>
</tr>
<tr>
<td>15-pdr. B.L.C.</td>
<td>623</td>
<td>228</td>
</tr>
<tr>
<td>5-in. how.</td>
<td>150</td>
<td>80</td>
</tr>
<tr>
<td>4.7-in.</td>
<td>164</td>
<td>88</td>
</tr>
</tbody>
</table>

The area in which the British artillery was most deficient was, as we have seen, weapons of heavy calibre. Large-calibre weapons were the responsibility of the Garrison artillery; they had three types of guns at their disposal:

- 6-in. B.L. Mk. VII
- 6-in. 30-cwt. B.L. how. Mk. 1
- 9.2-in. B.L. how.

A number of these guns, particularly those of heavy calibre, which were the army’s most desperate requirement, had technical problems. Both the 5-inch howitzer and 4.7-inch howitzer were obsolete weapons. They did not have hydraulic recoil, which made the rate of fire very slow and the fire inaccurate, as the gun jumped about in the pit with each shot. The 4.7’s shell had a driving band that was too narrow and was often ripped off on discharge, causing a loss of muzzle velocity and range. The band coming off also often caused premature. The 6-inch B.L. was also an obsolete weapon, whose shell could carry little charge and whose range was limited by poor barrel-rifling. This also caused the barrels to wear rapidly and muzzle velocity to drop, and thus accuracy was impaired. The 6-inch howitzers were a truly terrible weapon. These guns had been brought from the coastal forts from fixed emplacements, had their long barrel cut down and were then mounted on a temporary carriage. The cutting down of the barrel not only reduced accuracy to a great degree, but increased the recoil of the gun, giving it a vicious 'kick'. As the weapons had previously been fixed, they had no hydraulic recoil and extraordinary steps had to be taken to halt the gun. Ramps, up to five feet high, had to be placed behind each wheel of the gun and with each shot, the gun would run back into the pit. As one can imagine, accuracy was near to impossible as the gun’s altitude changed with each round. The one
modern effective heavy gun was the single 9.2-inch howitzer, which had finished its testing program in June 1914 and had been sent for field trials with the expeditionary force. With hydraulic recoil and thus high rates of fire and accuracy, a 300-pound H.E. shell, and range of 10,000 yards, it was the only British weapon that could match the German heavy artillery force.\textsuperscript{10}

To add to this meagre force, Britain had only a further handful of weapons of heavy calibre. As a temporary expedient, another thirty-six 6-inch howitzers could be converted; there were four hundred old 9.4-inch howitzers, relics of the South African war, whose inaccuracy and limited range made them virtually useless, and eighteen 10-inch R.M.L. guns, whose weight (12 tons for the gun and 17 tons for the carriage) meant that the only way they could be brought to bear on the German lines was by building special locomotives, carriages and railway lines to haul them up to the Front.\textsuperscript{11} It was with this grotesquely inadequate force that Sir John French’s army encountered the Germans in the autumn of 1914 and the spring of 1915. To provide some comparison, the German field artillery consisted of 7,150 lighter field guns and a huge force of 3,350 heavy guns and howitzers (above 5.9-inch calibre).\textsuperscript{12} The entire force of German heavy weapons was modern, well designed and manufactured by the specialist heavy gun manufacturer, Krupp of Essen.

The utter inadequacy of the British Army, with respect to artillery, was recognised at the Boulogne Conference held on 19th and 20th June 1915. The plan that emerged from the conference was called Gun Programme A.\textsuperscript{13} Prior to the adoption of this program, the war office had simply increased all of its standing orders for guns with the existing manufacturers and, as previously mentioned, attempted some improvisation with coastal defence guns. This \textit{ad hoc} approach had indeed produced some new guns by the time of the Boulogne Conference.\textsuperscript{14}
The planning for a great expansion in the Royal Artillery went through three distinct phases. The first of these was the period during which the War Office controlled the ordering of munitions. The officials of the War Office, working on the assumption that Kitchener’s call to arms would create an army of twenty divisions, ordered the equipment which was to fit out these new divisions with the standard divisional artillery that the regular divisions had taken to France. This required the building of 3,407 18-pdrs., 1,284 4.5-howitzers, and 725 60-pdrs. The orders emanating from the War Office were called Gun Programme A. After Aubers Ridge, and the adoption of the long barrage tactics, a second program was begun, to build a great force of heavy artillery. Programme B required the building of 800 additional 60-pdrs., 560 6-inch howitzers, 372 guns of either 8-in. or 9.2-in. calibre and 60 super heavy guns, either 12- or 15- in., for long-range destructive work. By September 1915, however, as the army prepared for the battle of Loos, the Ministry of Munitions, which by this time had taken over control of all facets of gun ordering and manufacturing, again reassessed the needs of the army. The Ministry, dealing directly with the War Council, issued on 8th September Programme C, with vastly increased amounts of heavy artillery compared with Programme B.15
There were two profound problems facing the British in the attempt to produce rapidly a
great heavy artillery force. The first was pointed out by Kitchener in his assessment of
Programme C. He noted that such a force as contemplated in the program would require
6,876 officers and 162,328 trained gunners to operate. It would not be possible to withdraw
experienced battery commanders from the field to train these men, nor were any artillery
schools or ranges able to accommodate such a vast number of trainees.16 But, for the
officers of the Ministry of Munitions, this was a secondary problem that the army would have to solve. For them, the most pressing problem was that they discovered that there were not the factories in Britain capable of filling even the tiniest proportion of the orders they wished to place.

There were only six sources of gun manufacture in Britain in 1914: the Royal Gun
Factory at Woolwich and five private ordnance making firms, Armstrongs, Vickers,
Cammell-Laird, Beardmore, and the Coventry Ordnance Works.17 The combined output of
these sources could not hope to reach Programme C’s production levels by the summer of
1916. One of Lloyd George’s first acts in reforming armaments production was to authorize
the Ministry of Munitions to lend the private firms over 2,300,000 pounds to expand their
factories.18 Despite this expanded capacity, the firms could not match the output required
by the program and were forced to sub-contract work out to local small manufacturing
firms, an expedient sanctioned by the Ministry who called it "cooperative manufacture".19
Impressed by the urgency of the situation, the Government authorised production to proceed
without establishing the price of the plant extensions or of the guns produced.20 The

<table>
<thead>
<tr>
<th>Type of Gun</th>
<th>Number to be Built</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-pdr.</td>
<td>4,800</td>
</tr>
<tr>
<td>4.5-in. how.</td>
<td>1,600</td>
</tr>
<tr>
<td>60-pdr.</td>
<td>800</td>
</tr>
<tr>
<td>6-in. how.</td>
<td>900</td>
</tr>
<tr>
<td>8-in. how.</td>
<td>430</td>
</tr>
<tr>
<td>9.2-in. how.</td>
<td>358</td>
</tr>
<tr>
<td>12-in. how.</td>
<td>76</td>
</tr>
</tbody>
</table>

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without establishing the price of the plant extensions or of the guns produced.20 The
Government also looked overseas, particularly at the manufacturing might of the United States. Orders were placed with the Bethlehem Company for two hundred 18-pdrs. and with the Mid-Vale Steel Company for two hundred 6-in. howitzers. American firms used the British Government's predicament to squeeze the highest possible price from them, up to three times the price asked by British firms, but the Government had no option but to pay what was asked.

The task facing the Ministry was that of extemporizing a great manufacturing capacity in one of the most technically complex industries of the day. It is not surprising, therefore, that the Gun Programme suffered many teething problems and that for 1915 and most of 1916 production never actually met the Programme's requirements.

One of the major problems was that of re-tooling sub-contractors with the equipment needed in the complicated process of gun casting. Another problem was of a different kind. Some of the guns requested by the British Staff had not even been designed at this stage. When the 8-in. gun was authorized to go into production on the 5th August, only the cradle and carriage, not the gun itself, had left the drawing-board. Most of the other guns were undergoing design modifications as the experience of battle showed up minor deficiencies in existing designs. These constantly changing demands emanating from the battlefield added to the complexity of the negotiations between the Ministry and the manufacturers engaged in tooling up for production.

In November 1915, the Bethlehem Company, the American manufacturer most favoured by the British Government and with whom substantial contracts had been placed, was set on fire by saboteurs. The fire destroyed not only the 18-pdrs. which the factory had built for Britain, but the drills, presses and machinery involved in their manufacture. Bethlehem machinery, prepared for the manufacture of 150, 4.5-in. howitzers for Britain, was also partially destroyed. This was a considerable set-back for the gun programme since
the Bethlehem Company, tooled up, could produce guns at a great rate, unhampered by the shortages of steel and workers which plagued the British factories.

In Britain, armaments firms which had expanded their factories with Government money were discovering that amongst the millions of men who had responded to Kitchener's call were many skilled ordnance workers: they could not find the skilled operators to man their new machines. By December 1915, 750 presses and other machines were idle for lack of skilled operators. Raw materials were in equally short supply since many of them came from Australia, Canada or South Africa, a supply route rendered hazardous and effectively restricted by the U-boat campaign. All of these set-backs combined to force an acknowledgement from the Ministry of Munitions by December 1915 that the projected output of Programme C would not be met and estimates of delivery were substantially downgraded. But the reality was even worse than it appeared in the Ministry's new, less optimistic predictions. Almost every kind of gun and every kind of contractor seemed to run into some kind of problem.

The 16-in. howitzer is one example. This was a crucial heavy howitzer, precisely the sort of weapon that the British artillery needed to crush German dug-outs and destroy machine-gun posts. Programme C required 560 of these weapons in 140 batteries, two for each division of the 70-division army. Vickers had been given the contract for these weapons and had undertaken a great expansion in order to meet the production rates required by the program. But their sub-contracting system was imperfect and while Vickers successfully completed the guns themselves, the firms making the carriages failed. On 31st March 1916, completion date for the contract, Vickers could offer the War Office only 67 of the completed guns. The 8-in. howitzer was delayed by a different cause. Its design was not completed until August 1915, with the consequence that the bulk of the guns would arrive in France, not in the spring, but in the autumn of 1916. But the Programme's worst set-back was the Bethlehem fire which not only destroyed the 18-pdrs. and 4.5-in. howitzers, but seems to have decisively slowed down the whole production capacity of the
factory. An order for 150, 9.2-in. howitzers placed in 1915, for example, was still uncompleted in July 1918.

The effect of these delays and problems was that when Britain came to launch its "great summer offensive" of 1916, its artillery force had barely begun to receive shipments of guns from Britain and was only a fraction of the size imagined in Programme C. In the matter of lighter field guns, the 18-pdrs. and 4.5-in. howitzers, the discrepancies were not so great, but in the vital area of heavy pieces the difference between the numbers ordered for the Programme and the number that actually arrived in time for the bombardment was very great. The Programme envisaged a force of 1,792 heavy guns with which to launch the summer offensive: 800, 60-pdrs.; 560, 6-in. howitzers; 372, 8-in. or 9.2-in. guns; 60 super heavy 12- or 15-in. guns.27 Compare this with the guns the Fourth Army actually brought to bear on the German defences in its preliminary barrage: 128, 60-pdrs. (672 fewer); 104, 6-in. howitzers (456 fewer); 125, 8 or 9-in. guns (247 fewer); and 17 super heavies (43 fewer).28

Not only were the sheer numbers nowhere near what the planners had imagined but, for reasons which will be discussed later, this deficiency was not allowed for in the offensive which proceeded on the basis of a huge force of guns. As a consequence, the older guns were again pressed into service. Most of the 104 6-in. howitzers were the 1895 model, as the replacements simply had not arrived. The same is true of the heavier guns; because the new 8-in. guns had not arrived from the factories, the old coastal defence guns were again brought into the field in spite of their notorious slow rate of fire, inaccuracy and limited range. Despite the efforts of the energetic Ministry of Munitions and despite a vast expenditure of money, Britain had failed to provide its army with the force of heavy artillery that everyone acknowledged was necessary for successful attacks on the Western Front.
But the sheer lack of guns in the preliminary bombardments throughout 1915 and 1916 was not the only problem faced by the artillery. The production of shells to supply the new artillery force had proved to be even more difficult than the production of guns.

Shells

At the time and frequently since, the woes of the British Army in 1915 - the repeated failures of Neuve Chapelle, Aubers, Festubert, and then most costly of all, Loos - were blamed on the lack of gun ammunition. During 1915 itself the army commander, French, the man soon to replace him, Haig, and even such journals as The Times newspaper, ascribed the failure of the B.E.F.'s attacks to the lack of shells. The official historian, Edmonds, also agrees that most of the problems in attacking the entrenched Germans in 1915 arose from the lack of gun ammunition, combined with the lack of heavy guns.29 Perhaps it is not surprising that it was the lack of shells that caught the imagination of the public as well as that of the soldiers at the time, for the batteries of heavy guns the B.E.F. required could hardly be imagined, but the image of the existing guns falling silent for lack of shells gave a vivid impression of Britain's unpreparedness. While the gun programmes that emerged were of vital importance, it was to improve shell production that the Ministry was brought into existence and that was its greatest challenge - and in the end, its greatest triumph. But the task was not simple. As has already been explained in the case of gun manufacture, Britain began the war with very little manufacturing capacity and no contingency plans for rapid expansion.

As it did with gun supply, in the early months of the war the War Office simply enlarged its orders for shells with existing manufacturers. The first clashes with the Germans, however, "swept away all previously accepted standards of expenditure of gun ammunition".30 As with the gun programme, it was the appointment of Lloyd George and
the Boulogne Conference which saw the first real attempts to assess shell needs and place orders for their manufacture.

<table>
<thead>
<tr>
<th>Type</th>
<th>Stocks at Outbreak of War</th>
<th>Orders placed after Boulogne Conference</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-pdr. shrapnel</td>
<td>654,480</td>
<td>6,580,923</td>
</tr>
<tr>
<td>H.E.</td>
<td></td>
<td>758,000</td>
</tr>
<tr>
<td>13-pdr. shrapnel</td>
<td>95,400</td>
<td>283,000</td>
</tr>
<tr>
<td>H.E.</td>
<td></td>
<td>50,000</td>
</tr>
<tr>
<td>4.5-in. shrapnel</td>
<td>86,400</td>
<td>347,500</td>
</tr>
<tr>
<td>H.E.</td>
<td>43,200</td>
<td>476,500</td>
</tr>
<tr>
<td>60-pdr. shrapnel</td>
<td>16,800</td>
<td>123,100</td>
</tr>
<tr>
<td>H.E.</td>
<td>7,200</td>
<td>137,450</td>
</tr>
</tbody>
</table>

These orders were placed with British armaments firms and overseas factories.

<p>| | |</p>
<table>
<thead>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Domestic production</td>
<td>7,022,000</td>
</tr>
<tr>
<td>American</td>
<td>1,280,000</td>
</tr>
<tr>
<td>Canadian</td>
<td>1,700,000</td>
</tr>
<tr>
<td>Indian</td>
<td>52,000</td>
</tr>
<tr>
<td><strong>Total ordered in 1914/15</strong></td>
<td><strong>10,054,000</strong></td>
</tr>
</tbody>
</table>

The great majority of the manufacture was to be undertaken in Britain. Although shell making was considerably simpler than gun manufacture, the producers still faced numerous hurdles. The U-boat campaign had reduced imports to Britain, which faced shortages of steel and lead, vital ingredients in making shell cases. As with gun production, skilled labour in furnaces and machine operating was reduced by army recruitment. The Ministry of Munitions followed the same procedure it had with gun manufacture, first placing vast orders for various components with private firms and then lending the firms the capital to expand their production. The objective of the program was to produce some 10,000,000 shells before summer of 1916 to stockpile for the campaign of that year, while producing enough shells to keep the army supplied during the summer of
1915. This reliance on private manufacturers broke down completely in the first few months of 1915. The firms were unable to acquire new machine tools from the US, they could not find the skilled labour to man the machines, and many had existing civilian contracts that would have to be completed before factories could be converted to shell production. It was this breakdown that created the shell shortages suffered by the British at Aubers Ridge and the preceding battles of the 1915 campaign. In response to the crisis, the Ministry of Munitions had taken extraordinary steps. In June and July of 1915 the Ministry began building National shell-filling factories in a number of locations around Britain. These were fully government owned and operated enterprises, built from the ground up to complete the last and most complex stage of shell manufacture, the filling with explosive and fusing. The Ministry also took over private establishments and converted them from civilian production to shell manufacture. Hundreds of thousands of unskilled women workers were employed in these new enterprises, taking up what had been previously skilled jobs, as shell production was rapidly simplified for mass production. The result of the feverish activity was that by the winter of 1915/16, the shell crisis was apparently alleviated. After Loos the stockpiles in France grew at an ever-increasing rate. The target of 10,000,000 shells for the summer of 1916 was, in fact, achieved. But the problem was that, in achieving this great feat, the Ministry had authorised short-cuts in design and reductions in inspection, and had generally allowed considerations of quantity to outweigh those of quality to such an extent that much of the ammunition produced during this period was defective, the shells proving to be either duds or, worse, premature.

The greatest challenge facing the shell program was that, at the outbreak of the war, Britain’s artillery had neither a supply of H.E. with which to fill its shells nor a fuse that could successfully detonate it. The demand for an effective H.E. shell was immediate, beginning from the first time the British engaged the Germans. Having concentrated hitherto exclusively on shrapnel for its lighter guns and even using a high proportion of shrapnel in large-calibre weapons, ordnance-makers and government committees embarked
on a search for a suitable filling and detonator for H.E. shells. It was to take two years before satisfactory answers were found.

Broadly speaking, it may be said that the failures with high explosive ammunition, which were a constant difficulty during the first two years of the war, were due to the fact that at the outset more shrapnel than high explosive ammunition was used by the British field army, that a really satisfactory fuse for high explosive shell did not exist, and that shortage of materials necessitated the adoption of new and untried explosive mixtures, the proper method of filling and detonating of which had to be evolved by experiment.36

The first and most crucial project was to find a source of H.E. with which to fill the H.E. ammunition.

The explosives required to build gun ammunition fall into three categories: the propellant; the bursting charge; and the igniting agents, the explosive in the fuse which ignites the charge. The outbreak of war found the British artillery with an effective propellant but lacking the other two forms of explosive required. The propellant used by both the Royal Artillery and the Navy was Cordite M.D., which had replaced Cordite Mk.1 in 1901 and thus had many years of use and testing before the war began.37 The only problem arising in the matter of Cordite supply was that of the shortage of the vital ingredient, acetone, a solvent used in the Cordite manufacturing process. The solution to this problem was found by the eminent chemist (and Zionist), Chaim Weizmann, who devised a method of producing solvent from grain, which could then be used to produce a form of Cordite known as Cordite R.D.B.38 Cordite R.D.B. had the same firing characteristics as M.D. and thus the same ballistic properties, yet was much easier and cheaper to mass produce. Weizmann’s contribution virtually ended all problems with propellant explosive. Full production of Cordite R.D.B. began in May 1915 and, after this point, all shells, bar naval ones, used the new compound.39

The situation with high explosive was very different. The outbreak of war had found the artillery in the midst of changing from one type of high explosive to another. Before the war, British shells were filled with Lyddite but this proved to be too unstable: salts extruded by the explosive could be easily ignited, detonating the shell.40 In August 1914
the artillery were in the process of converting to pure T.N.T., a much more stable compound, which was recommended by the Ordnance Board on 11th August 1914. This decision was to present the munition makers of 1915 with a considerable headache, for Britain had almost no capacity to manufacture T.N.T., the raw materials for which were difficult to obtain and one, Oleum, impossible to buy as the only source was German chemical companies. The decision to introduce a new high explosive charge also meant that new methods for filling shells and fusing them would have to be devised.

The first task was to devise a way of producing T.N.T. without Oleum. This was achieved by 17th January 1915, by Dr. Hodgkinson of the Ordnance College. His process, called R.D. Process No. 1, resulted in a huge lift in the output of T.N.T. which reached three tons a week by June 1915, compared to less than one ton a year produced in 1914. But the restricted supply of various components of T.N.T., particularly Tolveme, meant that its production would never reach the volume required to fill the shells, orders for which were pouring from the Ministry of Munitions. This was recognised as early as November 1914 by Lord Moulton, Chairman of the Committee on High Explosives. Moulton suggested mixing T.N.T. with some other readily available agent, such as ammonium nitrate, to form a new high explosive that required less T.N.T. What emerged from the experiments authorised by Moulton was Amatol, a mixture of 40% ammonium nitrate and 60% T.N.T. It is worth noting that the many problems of converting shell design, filling procedures, and fuses inherent in the switch to Amatol were fully anticipated by experts in the artillery. They, in fact, opposed Amatol from its inception, arguing that during the pressure of war there would be no time for the extensive testing and modification that usually preceded the introduction of a new explosive. They were proved entirely correct in the short run, in that many of the problems with shells faced by the artillery in 1916 - duds, premature, and inconsistent ballistic properties - were caused by the problems attendant upon the conversion to Amatol. But Moulton's position was justified on a longer view. By the end of 1916 the vast expenditure of H.E. shells far out-stripped T.N.T. production.
Problems of Amatol

The major problem with Amatol as a shell charge was that there were no existing techniques for filling shells. The first method tried was that of pressing Amatol into blocks and then inserting the blocks into the shell cases. This method copied the French process used with their explosive, Schneiderite. Unfortunately, this proved unsuitable for Amatol as it did not give the density required for detonation. Even more unfortunately, this fault was not discovered until after a great stockpile of shells had been created; in fact, almost all the H.E. shells used in 1916 were block-filled Amatol shells. The actual number of duds for which the block-filling process was responsible is now impossible to calculate, for shells could fail to detonate for a number of other causes, particularly bad fuses, and the precise number of duds is unknown. But there is no doubt that the vast number of duds fired during the Somme battle, described by the Ministry of Munitions' records as a "high proportion," and estimated by modern historians as between one quarter and one third of all shells fired, were partly caused by the block-filling technique. Evidence for this can be seen in the response to the complaints from the artillery that occurred after the 1916 campaign. A new method of filling was devised, heating the Amatol and pouring it into the shell cases, and testing for duds was carried out in the factories. The new process and the testing program between them reduced duds to the extent that by September 1917 Amatol shells performed as well as ones filled with pure T.N.T.

The filling procedure was only one of the problems created by the switch to Amatol. Amatol Shells required a stronger explosive force in the fuse to detonate than either Lyddite or T.N.T. and the difficulty increased with the percentage of ammonium nitrate added. This was, in fact, the only reason that a 60/40 mixture was chosen rather than one of 80/20 which would have saved even more T.N.T. fuses. Fuses were the most complex components that went to make up shells and it was fuse production that held up the rate of completed shell output in 1915. The fuses being built in 1915 were the No. 17 and No.
44, which were percussion fuses, acting on impact, and the No. 8 timed fuse (that is, the fuse detonates after a given lapse of time after firing). What the artillery did not have was a graze fuse, which is one that detonates not only on impact, but also if the shell is merely slowed in its flight, as it was, for instance, by striking barbed-wire entanglements. The need for an effective graze fuse was felt from the moment the German army dug in and began to use wire as one of their primary means of protection. To remedy this deficiency, Woolwich issued a compromise graze fuse, combining the 44 and 80 fuses and removing their safety-pins. They also had a design for a genuine graze fuse drawn up and rushed into production, the No. 100, first issued in February 1915. All of these fuses proved flawed in one way or another and all were redesigned during 1916, but the stockpile of shells built with these early fuses caused problems throughout 1915 and 1916.

The major problem with the standard 44 and 80 fuses was that they were simply not strong enough to detonate shells filled with Amatol 60/40. As has been pointed out, the exact number of blinds is impossible to establish, but the Ministry of Munitions' tests showed that the two major causes were poor filling or failure of fuse to detonate charge. The conclusive evidence for this was furnished in 1917 when, after modifying filling procedure, increasing the charge in the fuse, and instituting a proofing program at Woolwich, a 99% detonation rate with 60/40 and even with 80/20 Amatol was achieved. But duds, although they had disastrous effects on the strength and effectiveness of British bombardments, were not the British artilleryman's greatest bane. It was premature, in which the shell goes off in the barrel or shortly after, that caused the greatest anxiety.

Throughout 1915 and continuing into the summer of 1916, the gunners of the Royal Artillery found the improvised graze fuse, the 44/80, and the hastily designed No. 100 fuse almost as great a danger to themselves as to the enemy. By September 1915 the rate of premature had reached one every 5,000 rounds of H.E. shell fired. In the 44/80 fused shells, the removal of the safety-pin made premature more frequent, although the irony was that if the shell did not go off prematurely it was unlikely to go off at all, the worst of all
worlds. The 100, brought in to replace it, proved far too sensitive, causing prematures and other disasters while it was being handled. The fuse was triggered by a cocked spring which was liable to be released merely by the rough handling incidental to ordinary battlefield conditions.\(^{58}\) The great fire in Rouen which destroyed an ammunition stockpile and damaged the city was caused by a 100 fuse going off when accidentally dropped.\(^{59}\)

Prematures varied in rate depending on the type of gun and the particular batch of shells it fired. In the modern 18-pdr., it was not as high as in other ordnances, but was still at an unacceptably high level, a gun destroyed or damaged for every 27,650 rounds of H.E. fired.\(^{60}\) This should be compared with the rate of prematures in the French Artillery of one in over 100,000 rounds - clear evidence of the dangerous inferiority of early British fuses. The situation with the older guns was even worse. In the case of the 4.5-in. howitzer, the problems with over-sensitive fuses were exacerbated by poor design of gun and faults in loading procedures. The rate of prematures in the 4.5-in. howitzer was greater than one in every 5,000 rounds, which explains why 4.5 batteries came to be referred to as "suicide clubs" and why gunners came to regard being sent to a 4.5 battery as a certain ticket to oblivion.\(^{61}\)

The notorious 4.5s suffered from many problems. Not only were the fuses for their shells, and their loading procedure both dangerous, but their shells were also affected by the most disastrous attempt to expedite production - that of removing the base-plate to simplify design. The fitting of base-plates is one of the most important tasks in building H.E. shells. It is also the most time-consuming. In the first rush to build shells it was found that base-plate fitting determined the rate of shell output.\(^{62}\) It was decided to attempt to build 4.5-in., 4.7-in., and 60-pound shells without separate base-plates. This greatly speeded up production and shells without base-plates filled the stockpiles for those types of guns. The rate of prematures which resulted led to the abandonment of that particular short-cut and manufacturers were ordered to build only shells with separate base-plates.\(^{63}\) But they had already made a large number of plateless shell cases and continued to deliver them up to the
end of 1915. The destruction of 4.5 and 4.7 batteries - to say nothing of the casualties and their effects on morale - prompted the Ministry of Munitions to act decisively to stop the plateless shells reaching the battlefield. Despite the shortage of shell, the Department ordered that it would not longer accept plateless shell cases for filling and ordered that existing stocks of such shells be destroyed.64 However, many of the lethal shells were already in France in the great stockpiles of ammunition being created for the summer offensive.

There remained one last problem with the shell program of 1915. It was, in some ways, the least expected and, in the battles of 1916, the most damaging to the effectiveness of the British Artillery. One of the characteristics of Amatol was that its explosion created very little smoke. The significance of this was not lost on Sir John French who pointed out that this would make ranging extremely difficult.65 The ordnance board and the ordnance committee did little to act on Sir John’s point until, in the course of the summer campaign, its truth was amply demonstrated. By 19th April 1916, G.H.Q. in France was demanding that some kind of smoke indicator should be introduced into the shells to aid artillery registration.66 They were responding to reports from the battlefield, such as that made by the Canadian Corps, that attempting registration with Amatol shells was a waste of time.67 The first army similarly complained to the artillery commander at G.H.Q. that Amatol H.E. shells, as well as producing a high proportion of duds and premature, were difficult to range because of the lack of smoke, as did the R.A.C. The solution to the lack of smoke was technically very simple, but its implementation, as in other matters involved in shell production that have been discussed, was hamstrung by lack of supplies. The standard ingredients used to give shells more smoke, phosphorous or aluminium, were in short supply and it was not until August 1916, after the artillery had fought most of the 1916 summer campaign with these defective shells, that a solution was found. By the campaign of summer 1917 all Amatol shells contained 30% ammonium chloride, the smoky discharge of which made ranging, either at distance from a forward O.P. or from the air, easy.68 However, throughout 1916 the constant complaint by the Royal Artillery that observation
was difficult or impossible can largely be ascribed to the lack of smoke in Amatol shells manufactured in 1915 and early 1916.
Consistency

There was one problem with the production program of 1915 and 1916 that affected both guns and shells equally, the reduction in inspection of the completed product. Accurate artillery work requires a high level of uniformity in its guns and shells. Registration of guns on to targets relies on each shell having the same ballistic properties. Equally, the transfer of ranging information from one gun to another relies on the guns having uniform performance characteristics. In the pre-war artillery these standards were maintained by the rigorous inspection program at Woolwich. Every shell, every gun, was carefully measured, weighed and tested to ensure that it complied with the set standards. The flood of production unleashed by the Boulogne Conference, however, simply overwhelmed the inspection department at Woolwich. It had neither the men nor the equipment, particularly crucial calibration gauges, to test all the ordnance put before it.\(^{69}\) The bottle-neck in supplies at the Woolwich inspection workshops, combined with the urgent pressure to get guns and shells to the Front, led to a series of decisions to reduce inspection standards. Weight tolerances, for example, were relaxed, as were size and calibre restrictions.\(^{70}\) Instead of testing each shell, a system of selecting single shells from 'lots' was increased.\(^{71}\) It was a straight-forward, radical lowering of standards. A vast number of shells and guns which would have failed pre-war inspection tests arrived in France.

In most cases, the discrepancies in size and weight were not immediately discernible to the gunners, though the problems they created in ranging onto targets frustrated the artillery’s efforts throughout the Somme battle. But, in some cases, the discrepancies were so huge that the gunners, even in the heat of battle, could not help but notice the differences in the shells they were handling. It was found, for example, that some '6-inch' shells varied in length by up to four inches!\(^{72}\) How such manifestly defective shells got into ammunition supplies can be explained only by the lowering of inspection standards in 1915. The outcry from the artillery and the scathing reports that arrived at the Ministry of Munitions from the G.H.Q. artillery led to the entire inspection department being reorganized late in 1916\(^{73}\), when the department was massively expanded and supplies of gauges and other measuring
equipment was expedited. Most of the pre-war rigour in testing was recaptured and the quality of ammunition improved. But, as with the problems with Amatol, the great stockpile of shells built to fight the Somme battle of 1916 had been created while standards were depressed, so the great inconsistency of ammunition plagued the artillery throughout the year.

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1 Du Cane report on shells and fuses. 7th February 1916. Mun. 5 122/900/7
3 History of the Ministry of Munitions. This history of the department’s activities was drawn up by the members of the department’s own historical records section. It was drawn up as the department was being wound up, and many of its records destroyed. In many cases the only record of various munitions matters is the review of papers in the history, although, substantial amounts of munitions records were saved.
4 Munition program and review. 27th August 1915, Mun. 4/2534.
5 Ibid.
6 Ibid.
7 Ibid.
8 Ibid.
9 Ibid.
10 The preference and firing characteristics of British guns is reviewed in History of the Ministry of Munitions, vol. X, chap. 1, part 1.
11 Ibid.
13 Mun. 4/2539.
14 Ibid.
15 Ibid.
17 Ibid., chap. 1, part 1, p. 1.
18 Ibid., chap. V, part 1, p. 60.
19 Ibid. p. 61.
20 Ibid. p. 60.
21 Ibid. p. 64.
22 Ibid. p. 65. Mid-Vale became available only after the pro-German owners were bought out by a pro-British syndicate.
23 History of the Ministry of Munitions, vol. IX, chap. 2, part 1, p. 27.
24 Ibid.
25 Ibid.
26 Ibid. p. 71.
27 Ibid. p. 16.
28 Fourth Army Artillery Programme of Preliminary Bombardment, 5 June 1916. Rawlinson Papers, 520/33/70.
31 Mun. 4/2534.
32 Ibid. p. 113.
34 Ibid., vol. 1, chap. 1, part 3, p. 90.

History of the Ministry of Munitions, vol. X, chap. 1, part 4, p. 2. The Navy continued with M.D. because it was more resistant to water.

Ibid. p. 4.


Sir R. Robertson, *Nature* 105 (5 August 1920). Robertson was head of the research department at Woolwich, and recounts much of the story of the development of Amatol in these articles.


Ibid.


That it was the filling technique that created the high rate of duds was revealed by testing in the latter part of 1916. See "Report on Detonation of Amatol", H.A. Humphrey, MICE. 11th October 1916, Mun. 4/1669.


Ibid.

Ibid.

Ibid.


Ibid. p. 46.

Ibid. p. 48.


Ibid. p. 44.

Ibid.


OB832, 19th April 1916, Mun. 4/2877.


Ibid. p. 42.

Farndale, op.cit., p. 141.

"Men were falling right and left of me, screaming above the noise of the shell fire and machine-guns - guns we had been assured would have been silenced by our barrage. No man in his right mind would have done what we were doing."

Lance-corporal J.J. Cousins, recalling the advance of the 7th Bedfords, to Martin Middlebrook.¹

"Poor Haig - as he was always inclined to do - spread his guns."

Noel Birch, artillery c to G.H.Q., recalling the Somme to Edmonds in 1930.²
The 1st July 1916 marks the arrival of British forces on the Western Front as a major offensive power. The French losses at Verdun had so reduced the French component of what had originally been a joint offensive that the British Army, in the summer and autumn of 1916, became for the first time the offensive motor of the alliance. The attack launched on the 1st of July, beginning the Somme campaign, could hardly have been less auspicious. It was a military calamity, perhaps rivalled only by the capture of Singapore as the worst ever suffered by British arms. During the spring of 1916, while the battle of Verdun raged to the south, the British Army in France absorbed and trained the hundreds of thousands of Kitchener’s new army volunteers. The artillery meanwhile stockpiled the hundreds of thousands of shells produced during the frenzy of shell-building in 1915, and accepted the new guns the Ministry had managed to construct. These were used to fire the first sustained bombardment by the Royal Artillery in eight days of shell fire, consuming over a million and a half shells. When this concluded on 1st July, 120,000 troops advanced on the German positions. By the end of the day about 50%, some 60,000 of them, were casualties, in return for no significant gains in territory. Indeed most assaults got no further than the uncut German wire and the men were slaughtered there by German machine-gun and artillery fire. The primary cause of this disaster, the failure of the eight-day bombardment to cut the wire effectively, crush the machine-gun positions, and silence the German artillery has been noted by almost every historian who has examined the Somme. What has received less attention are the particular causes of the barrage’s failure and why this failure was not anticipated by the Senior Staff of the Fourth Army and G.H.Q.

The primary reason that the eight-day preliminary bombardment before 1st July failed was simply that the task presented to the R.A. was too vast for it to accomplish. By July 1916, because of the manufacturing problems discussed in the previous chapter, the Fourth Army had only 227 modern, effective, heavy guns at its disposal, out of a total force of 1,437. (See Table 1)
This was a not inconsiderable artillery force, twice the size of that used at Loos, but was still far smaller than required in June of 1916. This was because the frontage of the attack was enormous, more than twice that of Loos, covering almost fifteen miles of German defences. This problem was compounded by two factors, the first being the depth of the proposed attack. At Haig’s insistence the attack aimed, as Rawlinson the Fourth Army Commander put it, for "an unlimited offensive", a complete breakthrough of the German
This meant the artillery had not only to crush the forward German defences but all three German lines of resistance. Thus the bombardment by the Fourth Army had to cover an area of some fifteen miles in width and four to five miles in depth. The second compounding factor was the great protective strength of the German positions, dug deep into the chalky soil of the Somme uplands. The dug-outs which housed the German machine-gunners of the first and second lines of defences were up to thirty feet deep, some with piped water and electrical power. These required a direct strike by a heavy shell to seal or crush. The plan adopted by the Fourth Army was, however, one that required not simply the harassing or weakening of these strong defences over such a wide area but their complete destruction. The infantry assault was premised on a total destruction of the German forward positions, for the troops were to advance in close order, at a slow pace, towards the German trenches at the moment of assault. No contingency plans for evasive action by the infantry were made, nor any for small probing attacks to test the effectiveness of bombardment.

Rawlinson’s confidence, entirely misplaced as it turned out, that this vast bombardment would at the bare minimum crush the German front line and allow the assault troops to cross no-man’s land easily seems to have been complete. He assured his Corps Commanders that "nothing could exist at the conclusion of the bombardment in the area covered by it". The lack of any contingency planning for the failure of the bombardment, and the remarkable statement in the Fourth Army’s tactical notes drawn up for the assault that "the capture of a system of hostile trenches is an easy matter compared with the difficulty of retaining", reveal that Fourth Army Command had not even considered the possibility of a complete failure of the bombardment.

This faith in the power of the bombardment, and Haig’s and Rawlinson’s doubts concerning the discipline of the newly trained volunteers of the new army, led to the adoption of infantry formations that simply invited disaster.
Advancing in tightly bunched mass formation, the divisions of the new army were to present the easiest possible targets for the sweeping scythes of the German machine-gunners. Thus the infantry plan relied utterly on the success of preparatory bombardment, a bombardment that was in fact doomed to failure because of Haig’s insistence on a highly extended frontage and deep, breakthrough penetration in the initial assault.

The reason such an extended frontage for the Somme offensive was chosen was because Haig perceived that only wide attacks could achieve decisive results. As T. Travers has pointed out, Haig applied in this case the principle learnt at Staff College that, as Haig put it breakdown could only come from wide frontage attacks,

"... by applying the old principles to the present conditions. Engage the enemy on a wide front, the wider the better, 100 miles or more, then after five or six days, bring up a strong reserve of all arms, attack by surprise and break through where the enemy had shown he was weak." 9

This preference for wide frontages, "the wider the better", was reinforced in 1915 as we have seen in the attacks at Festurbert and Givenchy. In these assaults, when the British had concentrated their meagre artillery resources on narrow frontages for their first long bombardments, German flanking fire had devastated the attacks. It is clear that the long fifteen-mile frontage of the Somme attack was not solely a product of Haig’s Staff College training, for there was no provision for five or six days of probing attacks before the main decisive assault. Haig intended to smash through the three lines of defence, along the entire fifteen miles, on the first day of the infantry assault. Haig’s insistence on a long frontage was a product of his previous tactical training, his experiences in 1915 with the First Army and his desire to produce not a limited advance, but a massive, war-changing breakthrough
in his first offensive as Commander-in-Chief. It was this last factor which also led him to insist upon the bombardment’s great depth, in the face of opposition from Rawlinson, the Fourth Army Commander.

In April of 1916 Haig had called upon Rawlinson to draw up an outline of a huge Fourth Army offensive from the Somme Valley. In these early plans Rawlinson advocated a shallow initial assault. He planned to bombard only the foremost German line and only after that had been taken and consolidated would the bombardment of the next German line be undertaken. The frontage of the attack, while considerable, was about 10 miles, far less than in the final revised plan. Haig rejected Rawlinson’s cautious approach and insisted on two crucial changes. The frontage was extended by one third, to include Gommecourt to the north and Montauban on the southern flank. The depth of the initial assault, and therefore the preliminary bombardment, was pushed back from the first line to the third. At Haig’s insistence Rawlinson revised his plans, extending the frontage to those suggested by Haig, but retained his initial conception of a limited advance to the first line. Haig again insisted on change and in June the deep objectives were included in the plan along most of the frontage. Thus it is clear that the primary flaw in the Somme attack’s planning, namely that the plan required a completely overwhelming destructive preliminary bombardment yet the bombardment was spread over an extended frontage with deep targets, was the product of Haig’s desire to inflict a decisive defeat on the Germans and push right through to the green fields behind the German lines.

In choosing to attack along a wide frontage with deep objectives Haig not only overrode Rawlinson, the Army Commander, but also Noel Birch, the man best placed to judge whether a comprehensively destructive bombardment over such an areas was possible. In July 1916 Birch was promoted to Army Artillery Commander, that is he controlled and coordinated the entire preparatory bombardment launched by the Fourth Army. This in itself was a significant step for the artillery, for it was another recognition of the need for
centralized artillery command, independent of the infantry. Birch’s first task as an Army Artillery Commander was a difficult one however. On receiving the plans being developed by Haig and Rawlinson, Birch quickly arrived at the conclusion that too much was being asked of the Fourth Army’s artillery, that it would be "stretching" its resources over too great an area for the level of destruction required. Along fifteen miles of front he could only deploy 1,437 guns, one every 17 yards. He had a heavy gun only every 59 yards and if one excludes the older obsolete weapons, an effective heavy every 92 yards. His immediate response was to communicate his concerns to Haig. Haig dismissed them as "immaterial". Haig’s reasons for dismissing Birch’s concerns are revealed in a letter he wrote to the Fourth Army Corps Commanders in May of 1916.

"As regards the bombardment, looking at the operations as a whole, we shall have twice as many guns for the bombardment as we had at Loos," but goes on to say at a later stage of his instructions, "we are to attack on a front rather more than twice as wide as we attacked on at Loos".

Therefore there was about the same density of guns in the proposed Somme attack as at Loos, and yet at Loos Haig had complained that the artillery was insufficient to smother the German defence. Why did Haig believe that the Somme attack would achieve any more than the ill-fated Loos assault? Haig gave two reasons:

"We shall have practically an unlimited supply of ammunition" and that "we have a great many more reserves at our disposal than we had then".

What these statements reveal is Haig’s complete lack of knowledge concerning the state of his artillery, the very force on which his entire attack plan rested. The Fourth Army’s supply of shells was not unlimited; it was only just over two million rounds, of which over two thirds were shrapnel, useless for destructive work. Indeed the Fourth Army had only 750,000 rounds of the crucial H.E. shells, and of those only 500,000 could be expended in the preliminary bombardment (some having to be retained for later fighting). Even with the small number of guns used, H.E. shells were still rationed to batteries during
the bombardment. The second point is that a shortage of guns cannot be made up by simply firing more shells from the guns one has. Each round causes wear, and with each shot a gun consumes part of its effective life. By pouring so many shells through so few guns the Fourth Army exacerbated the problems of accuracy which were already being exhibited in the bombardments of 1915. The third and most crucial of Haig's misunderstandings was that the paucity of the barrage could not be remedied by simply pouring more men onto the battlefield. The truth of this was demonstrated on 1st July.

Haig, having over-ridden both his Army Commander and Army Artillery Commander, must take responsibility for the appalling tactics used in the preparation and execution of the initial Somme attack. One remaining question however, is why evidence of failure of the bombardment apparently did not reach him.

On 16th April, when Rawlinson had explained the nature of the forthcoming attack to his Corps commanders, he read out a letter from Haig which summarised the overall nature of the attack. Haig wrote, "The artillery bombardment will be of the nature of a methodical bombardment and be continued until the officers commanding the attacking units are satisfied the obstacles to their advance have been adequately destroyed." At that time Haig explicitly recognised that a large daylight attack at the end of six days' bombardment could only be made against defences that had been utterly devastated by the barrage and that the only men capable of judging whether the level of destruction was sufficient were the front-line infantry forces. Yet, a month and a half later, when intelligence reported that the bombardment was not achieving its designated destructive effects, the warnings were ignored, dismissed as "windiness" on the part of the officers who submitted them. Raids from three of the five Corps which were due to attack reported trouble in getting through the wire to raid the German lines. If groups of ten to twenty men struggled to get through the gaps, what hope for thousands of men marching abreast? The survival of the German dug-outs was also known, the intelligence summaries of the raiding just before the attack

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reporting, "dug-outs are still good. The men appear to remain in these dug-outs all the time and are completely sheltered." Raiding on 26th June established that not only were there deep dug-outs in the very front line of the German defence, and that these had survived the heaviest shelling, but a prisoner from the 26th Reserve Division explained that his unit had lost only three men in the bombardment and was still able to continue building dug-outs and repairing wire, despite the British artillery's best efforts.

These reports, which should have caused at least a re-assessment of the breadth of the attack, seem to have passed almost unnoticed by the senior officers. Rawlinson expressed some last-minute doubts in his diary on the eve of the battle, noting that, "I am not quite satisfied that all the wire has been thoroughly well cut and in places the front trench is not as much knocked about as I should like to see it in the photos." But Rawlinson does not seem to have expressed his doubts to his commander, for Haig's diary reveals only unbounded confidence. "The wire has never been so well cut, nor the artillery preparation so thorough." Either Haig's intelligence service, under the command of the ever-optimistic General Charteris, or Haig himself, chose to ignore the evidence that the long bombardment on which they had lavished the greater part of their ammunition stockpile might nevertheless have failed to achieve the destruction required. One might argue that by 26th June it was too late to alter plans, or that such late alterations might have produced more confusion than benefit. But changes such as narrowing the frontage to concentrate the heavy guns, or perhaps limiting the infantry assault force, could hardly have produced results worse than those that, in the event, occurred.

Although it could not succeed, the Fourth Army's attempt to organize the preliminary bombardment for the Somme marks the beginnings of a number of crucial improvements in artillery work by the R.A. The most significant of these, which has already been mentioned, was the appointment of Birch as an Artillery Commander for the entire Fourth Army. Now at least the ever growing complexity of artillery organisation could be co-ordinated from one office. Birch was determined to avoid the problems he had
observed in previous attacks. Having seen the disastrous consequences arising from the cutting of the wiring of telephone lines in the attacks of 1915, he introduced a huge cable-burying programme. Seven thousand miles of line were buried six feet deep, connecting observation positions to batteries, batteries to each other and to headquarters. Over and above the 7,000 miles of buried cable there was a further 43,000 miles of above-ground cable laid, a total of 50,000 miles of cable, enough to circle the earth twice over.25

Birch also did his utmost to improve the observation service to his gunners, attempting to avoid the poorly-directed shooting of 1915 by devising the first co-ordinated artillery air-observer programme. It required the R.F.C. to gain control of the air and then put up four squadrons of observer planes for the entire duration of the bombardment. He also employed a squadron of captive balloons to assist the observers. For the first time in the war observers were able to range guns on targets deep in the defences. As in previous battles F.O.O.s were to accompany the leading infantry units, unreeling their line behind them as they went.26

Birch issued the first army artillery order on June 5th. While it was a truly significant document in that co-ordination of the artillery from the army level would become the norm after the Somme, as a first attempt it was seriously flawed. Rather than actually constructing the firing tables for each battery, Birch limited himself to stating general principles and the outline of the bombardment, such as its duration (six days), and organising for all guns to cease firing at given times to allow aerial photographs to be taken. Perhaps because he was still sensitive to the prerogatives of his C.R.A.s, Birch left all target-selection, time-tabling, and gun control to them.

He was also determined to avoid the calamity that had occurred at Aubers Ridge when a change in the weather had rendered all the registration of the previous days useless. To this end he had a meteorological section created and it issued a daily meteorological
telegram to each battery, giving wind speeds, barometric pressures, and wind directions at various altitudes. Despite these improvements the preliminary bombardment was erratic, inaccurate, and ineffectual, even taking into account the small number of guns and H.E. shells Birch’s gunners had at their disposal. The reasons were two-fold. Firstly there were the problems that emerged in the ammunition built in great haste in 1915, and secondly the problem of wear in the small force of guns the Fourth Army had at its disposal. Prematures were the most immediate and dramatic of the problems to emerge. As we have seen, the reduction in inspection standards and design changes in shells, together with poorly designed fuses, led to a rate of prematures of 1 in 5,000 rounds of H.E. in September 1915. By the time the stock-pile for the Somme was being delivered to France, the rate was still one in 27,000 rounds of 18-pdr. H.E. and even higher in the older types of guns. (The French artillery meanwhile suffered only one premature every 100,000 rounds of H.E.) This not only destroyed valuable guns and crews using H.E. in the preparatory bombardment for 1st July, but understandably led battery commanders to prefer shrapnel to H.E. Thus shrapnel was used in vast quantity in the Somme bombardment. Of the roughly one and a half million shells fired, over one million were shrapnel, even though the primary tasks of the bombardment were destructive ones requiring H.E.

Despite Birch’s effort to organise a great amount of aerial observation to compensate for the lack of ground positions, the introduction of Amatol created an unexpected problem. As we have seen, the Somme bombardment involved the first large-scale use of the shells built in the latter part of 1915 and early 1916 when the first generation of Amatol 60/40 was used. Gunners immediately noted that Amatol’s lack of smoke on detonation made observation very difficult. What soon became apparent on the Somme was that while Amatol made ground observation very difficult, it made aerial observation virtually impossible. Since the noise of his plane’s engine drowns out that of detonation, the aerial observer is entirely reliant on smoke to spot the fall of shell so the difficulties produced by
Amatol's lack of smoke are obvious. The other great problem with these early Amatol shells was duds.

The number of duds in the preliminary bombardment can not be precisely established but it has been estimated at between one third and one quarter of all shells fired and was probably higher in H.E. shells. The cause of these failures was largely that the British were trying to detonate Amatol shells with fuses designed to suit Lyddite or T.N.T. shells. With some shells it was worse than with others: in the 8-inch howitzer it was so high that reports after the fighting claimed that the battlefield was "littered" with dud 8-inch shells. A visitor to the battlefield a year later claimed that one could not take a single step without treading on dud shells in the old German positions. But, as though the problems with ammunition were not enough, the Royal Artillery were also plagued by mechanical problems in the small force of guns they had available to fulfil their objective of destroying the German line.

The failure of the Gun programme had a number of profound consequences. Firstly, the British did not have the great force of new guns with which to begin the Somme battles. Also, because the promised new guns had not arrived, old guns were being pressed into service long after their normal working life. The rush to build new guns had meant that there had been little manufacturing capacity devoted to building spare parts to keep these old guns firing. The result was that much of the Royal Artillery force at the Somme was worn, breaking down, or held together by improvised battlefield repairs. During the course of the battle up to 35% of field guns were out of action at any one time due to breakdown. The worst problem was that of barrel wear. As each shell is fired the barrel of a gun is slightly worn away, changing its firing characteristics and reducing muzzle velocity. The effects of wear had become increasingly apparent through the early part of 1916 and should have served as a warning as to the great rate of failures, breakdowns, and inaccurate shooting that would occur in the Somme bombardment. The 123rd battery of 4.7-guns, for example, was
removed from the line because its fire was visibly wild. The cause of the wild firing was found to be that the barrels were so worn that a correction of 1,900 yards had to be applied to allow for the effects of wear. Guns of the 71st heavy battery were found to have a 50% zone of 800 yards. (The 50% zone is the area in which 50% of a gun’s shells fall when aimed at a fixed target.) If these guns could only get 50% of their shells into a target area of 800 square yards, then their chances of hitting targets such as machine-gun posts or rival gun positions were negligible.37

Barrel wear was not the only sign that Britain’s artillery force was rapidly deteriorating through over-use. The recuperator system which absorbed recoil was second only to the barrel in the amount of punishment it took in the course of long bombardments. The heavy demands placed on the limited number of guns at the disposal of the British revealed "serious defects" in the recoil and recuperator systems of "practically all equipments."38 In the 18-pdr., whose fast rate of fire placed great demands on its recoil system, failure of the buffer springs was common, so common that during 1916 18-pdrs. had to be withdrawn from the line every three months for an overhaul of the recoil system.39 The problem with the 18-pdrs. was that their recoil system was out-dated, using springs to check the barrel. (The French "75" used air recuperation, which explains how the "75" achieved higher rates of fire with greater accuracy than the 18-pdr.) The problem was exacerbated by the failure of the Ministry of Munitions to make provisions in its hastily-devised programme for the supply of spare parts such as springs. When guns were withdrawn for replacement of buffer springs it was found there were no new springs available. In the artillery’s workshops attempts were made to re-temper the old springs but these proved ineffectual and many guns had to be sent back without effective repair.40 The effect of the failure of the recoil system was two-fold; it both slowed the rate of fire and reduced accuracy. As the spring lost its tensile qualities the gun would begin to jump back with each round. To fire the next round the gun would have to be "run up" by hand, that is, man-handled back into the gun pit. This not only slowed down the rate of fire but with each
"run up" the gun's position would change. Accurate firing, of course, relies not only on consistency of shell and gun barrel but also the position of the gun. One can imagine how difficult ranging became when, with each shot, the altitude of the gun changed.

The problem of failing recoil systems was not confined to the 18-pdr. with its spring recuperators. The heavier calibre weapons of the British artillery used a hydraulic recuperation system employing a liquid consisting of water and glycerine. The constant pounding and resulting heating of the mixture, particularly in the long bombardment before the Somme attack, revealed the impurities in the glycerine being used by the British. These impurities scoured the cylinders holding the hydraulic fluid, creating leakage and eventually allowing the fluid to escape. This too caused the guns to jump and have to be run up by hand, with all the problems entailed.41

The solution to these recoil problems was in both cases very simple. By September 1916 Vickers had designed an air recuperation system for the 18-pdr. and all 18-pdr. production was changed to the new design.42 Experimentation in the ordnance workshops showed that oil was far preferable to the glycerine-water mixture and by the end of 1916 all hydraulic guns were being fitted for conversion to oil.43 But these modifications did not help the gunners on the Somme: for them it was a constant struggle with guns whose failing recoil systems made loading and firing slow and back-breaking work and also made the task of observers trying to range the guns almost impossible.

Despite its apparent size and its constant thundering of guns which could be heard as far away as the south of England, the preliminary bombardment for the great attack of 1st July failed in almost every respect. Even the wire cutting programme, to which 750,000 shells were devoted, failed. Wire cutting required great accuracy and, as we have seen, the batteries of 18-pdrs. which conducted the majority of the wire cutting were plagued by buffer problems that hampered any accuracy of fire. It must also be remembered that many
of the men manning these batteries were inexperienced recruits, products of Kitchener’s call to arms. And even when the inexperienced batteries managed to get their deteriorating weapons to fire on the wire, later investigation showed that the compromise fuse they used, the 80/40, was unsuitable for wire-cutting. Ministry of Munitions’ testing showed that the slight delay between the ignition passing from the first fuse to the second was long enough for the shell to plunge past the wire and discharge into the ground.44

The heavier guns, whose task it was to crush the trenches, machine-gun nests, artillery batteries and deep dug-outs also failed. There were simply too few of them to take the many German targets their task required. The H.E. shells they needed for the task were prone to duds and premature explosions and, for lack of smoke, impossible to range. As we have shown in the case of the 71st heavy battery, their guns were extremely worn, when only pin-point accuracy would do the job. So for all its sound and fury the Somme bombardment was merely a pathetic shadow of the heavy, sustained, and accurate bombardment that was required to fulfil the Staff’s ambition for the complete destruction of the German line along its 15 miles of front.

To make matters worse, wet weather had led to a last-minute delay in the attacks launched. The barrage was extended for a further two days, taking it to eight days in total. Unfortunately, the ammunition stockpiles had been carefully calculated on a six-day bombardment and hence rates of fire had to be reduced to stretch the ammunition resources over the extra two days. The bombardment, rather than rising to an intensive crescendo, petered out in the two days before the attack, allowing the Germans to repair their wire where it had been damaged, get supplies up to the front line, and generally prepare for the attack which they knew to be imminent.45

The unexpected summer rains had simply added to the woes of the British artillery, for it kept the air observers out of the sky for the crucial days before the attack. As General
Sir James Marshall-Cornwall, who was in 1916 a Major in G.H.Q.’s intelligence staff, recalled to Lyn Macdonald, the weather was one of the factors among many others hampering the artillery’s efforts.

"For five days out of the six of the bombardment there was low cloud and drizzle. Air observation was impossible and artillery observation was very hampered. The fact was that neither did they [the British artillery] pin-point the machine-gun posts opposite them, they also failed to cut the wire and the failure of the cutting of the wire was most disastrous. Our procedure at that time was to use a shrapnel shell which burst about twenty feet above the ground and the hail of bullets going forward when the shell burst in the air swept away the wire entanglements. But it all depended on the accurate setting of the time fuse which ignited the shrapnel shells and our munitions factories were only just getting into full swing. There were a lot of manufacturing faults in the fuses. They didn’t all burn the right length and, I’m afraid, a lot of the half-trained gunners of the New Army divisions didn’t set the fuses exactly accurate. The fact was that many shells burst too high and the bullets dropped into the ground, and the fuse didn’t work and it buried itself into the ground so the wire was left."46

I do not intend to review the tragic British infantry assaults of July 1st in which 60,000 men became casualties in the space of a few hours. Those bloody paths have been marched over and over again by historians ever since.47 Instead I will quote from the account of the attack given by a young front-line German infantryman, for what he experienced well summarises the action of the defenders and the fate of most of the British attacks.

"The intense bombardment was realised by all to be the prelude to an infantry assault sooner or later. The men in the dug-outs therefore waited ready, belts full of hand-grenades around them, gripping their rifles and listening for the bombardment to lift from the front defence zone on to the rear defences. It was of vital importance to lose not a second in taking up position in the open to meet the British infantry which would advance immediately behind the artillery barrage ... At 7.30 am the hurricane of shells ceased as suddenly as it had begun. Our men at once clambered up the steep shafts leading from the dug-outs to daylight and ran, singly or in groups, to the nearest shell craters. The machine guns were pulled out of the dug-outs and hurriedly placed in position, their crews dragging the heavy ammunition boxes up the steps and out to the guns."
Having got into position the Germans then watched as a great line of British infantry clambered out of their trenches and began to advance towards them. "They came at a steady, easy pace" the German infantryman recalls "as if expecting to find nothing alive in our front trenches." This is, of course, exactly what their commanders had told them to expect.

"A few moments later, when the leading British line was within a hundred yards, the rattle of machine-gun and rifle fire broke out along the whole line of shell holes. Some fired kneeling so as to get a better target over the broken ground whilst others, in the excitement of the moment, stood up, regardless of their own safety, to fire into the crowd of men in front of them. Red rockets sped up into the blue sky as a signal to the artillery and, immediately afterwards, a mass of shell from German batteries in the rear tore through the air and burst among the advancing lines. Whole sections seemed to fall and the rear formations, moving in closer order, quickly scattered."48

One can see in this brief account of German defence the essential elements that caused the failure of the British attack on the Somme. The long barrage did not crush the dug-outs in which this German officer’s men were ensconced: the bombardment in fact only warned them that an attack was imminent, allowing them to prepare accordingly. Having failed to destroy the dug-outs, the strictly time-tabled bombardment then lifted back to deeper targets, not only serving as an alarm bell to the Germans but allowing them time to race out of their protection and leaving them completely unmolested during the period in which they were actually repulsing the attack. Finally, it reveals how the British counter-battery fire failed to suppress the fire of the German artillery, who are reported to have responded to their infantry’s call "immediately". As can be seen from this report, the slow-moving, tightly-bunched formations that the British infantry were ordered to adopt did not cause the attack to fail: it simply made the machine-gunner’s task easier. Even after the British troops scattered there was still no way forward, for the simple reason that the British bombardment had failed to suppress the two crucial elements of the German defence, the machine-guns, and the defensive artillery. It is a touch of dreadful irony that the British shell-craters were seen by the German infantryman as useful protective cover for all but the over-excited. It was the failure of the bombardment that led to the complete breakdown of

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the British attack, the 60,000 casualties, and the worst reverse in terms of the sheer number of casualties in one day's fighting for Britain in the entire war, or indeed, any war.

When night fell on 1st July most of the Fourth Army were either back in the trenches from which they had jumped off or scattered through no-man's land as casualties. A few isolated parties had managed to actually get into the German trenches but, with the general failure of the attack, these groups were cut off and destroyed by the German defence. Only the most southern wing of the attack had succeeded in moving forward and capturing some German positions.

The French attack, which had been reduced because of terrible losses at Verdun to a flanking operation of only eight miles frontage, had followed a very different course to that of the British and, in fact, the limited advance made by the southern wing of the British attack would seem to have been a result of the assistance afforded by the successful French advance.

The French contribution to the Somme offensive gives an illuminating comparison by which to judge the primary causes of the British failure. The capacity of the French Army had been greatly diminished by the carnage at Verdun. When the Somme offensive was first proposed the French were to have attacked on twenty miles of frontage. But the experience of Verdun, especially the very heavy barrage that was used by both French and Germans there, had obviously given the French a much clearer idea of the number of guns required to crush a defensive system thoroughly. At the Somme, although the French frontage was only about eight miles long, compared with the British of about fifteen miles length, and the German defences in that part of the front contained only eight heavy artillery batteries, the French assembled eighty-five heavy artillery batteries to attack the German positions, achieving thereby twice the density of heavy guns of the British. The counter-battery programme this large force of heavy guns undertook not only devastated the German
batteries before their own positions but also those protecting the trenches to be attacked by the most southerly of the British Corps, XIII. This in no small part explains why XIII. Corps was the most successful of the British Corps on 1st. July. The counter-battery fire on the southern end of the frontage was described by the Germans as "verheerend" - devastating - and as the barrage continued, "all howitzers became gradually unserviceable. The greater part of the other batteries of the group had considerable losses. Their fighting power fell off more and more." The bombardment not only destroyed the German artillery positions but tore up the trenches and destroyed the machine-gunners' dug-outs.

"Nearly all the deep dug-outs in the first position were blown in, only a few specially deep ones were still partly serviceable. The garrison lay mainly in shell and mine craters." Having largely lost the protection of their dug-outs the German defenders sustained many losses from the French artillery fire. The wire having been effectively cut, the French were able to rush the isolated detachments manning the cratered remains of the German front line. As the history of the French XX. Corps triumphantly records, "at the end of the day the XX Corps was in occupation of the entire German first position; it had suffered very few losses and had not employed any reserves, not even partially." The barrage and infantry rush had inflicted heavy losses on the German garrison the 6th Bavarian Reserve Regiment for example, according to the Bavarian official account, was "practically wiped out." Lieut.-Colonel Bedall, an officer of the 6th Bavarian, was even more explicit in his diary. "The 6th", he writes, "was completely destroyed; of 3,500 men only 500 survivors remain and these for the most part are men who have not taken part in the battle, with two regimental officers, and a few stragglers who turned up on the following day. All the rest are dead, wounded, or missing." The French attack proceeded smoothly to its objectives and the French Commander, General Norrisson, was in fact contemplating moving his reserves up to attack the village of Hardecourt when news of the British failure reached the French.

The success of the French attack on the Somme shows clearly that it was not the tactical approach adopted by the British that caused their attack to fail, for the French
pursued a tactical doctrine essentially similar to that of the long bombardment of the British. Instead, it shows what was required to carry out that shared tactic. Having abandoned any element of surprise or deception and having placed complete reliance on the power of the heavy artillery to destroy the defences, the attacking force required a truly overwhelming superiority in heavy guns. This the French achieved, and as a result their attacks succeeded in gaining their objectives with few losses while the German defenders, devastated by the barrage and sudden rush of infantry, lost heavily. It must be admitted that the French attack was greatly assisted by the German defenders’ complete absorption in the major British assault north of the Somme and cannot be wholly isolated from the entire Allied attack. But its success nonetheless demonstrates that the tactical doctrine of the sustained and heavy bombardment was not entirely nonsensical. The British Staff had simply failed to recognise the prodigious number of guns that would be required to execute such a plan over a long attack frontage. Nor had they recognized that even with such a concentration of guns, the sort of complete breakthrough in one blow that Haig clearly desired, was impossible to achieve. Not only did the frontage of an attack need to be determined by the number of guns available, but its depth was limited by the effective range of the guns. Haig’s failure to recognize either of these truths led to the disaster of July the 1st.

The Somme campaign did not end with the disaster of 1st July; it would continue on its blundering course for another five months, until winter rains finally brought it to an end. One of the most remarkable features of the aftermath of the first assault was how little the Commander-in-Chief seems to have been thrown off strike by the calamity that had befallen his first great attack. When, the day after, he was shown approximate casualty figures of over 40,000 (they were in fact closer to 60,000), Haig blandly stated, "This cannot be considered severe in view of the numbers engaged and the length of front attacked."56 The strategy Haig adopted in light of what had happened on 1st July was reduced to a three-word catechism which he used to explain his policy to Robertson and, through him, the War Committee. "Maintain our offensive." By this Haig did not mean breaking off the attack on
the Somme to resume it on some other portion of the line, an idea that Haig had in fact suggested in the initial planning for the attack. Instead, he argued that the effects of repeated bombardments and attacks would be cumulative, and by attacking elsewhere the great eight-day bombardment would be wasted. Haig ignored the fact that, just like the British, the Germans rotated their units involved in the heaviest fighting and that the German Regiments which had suffered through the long shelling would soon be relieved from the front line. But even more crucially, he ignored the fact that the effects of any cumulative repeated assaults would be more than outweighed by the German defensive response.

The events of 1st July having revealed that the Fourth Army’s assault was indeed to be the main Allied offensive for 1916, the German Somme defence receive a transfusion of the most elite infantry units, a great body of artillery that had previously pounded the French at Verdun, and the concentrated efforts of their labour divisions. The ensuing battles were of a tremendous ferocity as the British concentrated their artillery on to relatively narrow frontages and attempted to advance up the slope to Pozieres Heights, the task they had failed to achieve on 1st July. Each of the limited advances the British made was contested bitterly by the German defence, every village and wood the scene of costly struggles. Often the gains of some heroic and slow advance would be lost a few days later to counter-attack. Over the five months of fighting British casualties rose to around 420,000, French to 200,000, while the Germans suffered somewhere between 500,000 and 680,000. For the Royal Artillery this long sequence of attacks saw the emergence of one of the most significant developments in artillery tactics on the Western Front - the creeping barrage. It would come to be such an integral feature of every subsequent attack that it is easy to forget that there was a period when this technique was beyond the technical powers of the R.A. In fact, it was the crucible of the long Somme offensive that forged the skills needed to fire a tight, creeping barrage, providing a shield to protect the infantry as they crossed no-man’s land, by keeping those German machine-gunners who had devastated the
British attack on 1st July deep in their dug-outs for as long as it took to get the infantry across.

**Creeping Barrage**

The origins of the creeping barrage, that is, one that attempts to move steadily in front of the assaulting infantry, conforming to the pace of their advance rather than "jumping" from one line of trenches to another, is shrouded in confusion. German, French, and British artillery officers all claimed that the idea was theirs, and since each of the armies began some sort of experimentation with the technique during the summer of 1916 it is hard to separate the rival claims. According to the British version, the creeping barrage was born of a discussion of the Loos offensive between Major-General E.W. Alexander V.C.G.O., C.R.A. XV. Corps, and Major-General G.E.D. Budworth.61 What is clear is that by the time Birch and Budworth came to draw up the Fourth Army’s artillery plan, the idea of a creeping barrage was in the forefront of their minds. The Fourth Army tactical notes, issued in May, stated that "The ideal is for the artillery to keep their fire immediately in front of the infantry as the latter advances, battering down all opposition with a hurricane of projectiles."62 But later in the notes it is pointed out that, because of the difficulties of observation, and the impossibility of getting messages back from the front line to artillery batteries, a rigid set of timetables and fixed lifts in range would have to be adopted. The note’s only indication as to how these two apparently irreconcilable instructions were to be followed was very brief. It suggested that the period of time between lifts be extended, allowing infantry who have fallen behind to catch up. It also suggested that long lifts be broken up into a series of short ones, a sort of compromise creeping barrage. Not surprisingly, given the contradictory and vague nature of the instructions and the liberty Birch allowed to his C.R.A.s in matters of timetables and tactics, there was a great deal of variety in the way that each of the five attacking Corps tried to creep their barrages on July 1st.
XV. Corp’s artillery came closest to firing an effective creeping barrage on that day; its field guns dropping a shrapnel barrage on the German front line at the moment the infantry jumped off. As the infantrymen advanced, XV. field guns increased their range by 50 yards a minute. After 200 yards there was a pause to allow stragglers to catch up and then the attack pressed on again at 50 yards a minute. Unfortunately for XV. Corps, their excellent artillery plan did not shield them from disaster. The village of Fricourt, one of XV. Corp’s main objectives, had been heavily fortified by the Germans and its cellars housed many machine-gun crews. The British heavy artillery having failed to destroy these strongholds, the creeping barrage simply passed over it, hardly troubling the defenders. By the time the British infantry had struggled to the German front line their barrage was 500 yards ahead of them. Themselves halted by the storm of fire from the Fricourt ruins, the men of XV. Corps had no way of arresting their barrage which advanced off into the distance at 50 yards a minute.63

XIII. Corps, the most successful of the day, also attempted to put the army’s vague ideas into some sort of practice. Like XV. Corps, it used its field guns, firing shrapnel, to form a curtain of shells on the German front line at the moment the British troops clambered out of their trenches. Obviously the XIII. Corp’s instruction to "creep back by short lifts" was not appreciated by all divisional officers, for one Division, the 30th, insisted on four huge lifts rather than a series of smaller ones. The other divisions, however, lifted at 50 yards every minute and a half. The primary reason XIII. Corps was able to achieve some sort of advance on 1st July, when every other Corps was heavily repulsed was, as has been mentioned, the effect of the flanking fire from the concentration of French heavy artillery. But their partial adoption of the creeping barrage also seems to have assisted what was in fact the only successful assault by the British on 1st July.64
While two Corps attempted the creeping barrage, the rest ignored the tactical notes and tried various ideas of their own. III. Corps guns were lifted in six great bounds, supposedly taking the infantry through the defences at breakneck speed. The first of these bounds left the infantry exposed in no-man’s land to the fire of a multitude of unmolested German machine-guns and consequently the attack aborted almost immediately. III. Corps field guns had been ordered to rake back and forth in front of the infantry, which was hardly likely to encourage the infantry to follow the barrage closely. X. Corps also ignored the army instructions, having their guns lift from the German front line to the second line in one great lift. Not surprisingly, the infantry lost the barrage moments after the assault as it suddenly lifted 1,500 yards in range, leaving them at the mercy of the German machine-gunners. VII. Corps attack, on a narrow frontage, facing strong German artillery batteries, undamaged defences, uncut wire, was unlikely to succeed with the tightest of creeping barrages. But the inevitable disaster was made worse by the strict timetable of long lifts which, just as in the other two Corps, meant the barrage jumped away just as the infantry advanced into the open.65

While the results of using the creeping barrage on July the 1st had been varied, and the effectiveness hard to assess, the potential benefits of the techniques were perceived by a number of Artillery Officers. In every one of the many assaults launched after 1st July some variation of a creeping barrage was attempted. Indeed the first of these attacks had no long bombardment to precede it, but was based entirely upon a sudden creeping barrage. The attack was launched two weeks after the initial debacle, on the 14th, and aimed to make a limited advance up the ridge to Longueval.

The dawn assault of 14th July is interesting in a number of respects. The only evidence that the higher echelons of the British Staff were at all shaken by the events of 1st July is that in almost every respect the assault on the 14th was tactically different from that launched on the 1st. The plan was put forward by Brigadier-Generals H.H. Tudor and
E.W.A. Powell, the C.R.A.s of the 9th and 3rd Divisions. The two C.R.A.s convinced Rawlinson, who in turn convinced Haig, of the plan’s viability. The attack was to have no preliminary bombardment, only a rapid creeping barrage opening up only when the troops actually jumped off for the attack. The frontage was to be very narrow, only 1,500 yards, allowing the British to concentrate their heavy guns for this furious five-minute creeping barrage. The attack was also to be begun at dawn, allowing the troops to form up in the dark. The fundamental idea was to catch the German machine-gunners by surprise, not alerting them by a long barrage, but instead, suddenly trapping them in their dug-outs with the creeping barrage. It is worth noting that the French, who had become totally committed to long preliminary barrages, dismissed the plan as bound to fail. The only problem with this surprise attack plan was the German wire. It was obvious that a brief passage of the creeping barrage over it would not be enough to cut the German wire before Longueval. Thus the artillery plan had to be compromised by including a wire-cutting programme in the days just before the attack. This shelling might well have alerted the Germans to British intentions with disastrous consequences. But in the event, the Germans did not notice the wire cutting and the dawn assault caught them entirely off guard. Just as the planners had hoped, their machine-guns were unable to wreak the sort of havoc they had done on 1st July. The troops advanced and captured a section of the Pozieres Ridge and took 1,400 German soldiers and 42 officers prisoner. The reason the advance could only be a very limited one was twofold. Firstly, the creeping barrage had only a limited range, and as the troops advanced a few thousand yards, they rapidly took the 18-pdrs. and 4.5-inch howitzers to the limits of their range. As these guns dropped out of the barrage, German machine-gunners were able to contest the advance. The second factor limiting the advance applied to all of the repeated British efforts to move forward in the latter part of the Somme campaign; that is, the ever-increasing level of German resistance. The O.H.L., as well as ordering that any officer whose unit retreated would be court-martialled, also took the more practical step of drafting a great number of the heavy batteries from Verdun to the Somme defences after 1st July. The two central Corps of the defensive force, for example, received a draft of 32
batteries of heavy artillery in the space of six days after 1st July. Any British effort on the Somme frontage was met by the hostile fire of the many German heavy artillery batteries ensconced behind their defences.

Despite the evident problems of further attacks on the Somme battlefield, Haig pressed on with repeated narrow frontage assaults. In the next attempt to move forward, the Fourth Army Staff revealed that they had entirely misunderstood what had brought about the surprise and thus the limited success of 14th July. They leapt to the conclusion that it was the fact that the 14th July attack had been conducted at night, rather than in the absence of preliminary bombardment that had caught the Germans off guard. The next attack, launched on the evening of 22nd/23rd July, was heralded by a six-hour preliminary bombardment of the German positions. This of course alerted the Germans to British intentions and when the British assault force advanced into no-man’s land they found the sky suddenly lit by German flares and the attack stopped by the fire of German machine-guns. Having discovered that the cloak of darkness was no panacea for their problems the British reverted to daylight assaults. The next major advance was by Australian troops, capturing the bitterly-contested village of Pozieres on the crest of the Ridge.

Here the German defenders made a desperate stand, and every Australian advance was met by repeated counter-attacks: the ruins of the village changed hands repeatedly. What these Australian attacks revealed was that there were two crucial preconditions for the effective use of the creeping barrage. First, it was of vital importance to begin the barrage in no-man’s land in front of the German positions, to ensure that, as the troops were crossing the field of fire of the German machine-guns the barrage was actually falling on the front-line defences. The second point, and one closely related to the first, was that at all times the assault force had to be kept very close to the barrage. It was better to lose men to short shooting than to risk giving the Germans time to mount and man their machine-guns. Then, on 27th, 28th, and 29th July, the British attempted to take Deville Wood. In this
attack a further development to the creeping barrage was made. Here the guns were armed almost exclusively with H.E., even the 18-pdrs. which provided most of the fire for the creeping barrage and which, on previous occasions, had used only a small proportion of H.E. As we have seen, the artillery officers had a strong prejudice against H.E., understandable in light of the rate of premature and, when given the choice, chose shrapnel. Under orders from Birch, however, at Deville Wood a creeping barrage of H.E. was used. The results were far more destructive than shrapnel barrages, according to the official history; "So far as could be seen, no Germans except the dead and wounded, remained in the wood."72

The experiences of the heavy fighting in which the artillery had been involved as the British moved up the ridge from the Somme valley floor, were crystallized by Birch in a memorandum he drew up for issue by the General Staff late in July 1916. Birch's conclusion was that:

"One of the outstanding lessons of the recent fighting has been the great assistance afforded by a well-directed field artillery barrage maintained close in front of the advancing infantry. It is beyond dispute that on several occasions where field artillery has made a considerable lift, that is to say, has outstripped the infantry advance, the enemy has been able to man his parapets with rifles and machine-guns. It is therefore of the first importance that in all cases infantry should be instructed to advance right under the field artillery barrage, which should not uncover the first objective until the infantry are close up to it (even within 50 or 60 yards)."73

This was a crucial recognition.

The official endorsement of the creeping barrage, its incorporation into the tactical doctrine of the army, came in September when the Preliminary Notes on the Tactical Lessons of the Recent Operations (SS 119) was published by the General Staff. This outlined the conclusions drawn from the Somme fighting concerning the creeping barrage. To summarize: the creeping barrage was essential to suppress the fire of German machine-gunners; it should begin in no-man's land, and then advance into the defences. It was to be fired by the field guns, primarily the 18-pdrs., and they were to use a high proportion of
H.E.; lifts should be no more than fifty yards a minute and, most importantly, the infantry had to be instructed to follow the barrage extremely closely, risking casualties from short shooting. While the creeping barrage would undergo further modifications as the war went on - it would become deeper; heavier calibre weapons would be added to it; machine-guns firing at maximum range would be used in its initial stages - the essential elements of the creeping barrage emerged from the fighting on the Somme.

After heavy fighting in the German trenches, the attacks had succeeded in pushing the British line a few hundred yards further up the ridge. Despite the rain, which began to fall heavily from the middle of August, limiting aerial observation, hampering the movements of men, guns and munitions, and making the living conditions of the soldiers almost unspeakable, Haig and G.H.Q. pressed on with further assaults.

On 15th September another major effort to move forward was made. The formula of the creeping barrage was now firmly set, but the Staff continued to experiment with various refinements to their offensive. For the artillery plan there were two notable innovations. For the first time the British used gas shells against the Germans, as part of the preliminary bombardment: 9,000 4.5-inch shells filled with chlorine were fired at the German trenches and strong-points. British gunners had actually fired gas shells before, in the lead-up to 1st July, but these had been a mere handful borrowed from the French. 15th September was the first use of British-built gas shells. The small numbers available meant that the effects were minimal, but increasingly in 1916 and throughout 1917 and 1918 gas bombardments became an integral part of every major artillery assault plan. The second noticeable feature of the attack was that the British revealed the weapon they had been developing with great secrecy in Britain, the tank. This affected the artillery in as much as their creeping barrage was divided by lanes of 100 yards' width, through which the tanks were to pass. Unfortunately, neither the tanks nor the gas shells suppressed the fire of the many German heavy artillery batteries which virtually wiped out the tank force and shelled the British
attack from its outset. Although the village of Flers was captured, a great network of mutually supporting machine-gun nests, called the Quadrilateral, held up the assault with bitter hand-to-hand fighting in the muddy and collapsing trenches.74

Ten days later the Fifth Army took up the assault in the area of Thiepval. By now the arrival of some of the new guns promised by the Ministry, together with the narrowing of frontages for British attacks, had led to the Fifth Army being able to assemble a far greater density of guns for these later Somme attacks than the Fourth Army had done on 1st July. The attack on Thiepval Ridge was to be launched on only 6,000 yards of frontage, enabling the artillery to mass their 230 heavy guns and howitzers, and 570 field guns and howitzers, in very close order.75

If we compare 25th September attack to that of 1st July we find that while the July assault had one heavy piece per 58 yards of frontage, September’s had one per 26 yards, almost twice the density. The same holds true for the field pieces, one per 21 yards in July as compared with one per 10.5 yards in September. These tightly arrayed batteries of September also fired a very different barrage to that fired on 1st July. Most importantly, they were organised to fire a unified creeping barrage, with all batteries operating on the same principles and rates of forward movement.

In fact, this attack on Thiepval was to see a further modification to and improvement of the creeping barrage, with the addition of heavy machine-guns to its fire. Firing at high elevations, the heavy machine-guns could add their fire to that of the field-guns as the infantry approached the German defences, further encouraging the German machine-gunners to keep their heads down and delay maintaining their guns.76 The September attack also had to accommodate gas shells and mortars, and tanks, both of which had been brought into the assembled attacking forces since July. The attack on Thiepval succeeded, though again at great cost, holding the village and ridge in the face of repeated counter-attacks. By
massing their guns and firing a tight creeping barrage, the British were able to avoid the calamity that occurred on the first of July. The British infantry were not cut down by machine-gunners before they could even get to grips with the defence.

But despite these improvements the later battles of the Somme revealed a great deficiency in the British artillery. While they proved themselves able to defend the infantry from the German machine-gunners as they crossed no-man’s land, it nonetheless remained true that the fire of the German artillery stopped the 25th of September assault, constantly raking the small patch of ruined hill-tops the British had captured. If the months from July to September saw the solving of the problem of creeping fire, it served also to highlight the challenge the British artillery were failing to meet in 1916, that of counter-battery fire, or C.B.

The gradual development of the creeping barrage, and the consequent subduing of the German front-line machine-gunners had forced the German defence to place even greater reliance on the defensive barrage of their artillery during the course of the Somme battles. It is worth noting that, taking the war as a whole, almost 60% of the casualties suffered by the British Armies were inflicted by the German artillery, with rifle and machine-gun fire combined inflicting about 40% (complete figures: shell or mortar fire 58.51%, rifle and machine-gun bullets 38.98%, bombs/grenades 2.19% and bayonet 0.32%).

The problems presented by the German defensive artillery were far more complex than those presented by the German front-line defences, for one very simple reason, observation. As has been noted before, one of the dominant features of the artillery battles on the Western Front was that the Germans, by adopting a defensive posture, had won for themselves the right to determine where the fighting was to take place. All along the 450 miles from Switzerland to the sea, the Germans had marked out their line along whatever high ground they could find, forcing every Allied attack of 1915 and 1916 to suffer from
lack of observation positions, while the Germans above surveyed their enemies with the high-powered optical equipment that their well developed optical industry provided. As with T.N.T., the British Army discovered in 1914 that their major supplier of field-glasses and telescopic sights was German. This disadvantage in observation positions was most marked when the rival artilleries engaged each other at very extreme ranges. Artillery batteries were very small and, as targets, difficult to silence. When ensconced in a protected gun-pit, dug in and surrounded by sandbags, a near-to-direct hit was required to silence a hostile gun. To hit such a small target at extreme range required accurate and constant observation. Artillery pieces can also be moved rapidly, unlike trenches or strong points, thus observation was needed not only to find where the enemy gun-pits were, but which of them were being occupied. By the use of F.O.O.s and the rational organisation of observation positions, the British artillery in 1916 were able to get a clear field of view of the German front line: by pushing artillery observers into the front line of the British trenches and housing observers in ruined buildings, the German lines on the forward slopes of Pozieres Heights could be observed. But the great bulk of the German artillery was not on the forward slope, but hidden beyond the crest of the ridge dug into well-prepared and camouflaged pits in the valleys, beyond the purview of the British ground observers.

The British response to this dilemma was twofold. Firstly, Birch instituted co-ordinated air/artillery observation. The second approach, one that was to bear significant fruit in the years to come, was the creation of techniques for effective counter-battery fire that did not rely on direct observation of the target - that is to say, predicted fire. This second approach proved, in 1916, beyond the technical powers of the artillery, for it required great sophistication in artillery technique and great accuracy and predictability in guns and munitions-technologies that did not exist in 1916. But the experiments with predicted fire in 1916 deserve examination for they were the beginnings of a great technological and tactical breakthrough that the British would make in artillery in 1917 at the battle of Cambrai. At the Somme, however, the complete reliance the British were
forced to place on aerial observation was to prove their downfall in the duel with the German batteries. For aerial observation proved to be complex, prone to breakdowns in communications and, most importantly, completely at the mercy of the fickle northern European weather.

The first steps towards systematic aerial observation had been taken by late 1915. One must keep in mind the entire novelty of these techniques, given that flight was in its infancy and the problems presenting themselves to the aerial observer had not even been considered by the British before the war began. The first experiments had been conducted by Lieut. D.S. Lewis, a pilot with the R.F.C. who, while flying over the German positions could see targets for the artillery but was unable to communicate their location to the British artillery batteries.\(^78\) [It strikes a modern reader as beyond belief that the official method of identifying locations on a map in 1914 was by reference to the letters of the place-names on the map. (i.e. one might give a map location as "under the M in Amiens").] The problems of this extremely inexact method of location were exaggerated by the fact that the army issued a number of different maps, adding to the confusion over exact locations. The solution to this dilemma was extremely simple. Lewis squared his map, and gave each square a letter and number, thus an exact location could be given by a simple sequence of numbers and letters. The value of this system was recognised immediately and squared maps were issued by G.H.Q. from 1915, ensuring that all artillery and R.F.C. units were working from the same maps and using the same identification system.\(^79\)

Having established that the participants were all at least referring to the same maps, Lewis then applied his mind to the problem of wireless communication. Like flight, wireless telephoning was in its infancy and the heavy valve-filled wireleses of the day could hardly be fitted into the planes. Experiments had been tried ranging guns by observers' planes flying back and forth from target to battery, dropping message bags to gunners with each shot. This proved absurdly time-consuming and prone to breakdown. It was found
that by abandoning the observer and fitting the wireless into his empty seat, a pilot could get his plane off the ground although it made take-off very difficult and dangerous and, of course, left the pilot to fly the plane, observe the targets, and operate the radio simultaneously. Having got the wireless-equipped plane in the sky, Lewis found that the traditional system for directing a battery’s fire was too long-winded for his aerial observation. A ground-based F.O.O., observing the fire of his battery, would call back the corrections of range over the telephone using a long-established code of corrections, short, long, left or right, followed by an estimate of how many yards adrift of the target the shells were falling. Lewis found that given the problems of flying the plane, and observing the targets, and the additional factor of the weak and crackly reception of the early wirelosses, a much clearer, simpler and shorter code was required. In January 1915 he had therefore produced the clock-code which remained in use until the end of the war. Lewis’ memo. to his squadron commander adequately explains the system:

*I have celluloid discs with circles inserted at 25, 100, 200, 300, 400 yards radius according to the scale of the map. Outside are painted the figures of a clock. The circles are lettered A to E. The disc is pinned [to the map] with its centre on the target and its XII-VI diameter towards the battery firing. Shots are then signalled down according to their position on the map, C9, B2, etc. This will eliminate all error except that of map-reading, and I think it well worth trying. I intend to try it the next time I range the 4.7s.”*

Lewis’ system proved to be far more effective than the older codes and so staff memos introduced it to all aerial/artillery communications. It was found that a ten-yard circle was also needed, and it was also noted that by having XII-VI line run north-south rather than battery-to-target, a pilot could range a battery even if he did not know where the fire was coming from. But apart from these modifications, Lewis’ clock-code became the standard method of aerial ranging for the rest of the war.

However there remained serious problems with aerial ranging after Lewis’ work with the maps and clock-code, ones that were not a matter of organisation but of technology. The sterling transmitters used in these operations were not only very susceptible to German
jamming but also all operated on the same frequency. So, if two British planes were transmitting and came within a few thousand yards of each other, the interference would cancel out both radios. This meant that through 1915 no more than one or two radio planes could be used at once over a battlefield and thus their ranging could only be very limited. In early 1916 the 3rd wing of the R.F.C. conducted experiments with a device they called the "clapper-break". This simple device modified transmitters so that they could operate on three different levels, thus tripling the number of radio planes that could operate over a given area. It was this last development that made possible Birch's attempt, in the major offensive of 1916, to overcome the Fourth Army's disadvantage in ground-based observation by organising a vast aerial-observation programme, with the first large-scale use of radio planes and balloon observers.

While the developments in ranging communications and techniques made accurate aerial observation of C.B. fire theoretically possible, the practice of 1916 was a different matter. One factor that impeded Birch's plan for co-ordinated and destructive C.B. shoots throughout 1916 was that the R.F.C. never achieved a decisive superiority in the air. The slow-flying, unarmed artillery observation planes, cruising above the German positions with the pilot absorbed in watching the ground and operating his radio, provided the German pilots with ideal targets. Even when the observer flights were given escorts they were out-performed and out-fought by the Germans' more advanced, single-winged, forward-firing Fokker. The supply of experienced pilots familiar with artillery ranging dwindled rapidly in 1916.

A second problem was created by the inaccuracy of the heavy guns' fire and the use of Amatol 60/40 shells. As has been mentioned, 60/40 Amatol shells built in 1915 and early 1916 produced no smoke, which made detection of the shell-burst from the air very difficult. Even when the pilot could observe the burst, his ranging instructions were often useless as the erratic performance of both shells and guns made it impossible to get the gun
to fire on the target. And if he did by chance get the gun he was directing to lob a H.E. shell into the pit, there was of course a one-in-three chance it was a dud. The inaccuracy of the British heavy guns was such that the artillery found that even if the observer could do his work unmolested, find the camouflaged gun pit and make effective radio contact with his battery’s H.Q., it would still take an average 100 rounds of six-inch fire to hit the target gun-pit.\textsuperscript{82} If these were not enough problems, there was of course the weather to contend with.

The planes of 1916, with little navigational equipment, were unable to get airborne in rain or heavy mist. Even if they could they could not see through the cover to direct the shells. In northern France such conditions were, unfortunately for Birch, remarkably frequent. As Sir James Marshall-Cornwall noted earlier, five out of the six days of the preparatory bombardment period in June were so overcast as to make aerial ranging impossible.

It is obvious that throughout 1916 the British never had the artillery resources in heavy guns or shells to fire an effective counter-battery programme. The allotment of ammunition and guns for the C.B. programme for the preliminary bombardment and attack on July 1st reveals the extent to which the senior artillery officers under-estimated the difficulties of counter-battery fire. The XV. Corps’ heavy artillery diary records that the total allotment to C.B. on July 1st was four batteries firing 1,000 rounds in total. In X. Corps it was even worse, the commander ordering that hostile batteries should receive only 12 rounds each. In VIII. Corps the heavy guns were allotted only 20 rounds per gun, per day, to be expended on C.B. targets.\textsuperscript{83}

In their attacks after July 1st the British devoted ever-increasing numbers of guns to counter-battery work, stripping the heavy batteries which had previously been used simply to pound the German front-line trenches and dug-outs. Ever increasing ammunition and
time were allotted to the counter-battery fire, so much so that for the artillery, one attack merged into the next, as the artillery began what became in reality a five-month battle with the German artillery to gain superiority. The German artillery did not simply endure the ever-increasing British counter-battery fire: they themselves were in turn attempting to silence the British batteries ranged against them. Given greater range and accuracy of German guns and the superior positioning of their ground observers, the German C.B. programme had considerable advantages over the British and inflicted heavy losses on the R.A. in both men and guns. Both sides attempted to deceive each other by digging a multitude of false gun-pits and by firing flares from them to induce observers to believe that they were seeing the muzzle-flash of a hostile gun. Batteries were moved constantly to confuse observers, and the Germans made a concerted effort to win back complete control of the air in order to deprive the British of their aerial observers. By November 1916 the Fourth Army had lost 191 guns to hostile German shell fire destroying either the gun itself or the carriage, along with 905 weapons destroyed by prematures or condemned because of excessive wear. Over 11,000 artillerymen had become casualties through German counter-battery fire or prematures.

By the time the British had forced their way to the crest of the ridge and, on 15th September, attempted to occupy Pozieres, British Corps were devoting as many heavy guns to C.B. as to bombardment duties. For the Pozieres attack XIV. Corps, for example, used 56 heavy guns in a long counter-battery programme before the attack, and at the moment of assault they were joined by a further 24 heavy guns. But this was still insufficient. On the 15th, Fourth Army intelligence had reported 150 enemy batteries, of which the British had guns to engage only 70.

The hostile fire of the German batteries reduced the number of British guns, so that on the 16th, while intelligence still noted 142 hostile batteries, the British were able to engage only 45. By 25th September there were still 124 German batteries locatable from
the air, 47 were engaged and 24 silenced. Even when the British had reassessed the requirements of an effective counter-battery programme, it is clear that they were unable to get a decisive superiority over the German artillery that ringed the battlefield. The British lacked the heavy guns and the artillery techniques required to subdue the German artillery in 1916, which is why each of their attempts to move was met by heavy defensive barrages, heavy losses and meagre returns in terms of infantry advances.

The German artillery could range over much of the ground where the British attack assembled and engulfed any advance with heavy fire. As this Australian officer recalls of one of the attempts to advance past Pozieres,

"We went in single file along narrow communications trenches. We were shelled all the way up, but got absolute hell when passing through a particularly heavy curtain of fire which the enemy was playing on a ruined village [Pozieres, in fact]. In the midst of this barrage our line was held up: I went up from the rear and found we had been cut off, about half of us, from the rest of the battalion and were lost. I would gladly have shot myself, for I had not the slightest idea where our lines, or the enemy's were, and shells were coming at us from, it seemed, three directions ... the shelling was awful."

After "a long drink of neat whisky", this officer got his men forward only to discover no possibility of attacking since German shells were falling heavily all around the position. The C.O. was already dead, two other officers had gone mad under the welter of shell fire, and the troops had to dig for their lives to escape the fire of the German guns. "I refused to let any sound man help any wounded man, the sound men had to dig ..." He ordered that any man who stopped digging would be shot. "We dug on and finished amid a tornado of bursting shells. I was buried twice, and thrown down several times - buried with dead and dying ... The horror was indescribable."

The problem posed by the German batteries, illuminated by many such reports from the Somme, was the central challenge facing the British artillery in the next two years of warfare. In 1916 it proved insurmountable: but we can find, in that year of horrific costly
failure, the seeds that were to grow into the triumphant domination over the German artillery in 1918. The first change that occurred was the recognition by Birch and the senior artillery Staff that counter-battery fire had become the single most crucial and complex task confronting the artillery in preparing for an attack. The response to this was to create an entirely new class of officer in the R.A., the C.B.S.O., Counter-Battery Staff Officer.

In the initial bombardment for the July 1st attack, counter-battery fire was controlled by the various heavy group commanders, or C.R.A.s, who distributed their gunfire as they saw fit. By the end of the battle, counter-battery was the sole responsibility of a single specialist artillery officer in each Corps. Birch also attempted to reduce the British artillery dependence on aerial observation, which had proved so disastrous throughout the battle, and created two specialist groups within the Royal Engineers to improve ground-based hostile battery location. These two groups were the sound rangers and the flash spotters. The first was a group of scientists based around the young Nobel prize-winner, Lawrence Bragg. They attempted to perfect a method of locating hostile batteries by measuring the sound waves produced by the hostile guns' fire. They contributed little effective assistance to the artillery on the Somme as they had yet to perfect a microphone that was capable of separating a single report from the general din of battle.

The second group were attempting to train men to give accurate estimations of range by observing, not the German batteries themselves, but the huge muzzle flashes that are produced when a heavy gun fires a shell. Although it was promising, this development proved difficult to perfect, and contributed little effective intelligence during the Somme campaign. It was found that German batteries could not camouflage muzzle-flash, but on the other hand, it took considerable practice and experience to estimate range and direction on the basis of a momentary flash of light. Both these specialist groups, whilst unable to produce immediate solutions, held promise for the future, for they did not require the
complex business of air-to-ground communication and, most importantly, were unaffected by poor weather conditions or even darkness.

While the British artillery on the Somme were unable to subdue their German rivals, the experience gained by trial and (costly) error and the various experiments, would lead to improvements in counter-battery fire so that in less than twelve months after the muddy end of the Somme, the R.A. would demonstrate its ability to dominate completely German artillery fire on a given section of line and turn the tables on the German gunners across no-man’s land.

With the rival armies bogged by winter rains, in mud so deep that horses drowned in it, the Somme offensive finally ground to a halt. Britain had expended over twenty million shells, had revealed their secret weapon, the tank, and had suffered a staggering 419,654 casualties. Yet for all this they had advanced a mere four miles or so into the German-held territory. Bapaume, which the commander had wrongly thought might fall after two days of attack, was still miles behind the German lines after five months of struggle. The French had lost 204,253 casualties and the Germans, in their desperate and constant counter-attacks under a deluge of Allied artillery, had lost approximately 600,000. How are we to understand this titanic struggle and particularly the crucial role played in it by the British artillery? For Liddell Hart it was a case of shared and complementary incompetence on the part of the rival Staffs. The British artillery-based offensive doctrine was simply a mechanism to throw troops’ lives away in useless attacks. Fortunately for the British, the German commanders were equally incompetent, and thus the follies cancelled each other out, simply adding more men to the casualty lists.

"Thus the miscalled Battle(s) of the Somme closed in an atmosphere of disappointment and with such a drain on the British forces that the considerable strain on the enemy was obscured. This strain was largely due to the rigidity of the German higher command, especially General Von Below of the First Army, who issued an order that any
officer who gave up an inch of trench would be court-martialled and that every yard of lost trench must be re-taken by counter-attack. If German mistakes do not condone British mistakes, they at least caused a vain loss of life, and still more of morale, which helped to balance the British loss.\textsuperscript{92}

According to Liddell Hart then, there is little need for close examination of the various British attacks, for they were all equally incompetent, saved from disaster only by the equal stupidity of the German command. The analysis of the official historian is very different. Edmonds explains that, given two equally-matched opponents, as the two forces on the Western Front were the "necessity of wearing down an opponent by sheer hard fighting"\textsuperscript{93} was unavoidable. So the Somme was the "inevitable … battle of attrition."\textsuperscript{94} This attrition destroyed the best of the German armies and "the foundations of the final victory were laid."\textsuperscript{95} The notion of attrition, the wearing-down fight, carries with it the idea that the repeated blows were all of roughly the same sort, that it was the endurance of the British in maintaining their offensive that was the most notable feature of the attacks. This impression is confirmed when Edmonds discusses the artillery work in the retrospect to his two-volume analysis of the battle. "The Somme was an artillery battle, but the British artillery tactics underwent no important development during its course."\textsuperscript{96} Edmonds’ first point is undoubtedly true: the Somme was an artillery battle; the tactics used by the attackers and the defenders were based on the powers of the rival artillery forces. The success of attacks, counter-attacks, and to a lesser extent, defensive actions, all relied on the power and organisation of the artillery. To see the truth of this one need look no further than the ill-fated July 1st attack by the British, which for so long has been represented as a failure of infantry tactics, when the root cause, in reality, was the complete failure of the British artillery to subdue the defensive force. But Edmonds’ second point, that artillery tactics underwent no important development during the long sequence of attacks, is entirely erroneous. The British attacks on the Somme, in fact, witnessed numerous experiments in artillery tactics, some terrible failures, but some notable advances in the complex gunnery of the Western Front.
The most notable of those experiments was the development of the creeping barrage. When the British began their attacks, on 1st July, the creeping barrage was simply a vague idea in the minds of the senior artillery officers. During that failed attack, various types of creeping barrage were tried by the different C.R.A.s along the battlefront. By the end of the battle, the creeping barrage was an integral feature of every British attack. The attacks after 1st July saw the creeping barrage defined by trial and error. It was first established that the barrage was best carried out by field guns, and that it must begin, not on the German first line, but before it. It was also established that despite the prematures, duds, and general reluctance to use H.E. shells, an effective creeping barrage had to include a high proportion of H.E. fire. It was also found that machine-guns could usefully contribute to the creeping barrage, by firing their guns at high elevations in the first advances of the attack. It was further established that, subject to circumstances, 50 yards a minute was a reasonable rate for the barrage to creep. While later campaigns would see various modifications to the creeping fire - a general thickening of its fire and the additions of various heavier calibre weapons - there is no doubt that the creeping barrage was born of the terrible struggle up to Pozieres Heights.

While the Somme saw the British artillery develop the creeping barrage to subdue the German machine-gunners, it also saw the failure of the second important artillery tactic attempted, namely, the co-ordinated counter-battery shoot. Just as in the case of the creeping barrage, 1st July had seen the various C.R.A.s attempt to deal with the hostile batteries in their area. What emerged from the debacle was that before any attack could succeed, a thorough and co-ordinated effort to subdue the German artillery was required. What occurred in the sequence of assaults up to Pozieres and beyond was not the solving of this problem, but merely the defining of its complications.

Steps were taken in the course of the campaign to co-ordinate C.B. shooting, such as the creation of the C.B.S.O.s and the allotment of ever-increasing numbers of guns to
counter-battery tasks. The lesson learned by the artillery was, however, that a truly effective counter-battery shoot was still beyond their powers. The inability to locate and observe German guns was still the primary obstacle, but further problems emerged in the course of 1916. In an artillery/artillery duel, the matter of range is crucial, just as reach is in boxing, and throughout 1916 the British found that they did not have enough heavy-calibre weapons, with long enough range to tackle the German artillery effectively. Furthermore, the problem with the lack of heavy guns was exacerbated by the great inaccuracy of British fire. As has been mentioned, it was estimated that it required 100 rounds of well-directed 6-inch fire to destroy one German gun-pit. The reason for this inaccuracy was the British artillery’s inadequacy in the techniques of long-range fire and the worn and deteriorating state of their weapons. Lacking the skills and the accurate guns and ammunition required, the British counter-battery was forced to rely almost entirely on the unreliable and complex business of aerial observation. The battles of 1916 forced the British to recognize the nature of the problem posed by counter-battery fire, identify their deficiencies and begin the process of overcoming them. The first and most important step in this direction was the foundation of the sound-ranging, and flash-spotting sections. It was from these new sections, set up in 1916, that the solutions to the problem of counter-battery fire would emerge.

2 Correspondence of Birch to Edmonds, June 1930. Cab 45/132.
3 Figures derived from Artillery Lessons of the Battle of the Somme, no date, but presumably drawn up in November-December 1916, Field Marshal Sir Archibald Montgomery-Massingberd Papers, MM 48/12, KCL.
4 Rawlinson Diary, 23 May 1916, Rawlinson papers, 5201/33/26.
5 The Fourth Army Staff not only knew of the existence of these deep, well protected dug-outs, but also knew their bombardment was destroying them. Fourth Army Intelligence reports, 26 June 1916, WO 157/171.
7 Fourth Army tactical notes, 11 April 1916. Rawlinson papers, 5201/33/70.
8 Haig Diary, 15 June 1916, WO 256/10 PRO.
9  Haig Diary, 30 July 1915, WO 256/5. Travers suggests this was an attempt to apply a "Napoleonic advanced guard strategy" to the conditions of the Western Front. T. Travers, op.cit., p. 127.

10 Rawlinson, Plan for Offensive by Fourth Army, 3rd April 1916, WO 158/233.

11 Haig, Comments on Rawlinson’s plan for offensive by Fourth Army, 3 April 1916, WO 158/233. Haig’s alterations are dated 5 April 1916.

12 Haig Diary, 27 June 1916, WO 256/10.

13 Birch replaced Du Cane, who returned to England to become D.G.M.D. (Chief of Design) at the Ministry of Munitions, while Birch himself left no record of criticism of his predecessor’s lack of decisive leadership. Rawlins, Birch’s Chief of Staff, wrote in his review of the artillery in the war that the artillery notes drawn up by Du Cane were "indecisive and their character was rather reminiscent than doctrinal". Rawlins, A History of the Development of the British Artillery in France 1914-1918, Rawlins Papers, p.106.

14 Report of the Army Commanders’ remarks at the Conference held at G.H.Q. on 5 April 1916, 6 April 1916, WO 158/233. This criticism by Birch, that Haig had over-extended the frontage and increased the depth of the attack, is repeated in a letter Birch wrote to Edmonds in July 1930 commenting on the draft of the Official History’s Somme Volume. "There were miles and miles of wire to cut and no instantaneous fuses, and poor Haig - as he was always inclined to do - spread his guns." Cab 45/132, PRO.

15 See Table One.


17 Haig, OAD 876 dated 16 May. Rawlinson relayed the letter to his Corps Commanders the next day. Report of Conference held on 17 May 1916, Rawlinson papers.

18 Artillery Lessons of the Battle of the Somme, no date, Montgomery-Massingberd papers, MM 48/12.

19 The letter, while signed by Kiggell, related Haig’s thoughts on the forthcoming offensive. Kiggell to Rawlinson, 16 May 1916, WO 158/233.

20 Fourth Army Intelligence Summary, 27 June 1916, WO 151/171.

21 Ibid., 29 June 1916. Preliminary Examination of Leopold Gregier, 7th Company. See also Preliminary Examinations of Leopold Spraul 7th Company. "He states that the dug-outs are little damaged but that the trenches are being knocked about". Both prisoners also reported that the wire in their sectors had been cut in places.

22 Ibid., 27 June 1916. It must be noted that various prisoners captured as a result of the raiding on the 26th, 27th and 28th made greatly conflicting statements. A number claimed that their companies had suffered heavy casualties and that their trenches and wire had been cut up. The authors of the summaries simply ignored the more pessimistic reports and gave weight to the more optimistic. Thus in the Summary of 29th June, two days before the assault, the report concludes "Our bombardment continued with satisfactory results", despite some prisoners stating that dug-outs remained intact and the defence held in strength.

23 Rawlinson Diary, 30 June, 1916. Rawlinson papers, 5201/33/67.

24 Haig Diary, 30 June 1916, WO 256/10.


26 Ibid.

27 The creation of the meteorological service who provided the daily telegram was a product of Birch’s insistence, and also the persistent pressure of Major E. Gold, a meteorologist with the R.E. When in June of 1915 Du Cane was asked by Gold if he wanted the weather information Gold was collecting for G.H.Q., Du Cane replied that the artillery could not make "any use of this information" (see Anstey, p. 341). Gold however, produced a Fourth Army G.S. paper ‘Notes on Meteorological Conditions which Affect Gunnery’. (G.S. note, 20 March 1916). When Birch replaced Du Cane he acted on the note’s suggestions.
The first complaints concerning the smokeless detonation of Amatol were made in September 1915. By late April of 1916 Butler, on behalf of Haig, was writing concerning the "frequent representations ... made to me by responsible officers of both the Royal Flying Corps and the Royal Artillery regarding the serious nature of the difficulties". The Ministry of Munitions first attempted to supply a few smoke filled ranging shells. This failed however. Only in 1917, with a reliable smoke additive for Amatol, was the problem solved. Butler to D.G.M.D., 19 April 1916. Mun. 4/2877.

In Du Cane's report from the army to the Ministry of Munitions in February 1916, he described the problems of Amatol. "As regards improvement in quality, the most urgent question is the detonation of 80/20 Amatol". Du Cane's own department, Design, conducted extensive experiments throughout the early part of 1916. "The net result of these experiments is to show that the present projectile is unsatisfactory, and I am compelled to press for change". The new shells began arriving late in 1916. Mun. 5/122/900/7.


These two examples, typical of the many reports reaching the Ministry of Munitions during the preparations for the Somme, are noted by Farndale, History of the Royal Regiment of Artillery, p. 136.


Ibid.

Anstey, History of the Royal Artillery, Anstey papers, 1159/12, p. 114.


Ibid.

Ibid.

General Du Cane's report on effect of possible modification of design of shells and fuses. 7th February 1916, Mun. 5/122/900/7.

Fourth Army Intelligence Summary, 29 June 1916. Prisoners reported wire repairs and dug-out clearance continuing up to the night before the attack. WO 159/171.

Lyn Macdonald, Somme, pp. 45-8.

To name but one of many collections of first hand accounts of the infantry's slaughter on that day, see M. Middlebrook, The First Day on the Somme.


Ibid. p. 343.


Ibid.

Ibid, p. 343.

Ibid.

Ibid, p. 345.

Ibid, p. 343.

Haig Diary, 2 July 1916, WO 95/256.

Ibid. 14 June 1916.

Fourth Army Intelligence Summary, 14 July 1916, WO 157/172.

While the total of German casualties has received close examination over many years since the Somme, no exact figure has been established. Most historians would, I believe, accept the figure lies between the two mentioned. See Edmonds, Military Operations France and Belgium 1916, vol. II, pp. xiii-xvii, for a detailed
analysis of the figures and a review of the historical controversy that arose in the 1920's concerning them.

60 In the British Artillery the term 'creeping barrage' did not come into vogue until late 1916. During the first part of Somme offensive the first experimental attempts were called 'rolling barrages'.

61 Terraine states that the creeping barrage probably "spontaneously and simultaneously evolved out of identical experiences in several places". White Heat, p. 214. It certainly seems that the Germans were experimenting with a form of creeping barrage during the early part of 1916 as is made clear by Bruchmüller in Die Deutsche Artillerie in den Durchbruchs Schlachten des Weltkriegs, p. 44. Anstey claims it was Alexander and Budworth (see p. 118 of the History of Royal Artillery, Anstey papers) who first had the idea.

62 Fourth Army tactical notes, 11 April 1916, Rawlinson papers, 5201/33/70.


64 Anstey credits the success of XIII. to the use of the creeping barrage. He discounts the effects of the flanking French heavy artillery batteries destroying many of the German dug-outs and their effective counter-battery fire and seems to me to be reading too much in the Corps' use of the creeping fire. See his History of the Royal Artillery, p. 117.

65 The debacles of these three Corps' attacks and the effect of the barrage suddenly lifting in range are examined in Military Operations France and Belgium 1916, vol. II in some detail. The conclusion that lifts had to be kept short and with long delays between them was the major conclusion drawn in the report on the battle by Rawlinson's senior general Staff officers. "The Artillery of the Fourth Army. Artillery Lessons of the Battle of the Somme." Montgomery-Massingberd papers, MM 48.


67 Anstey, History of the Royal Artillery, Anstey papers, 1159/12, p.120.


69 The 9th Division had occupied only half of Longueval in its rapid rush. Having got to the limited range of cover afforded by the creeping barrage, they were foiled in any further attempt to move forward by "heavy hostile bombardments". They twice claimed to capture the tiny remaining section of the village, and twice they were driven out by German shellings. See Edmonds, Military Operations France and Belgium 1916, vol. II, p. 83.


71 A detailed account of the Australian assault of Pozieres Heights can be found in C.E.W. Bean, The Official History of Australia in the War of 1914-18, vol. III, chap. 19, (Sydney: Angus and Robertson, 1938).


74 The attack of the tanks and its failure due to heavy German bombardments are reviewed in detail in the many works concerning the use of tanks in the Great War, such as Bryan Cooper's Tank Battles. I shall not engage with what the tank men regard as the premature use of the weapon in "penny-packets" before a great force could be built. The point should be made, however, that the value of surprise, which was sacrificed, has to be balanced against the experience gained by using the tanks in 1916, which led to vital modifications to the machines and provided valuable experience for their crews.
The figures for the artillery are taken from Montgomery-Massingberd, Eleven Attacks Contrasted, undated but c. November 1916, Montgomery-Massingberd papers, MM 48/8.

Despite the fact that this co-ordinated approach between the R.F.C. and the artillery was of crucial importance, and senior officers recognized the importance of long-range counter-battery fire directed from the air (the III Corps Commander wrote in his diary of the Somme, "aeroplane observation now appears to be ... essential", (Jones, op.cit., vol. II, p. 234) the organisation of this effort was deemed worthy of a two-sentence long comment only, in the 78th point of the "Tactical notes" for the battle, that "certain arrangements have been made by the RFC for transmitting such information ", (Fourth Army Tactical Notes, 11th April 1916, Rawlinson papers). This reveals how little Fourth Army H.Q. recognized the vital importance of counter-battery work before 1st July.

Ibid.
Figures from the heavy artillery war diaries, quoted in Anstey, History of the Royal Artillery, Anstey papers, 1159/12, pp.118-9.
Ibid.
In September the Germans formed Jagdstaffen, pursuit squadrons armed with fast single seater scouts, whose sole purpose was to knock the British observer planes out of the sky. Jones, op.cit., vol. II, p. 281.
Anstey, History of the Royal Artillery, Anstey papers, 1159/12, p.124.
J.R. Innes, op.cit.
B. Liddell Hart, The Real War, p.267.
Ibid.
Ibid.
Ibid. p. 566.
CHAPTER FOUR

THE BATTLE OF ARRAS

We are the guns, and your masters!
Saw ye our flashes?
Heard ye the scream of our shells in the night
And the shuddering crashes?

Gilbert Frankau, from his poem "The Voice of the Guns"

"There's too much fuckin' artillery in this bloody war."

E. Norman Gladden, recalling the fighting of 1917.
In 1917 the guns utterly dominated the battlefields of the Western Front. The preparatory bombardment used before the beginning of the Somme offensive would be dwarfed by the massive and repeated bombardments of 1917. In their preparation for the first three of the five major attacks launched by the British in 1917, the Royal Artillery fired off over ten million shells, using over two thousand heavy weapons. The German artillery, firing counter-battery defensive barrages and protecting their counter-attacks, used only marginally less. The destructive fury of these massive artillery battles is still evident in the fields of Northern France and Flanders. Miles of country-side were laid waste, hills pounded down, villages obliterated, the landscape reduced to cratered moonscape inhabited only by the soldiers and the never-silent guns.

Despite the vast destructive power available to the British Generals of 1917, through the services of the Royal Artillery, none of the many attacks launched by the British achieved the goal much desired by the Staff at G.H.Q., a decisive breakthrough of the German defensive line. When the last shots were fired in December of 1917 the German armies were still ensconced in a strong trench system from Switzerland to the sea. The primary reasons for this failure were two-fold. Firstly, the German command evidently learnt as much from the Somme campaign as the British had done, for during 1917 they adopted a defensive arrangement that sought to minimize the effects of the long, destructive bombardments used by the British on the Somme. They followed a new defensive philosophy, defence-in-depth. The second reason, one connected to the first, was that the British Command, and Haig in particular, continued to launch attacks as if the German defences were simply a narrow zone, an obstacle which if pierced would collapse at an ever-accelerating rate. It is evident that even in 1917, after two years on the Western Front, Haig regarded the trench warfare and the Germans’ defensive positions as aberrations on the battlefield. If he could simply get his armies through the trench lines, a mobile, cavalry-led war of manoeuvre would commence. Despite the expenditure of millions of rounds of
ammunition and hundreds of thousands of casualties, none of the major British offensives of 1917 produced the decisive breakthrough Haig desired.

In this sequence of frustrated ambitions and failed plans however, the emergence of a distinct artillery doctrine can be discerned. In the summer offensives of 1915 and 1916 British artillery tactics and the effects of the bombardments were largely determined by the shortage of heavy guns, the poor quality of the shells, and the lack of sophisticated means of ranging on distant targets. During 1917 these impediments were removed. This made possible a much greater tactical flexibility in the artillery and led to a number of tactical experiments with artillery preparation in the offensives, and deep disputes over artillery tactics at the highest levels of army and G.H.Q. commands. The first of these disputes arose over the planning for the Arras operation, the British contribution to Nivelle’s Spring offensive. What faced the British Armies at Arras was not however the same type of defensive arrangements as the British had slowly overwhelmed in the Somme Valley. During the winter of 1916 the German armies on the Western Front had changed their defensive tactics in accord with their new Commander and his Staff.

On the 29th of August 1916, Falkenhayn had been replaced by Hindenburg as Commander of the forces in the west. With Hindenburg came an entirely new Staff at O.H.L., led by Ludendorff who in reality directed O.H.L. while Hindenburg acted as the mouth-piece and figure-head of the army. Hindenburg and Ludendorff set about re-organizing not only the defensive tactics to be employed by the German armies in the West, but the entire strategic position of the German line in France and Flanders, and the domestic economy of Germany. Conscription was extended to all men between sixteen and sixty and various troops previously classed as unfit were included in active service units, which increased the number of German divisions from 175 to 197.¹ The Hindenburg programme of munitions production was developed. That programme was very similar to Lloyd George’s energetic revision of munitions production in Britain in 1915, involving the creation of an independent government department (the Kriegsamt) with powers to sequester
the supplies of raw materials, and introduction of industrial conscription. But the benefits of the munitions programme would not be felt until the end of 1917 at the earliest. Thus the two commanders attempted to re-organize the resources at their disposal to best face the challenge of the inevitable Allied assaults in 1917.

Their first decision was to abandon Falkenhayn’s "old mistaken policy of not yielding a foot of ground until obliged to do so". Strategically this meant that, having lost the high ground on the Somme battlefield, they would not attempt to recapture it; rather they would pull back to another line of high ground and build an entirely new defensive line there. In fact, by pulling a number of their armies back they could establish a line much shorter than their original line had been, allowing greater concentration of effort. Tactically the new policy meant that these new defences would penetrate far deeper than the previous ones, thinning out the forward positions and relying on counter-attacks to stop any threatening assaults. The aim of this defence in depth was to keep the main body of defensive force beyond the range of the British artillery and not commit them to the battlefield until the Allied infantry were actually in amongst the defensive positions. Rather than distinct lines of defence, the new system called for zones: first, a forward zone in which a small garrison force occupied ferroconcrete dug-outs and machine-gun positions, protected by copious bales of barbed wire. This forward zone could not stop an attacking force but could simply slow it down and break up its organisation. Secondly, behind the forward zone was the battle zone, with vast underground shell-proof galleries below and concrete machine-gun bunkers above, called Mannschafts-Eisenbeton-Unkerstände. Behind this was the rear zone, where the artillery and counter-attacking forces were housed. The best troops and equipment were diverted to these "Eingreif" or counter-attacking divisions, whose task it was to halt any advance into the battle zone.

Between the zones were great open spaces, crisscrossed with lines of wire. It was on these that the German artillery carefully registered their weapons. The attacking forces, having fought their way through the forward zone, would be halted in these open areas by a
combination of the artillery’s barrages and the machine-gun fire from the battle zone, and then driven back as the Eingreifen divisions attacked. The greatest care was taken to site the major defences, the battle zone, on the reverse slopes to deny the British artillery any observation.5

The result of these deliberations was first noticed by the British at the end of October 1916. British airmen observed fresh earth-works some twelve miles behind the German lines.6 The poor mid-winter weather hampered long-range reconnaissances, but as the months passed it became clear that the Germans were constructing a massive defensive line some way back from their 1916 positions. The British called these new positions the Hindenburg line, but the German description "stellung" was far more apt, as the defences were up to eight miles deep in places. The Germans divided the stellungen into various sections according to the armies who held them and named the sections after the characters from the Niebelunglied. The labour lavished on these stellungen was vast; at one stage 65,000 men were at work on Siegfried stellung alone.7

The next stage of this re-organising of the German forces was operation Alberich, the controlled withdrawal of the German Armies back to their new positions and the destruction of the area as they withdrew. Alberich took place during March of 1917, and caught the Allied Staff entirely by surprise.8 They had thought the Hindenburg line was merely a fall-back position, a safeguard against a sudden Allied blow. As the German Armies withdrew they devastated the countryside the Allied forces would have to occupy as they closed up on the new German positions. Wells were polluted, roads destroyed, railway lines torn up, and any building or tower that could conceivably be used to provide observation positions was pulled down.9 The withdrawal to the new positions was, as Edmonds was forced to acknowledge, a "masterly piece of organisation".10 Hampered by the tangled ruins of the old German positions, and the destruction of the road and rail systems and by the multitude of booby-traps left by the retreating armies, the pursuit was
ineffective and the Germans were able to occupy their new field fortresses with few losses.11

Despite the constant efforts of the Allies, the Germans in the spring of 1917 were in a stronger defensive position than they had presented to the Allies in the spring of 1916. By surrendering a few miles of occupied territory, they won back for themselves all the advantages of position that they had lost because of the Somme offensive. And the experiences of that battle had led to their new and more sophisticated defence-in-depth tactical approach. But, at the same time, the experiences of the Somme had not been lost on the British Army, and the forces Britain arrayed to attack the new German stellungs were incomparably more destructive and threatening than those which Germany had faced in the spring of 1916.

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The various attacks on the Somme battlefield had, as we have seen, revealed serious defects in both the guns and ammunition being used by the Royal artillery. This did not go unnoticed in the Ministry of Munitions, for throughout the Somme campaign the department had been constantly berated in the reports it received from the senior artillery commanders. The result was a re-introduction of the inspection standards that had been abandoned with such disastrous consequences in 1915, and various changes in the design of guns and shells that eliminated all of the serious problems of 1916. One can hardly over-rate the significance of these improvements for they transformed what in 1916 had been a blunt and clumsy instrument into an artillery force with accuracy and destructive powers beyond the imaginings of the artillery commanders of 1916.

On the 27th of August 1916 the Ministry of Munitions replied to a report from the army council which had pointed out the disastrous failure of the shells the ministry had
supplied for the Somme campaign and which demanded to know what the Ministry was doing to rectify the problems. The Ministry’s reply made four recommendations:

1) Increasing the number of tests of shell ... with a view to reducing prematures due to defective shell.

2) The introduction of a shutter in the cavity at the head of the gaine.

3) Increasing knowledge and experience had resulted in the filling of shells being carried out more uniformly and the liability of any being incorrectly assembled had been thereby reduced.

4) Judging from the extensive trials carried out on the 4.5-in. howitzer, the introduction of No. 106 fuse into the service should greatly reduce the percentage of prematures.12

The Ministry’s hopes for its new 106 fuse were not disappointed, for its introduction ended the plague of prematures and duds caused by the use of the compromise fuses the British had used since the outbreak of the war. The 106 was a fast-acting graze fuse, detonated by the merest arresting of the shell’s flight - touching wire entanglements, for example. The Ministry also provided a new impact fuse, the No. 101, to replace the disastrously sensitive No. 100 fuse. The result of the introduction of the new fuses was dramatic and immediate.

When the Somme campaign had begun in 1916, the rate of prematures in 18-pdrs. using H.E. was one in 5,000 rounds; by April of 1917, with the new fuse, it was one in 317,000 rounds.13 In the 4.5-in. howitzer, which was an older style weapon and tended to buffet the shells, causing prematures, the new fuses improved the rate from one in 18,000 rounds to one in 108,000 rounds.14 Not only did the new fuses end the mass destruction caused by the prematures, but also the 106 proved to be ideal for wire cutting, scything away the wire yet not churning the ground beneath. All this was confirmed by Haig’s report to the army council on 25th April.15 The new fuses also helped reduce the number of duds, as did the conversion of the filling factories to the hot-melt filling technique. Testing during 1917 showed that the new shells had a detonation rate of 99%, a dramatic improvement over the significant rate of duds on the Somme.16
Ministry research had also overcome the other serious problem with 1916 gun ammunition, the lack of smoke produced by Amatol shell’s explosion. During 1916, in response to criticism from artillery officers that ranging with Amatol shells was rendered difficult from the ground and near impossible from the air because of the lack of smoke, the Ministry had experimented with various methods of adding a smoke charge to Amatol-filled shells. At first they had attempted to add a phosphorus smoke box to the shells but this had proved complex and unreliable. The addition of the box slowed down production considerably and phosphorus was in extremely limited supply. This, combined with the disadvantage that even a minute leakage of phosphorus into the Amatol charge would almost inevitably result in a premature, led to the phosphorus box’s production being discontinued. After further experimentation the solution was found in August 1916. A new shell filling mixture of 70% 80/20 Amatol combined with 30% ammonium chloride was found to have an explosive impact equal to that of pure 80/20 Amatol and produce a large and visible smoke cloud. It was immediately pressed into service and by February 1917, all H.E. shells were of the new smoky mixture.

The Ministry of Munitions had not only revised its shell programme, but had also improved the design of most of the guns its factories were producing. Most guns had the design of their recoil systems, which had caused such difficulties in 1916, revised and improved. The 18-pdrs. and 4.5-in. howitzers had their old spring system replaced by air-recuperation mechanisms, thereby enhancing both the rate of fire and accuracy. The heavier guns were converted to oil-based hydraulic recoil systems which proved far more effective than the water/glycerine mixture of 1916. Production of the 4.7-in. gun, whose poor design had caused many prematures in 1916, was discontinued to allow more productive capacity to be devoted to heavier guns. The 60-pdr. was modified to become the 60-pdr. Mk. II which was both 9-cwt. lighter than the old model, and more accurate because of a new sighting mechanism which automatically compensated for loss of muzzle velocity through barrel wear. The 6-in. gun was also completely redesigned, supplies of the new Mk. XIX arriving from March 1917. This new weapon not only had superior range, but weighed
only 10 tons and was thus much easier to handle than the old design. In fact, every calibre of weapon was modified and improved in light of the defects that had emerged on the Somme. Production of guns that were unsuitable was discontinued, while guns that had proved their usefulness in the heat of battle, such as the 9.2-in. howitzer, were produced in massively increased numbers.

But these improvements in the design of both guns and shells had not held production back, for now the full manufacturing capacity of Britain and her American suppliers was reaching its peak. When the British had begun the Somme campaign in 1916 they had at their disposal a total of 761 heavy guns, many of which were old and out-dated pieces. By the end of 1916, despite the wastage caused by German counter-battery fire, premature fires and general wear, the number of heavy pieces had grown to 1,157. By March 1917, after the artillery had weeded out older weapons that were too worn to use, and scrapped 80 of the 4.7-in. guns because of design faults, they commanded a force of over 1,500 heavy weapons.

Moreover, despite the fact that the new fuses and shell-filling methods were more complex than previous procedures, shell production had continued to expand at a rapid rate. In the second quarter of 1916, as the British were stock-piling ammunition for the Somme, the Ministry was able to send 706,222 completed rounds to France. By the last quarter of 1916 this had increased to 2,841,555 and by the second quarter of 1917, as the British prepared their assault on the new German defences, the Ministry despatched over five million completed rounds. It had taken twelve months longer than expected, but the Royal Artillery now had the means to pursue the long, destructive bombardment strategy upon which G.H.Q. had pinned its hopes.

Birch took the opportunity of the winter break in operations to re-organise completely both the structure of artillery command and the techniques of gunnery. Birch produced two papers on the lessons learned from the Somme fighting, "Artillery notes No.
3: Counter-battery work", and "Artillery notes No. 4: Artillery in offensive operations".23 These two papers cancelled the artillery notes issued in April 1916 and marked the final abandonment of the techniques and tactical principles with which the field artillery had entered the war.24 As Anstey notes, the papers would have "shocked the CRAs of the original expeditionary force",25 for the entire emphasis of artillery work had changed from speed of movement and rapidity of fire to a concentration on the tightness of organisation and accuracy of fire. They represented the realization that the artillery was involved, not in open battle in the field, but in an enormous siege, in which it held the key to destroying the vast fortress the Germans had constructed stretching from Switzerland to the sea.26

Birch's first point in "Artillery notes No. 4" was finally to end the bickering and arguments in the artillery over the prerogatives of their various levels of artillery command. Command was completely centralized under the G.O.C.R.A. army. This army artillery commander was the direct controller of every gun in his army, responsible only to Birch and G.H.Q. Beneath the army commander, Birch centralized the control of artillery within each Corps, creating a G.O.C.R.A. Corps. This officer was responsible only to his G.O.C.R.A. army, and controlled all guns, field, heavy and super heavy. The Corps Artillery Commander was given a specialised Staff, whose duties were to divide up into the various tasks the responsibilities of the Corps artillery.

The most significant of these were, first, the C.B.S.O., who was to control the counter-battery work of the Corps, and secondly the C.S.O. (Corps Signals Officer) who was in charge of artillery communications and intelligence gathering for the Corps. The powers given to these new artillery officers would also have amazed the artillery men of 1914, for the major tasks of the army artillery commander would be not merely tactical but strategic. His work would most crucially involve the selection of suitable sites for attack, that would "admit the fullest development and co-operation of the artillery".27 In fact, the tactical handling of the guns, which in 1914 had been the C.R.A.s major task, was now integrated into the infantry command structure, as the infantry had become so dependent on
artillery control. The old Divisional C.R.A. headquarters, which in 1914 had been the highest level of artillery control, was merged with the central Divisional headquarters, and the Divisional infantry commanders were given the power to alter and control the creeping barrages: they were so closely linked with the progress of the infantry that it was obviously more efficient to have one officer controlling both infantry and guns.

The paper went on to define the roles of the various weapons the Corps would have at its disposal. Birch pointed out that it was wasteful to use 18-pdrs. and 4.5-howitzers for counter-battery, as had been attempted at the Somme, since they lacked the range and destructive power to achieve any worthwhile results. They should be confined to firing the creeping barrage and to close range infantry support: counter-battery was to be left to weapons best able to range on to and destroy German batteries at long distance, the 8-in. and 9.2-in. howitzers, and the new super-heavy guns, the 12-in. and 15-in. howitzers. The longest range pieces of all, the 8-in. 9.2-in., 12-in., and 15-in. guns were reserved for harassing the Germans deep behind their lines, for ammunition dumps, railway stations, rest billets, communication and command centres.

Great significance was placed on maintaining communications between observers and gunners, for clearly this was the heart of accurate fire. This crucial task was to be the responsibility of the newly-created Corps signals officers, whose work was to be co-ordinated by a communications supremo at army headquarters, the Army Signals Officer. There were, at the beginning of 1917, twice as many radio-equipped planes as there had been at the beginning of 1916, and because of the clapper-break three times as many could operate over a given battlefield. But the vulnerability of aerial observation to bad weather obviously concerned Birch for he made great efforts to improve ground-based observation.

The most significant innovation was the abandonment of above ground telephone lines and their replacement by the "continuous wave" wireless set. While these weighed 101 pounds and had an inconvenient 15-foot aerial, they were not vulnerable to the wire cutting
that had plagued F.O.O.s before. It was also outlined just how deep and protected a F.O.O.’s position had to be. The notes stated that his dug-out should be able to resist the weapon favoured by the Germans for destroying dug-outs and emplacements, the 5.9 shells. The information gathered by the F.O.O.s and other specialised observer groups, the aerial observers, flash spotters, and sound rangers, was to be co-ordinated by the intelligence section of Corps artillery H.Q., so that batteries were not dependent on their own observers; rather they all gathered information from a common pool of intelligence.

During the Somme fighting, attempts to collate and distribute the increasing amounts of information concerning hostile German batteries had been merely one of many functions assigned to the Corps intelligence section. In each Corps H.Q. an officer had been designated the Artillery Intelligence Officer but these officers had been drawn from the intelligence section, not the artillery, and hence lacked the technical expertise to conduct the increasingly complex task of co-ordinated counter-battery fire. Birch resolved this dilemma when, in January 1917, he had all Corps artillery intelligence officers replaced by specialist artillery men who, like the newly created C.B.S.O., were to concentrate their efforts on the artillery duel that was now dominating the artillery’s work.

The significance that counter-battery fire had acquired as a result of the Somme fighting was made clear in Birch’s "Artillery notes No. 3, Counter-battery Work". This was a much shorter piece than "Artillery notes No. 4", but it made three very important points. The first was that whereas in 1916 simple bombardment of German trenches and strong points had received priority in the allocation of heavy guns, now counter-battery was to be the first and most important task. Every German battery was to be registered on the artillery’s hostile battery lists, and each was to have appropriate guns allocated to its destruction. Any heavy pieces over and above the number required to subdue all hostile batteries could then be allocated to general bombardment. The notes also drew a sharp distinction between counter-battery fire in the days leading up to an assault and that fired whilst the assault was in progress. In the days preceding an attack British COUNTER-
BATTERY batteries were to shoot for destruction, that is, using H.E. shells to put rounds into the German gun-pits with the objective of blowing up the gun and its crew. This sort of fire required great accuracy and careful shot-by-shot observation. On the day of the attack, however, any German batteries that remained were to be inconvenienced by what the memo called "neutralizing fire". This consisted of fire which mixed H.E., shrapnel, and gas shells, with the aim of disturbing the German gunners as they worked their guns. In this the gas shells were of crucial importance, for even if the German gunners were not caught out by the gas cloud, it forced them to wear their gas masks, hampering their vision and slowing their movements.

Further notes on counter-battery were issued in March of 1917, the most important being "Notes on sound-ranging". This document concerned itself with the destructive shooting that was to precede each attack. It pointed out that the volume of information now being provided by the various specialist observation and survey groups could allow a battery to fire on a hostile gun position even if it was not able to get direct observation of the target, or only intermittent observation. They could do this by reference to the new 1/10,000 scale maps produced by the field survey company, which covered the entire frontage occupied by the British armies. The survey company's previous efforts at map-making had been marred by the warping and shrinkage which maps had endured in the often wet conditions of battery H.Q.s. The new 1/10,000 scale maps were not only more detailed but were also fixed to a rigid board, thus retaining the accuracy of their scale, and hence facilitating the estimation of the range of a hostile battery by simple calculation from the map.

The notes on sound ranging then went on to show that recent developments in sound-ranging technology had made it possible to fix the position of an active hostile battery to within 25 yards on the map, and inform the British battery where its shells were falling in relation to the hostile gun so long as the hostile gun kept firing. Even if the German battery was silent, the battery commander could use the sound rangers to calculate the exact muzzle velocity of his own guns from which he could deduce how far his shells were flying; then
by referring to the meteorological telegrams, he could compare the effects of wind on that flight, and on that basis, should be able to drop rounds into the German gun-pit. The full potential of this technique of shooting by the map, that is to say, without any direct observation, was not recognised by Birch in his memo, but eight months later it would be revealed as the single most important breakthrough in artillery technique in the war.

The creation of the superstructure of command and intelligence for the artillery that Birch's review created had meant the promotion of many of the experienced C.R.A.s into Staff positions. One result of this was that battery commander positions were now being held by officers who had joined since the outbreak of the war and whose training had been limited by the pressure to get men to the Front. During 1915 and 1916 young officers had been given only a crash course in modern artillery methods after they arrived in France. The courses, lasting twelve working days, were conducted within each Corps and were, unfortunately, usually taught by an officer regarded as being of little use at the Front. Birch changed all this late in 1916. At his instigation the War Office established the Chapperton Down Artillery School, which was staffed by officers experienced in the techniques of long-range gunnery, and specialists from the meteorological and field survey sections, and sound-ranging companies. This school not only trained new recruits but, most importantly, all battery commanders and their second-in-commands, who were brought in sequence from France and put through the school's courses during the winter of 1916/17. The lessons of Chapperton Down were reinforced at army-based artillery schools in France.

One of the most important results of this new training programme was the bringing to the fore of the study of meteorological effects on artillery shooting. During 1916 the tiny meteorological section had issued two meteorological telegrams each day to batteries, but the information contained in each telegram was limited, and untrained battery commanders were often unable to interpret that little information. The training at Chapperton introduced officers to the complex calculations required to assess the effect of barometric pressure on shell flight, and showed how the winds at ground level could have entirely different strength
and direction from the air thousands of feet above the battlefield through which the shells of heavy pieces had to pass.32 Meteorological telegrams were increased to six a day by March 1917 and they provided much new information.33 Wind speeds were given for the various layers of the atmosphere, barometric pressures from sea level to the highest point occupied by the British, the mean temperature at various heights above the ground: all this was included in the new telegrams.

By March 1917 Birch had completed his re-organisation and re-education of the artillery. Artillery command had been centralized; artillery intelligence and communication were now in the hands of artillery officers, and the junior officers had all been initiated, through the training course, into scientific gunnery. In his staff notes Birch also laid out the tactical formulae the artillery were to adopt, defined the roles of the various types of weapons, and given in great detail the structure of the creeping barrages, destructive bombardments, and counter-battery fire that the artillery were to use.

Despite this, there erupted in the early months of 1917 a severe disagreement between senior artillery officers over the use of artillery in the forthcoming Arras offensive. The offensive was to begin with twin attacks by the Third Army, commanded by General Allenby, and the First Army, commanded by General Horne. The nature of the dispute over artillery doctrine is revealed in the plans submitted by the two army commanders on the 7th and 8th of February 1917. The First Army Artillery Plan for the Capture of Vimy Ridge34 submitted to G.H.Q. on the 8th of February and drawn up by the First Army’s artillery commander, General H.F. Mercer, was an attempt to realise Birch’s idea of a sustained, accurate bombardment that destroyed the German defences completely. The counter-battery destructive shoot was to begin "3 to 4 weeks previous"35 to the attack. Birch’s instruction that counter-battery was to take precedence over all other artillery work was made clear.
It must be fully appreciated that if the enemy concentrates such a force of artillery in the theatre of operations as to require the fire of more batteries than are available in the COUNTER-BATTERY groups, some of the siege batteries now allotted for trench destruction, will be placed at the disposal of one or more of these COUNTER-BATTERY groups.36

In the final ten days of the bombardment both the counter-battery and general bombardment were to reach a climax, with guns firing "continuously night and day"37 until the moment of attack, when the bombardment groups were to fire their own creeping barrage, while the counter-battery group turned to neutralizing fire using gas shells interspersed with H.E. and shrapnel. The First Army plan in every way embodied Birch’s outline of the sustained, methodical destruction of German positions by the artillery.

The Third Army plan was, however, very different. The Third Army artillery plan, drawn up by General Holland and submitted to G.H.Q. on the 7th of February 1917,38 was in essence a return to the rapid barrages the British had tried in 1915 with disastrous consequences. It proposed a preparation period, in which all of the British artillery for the attack would be brought into position secretly, and would range on to their targets in strict sequence such that the Germans would not notice any general increase in shell fire. This would be followed by a heavy bombardment and counter-battery programme that lasted a mere 48 hours, which Holland believed would be long enough to tear up the German strong points and crush the artillery. Holland’s confidence was founded on the belief that given only 48 hours warning of the assault, the Germans would be unable to pour reserves of artillery into the defence and thus his counter-battery programme would have to deal only with the divisional artillery attached to the German battalions holding that section of line.

This is a short bombardment for a defensive line of this nature. It is estimated however that as the resting battalions of the German divisions of the front line will already have been involved in the fight, and further reserves will not yet have come up, the brown line (i.e. the rear of the German defensive zone) will be weakly held.39

Holland’s radical proposal, and his insistence on it in face of opposition from Haig and Birch, resulted in his promotion out of the artillery command and his replacement by General Lecky. His removal, and the arguments that raged over his plan, became somewhat controversial and have been represented ever since as the suppression of new ideas by the
devotees of long bombardment attrition warfare. But Holland’s ideas were not new: they were in fact a reversion to pre-war attacking doctrine and close examination shows them to have been based on entirely over-optimistic views about the nature of the German defence.

They reflect Holland’s evident disgust at the long, bitter trench warfare that modern weapons had made inevitable and a longing to return to the furious gallops and rapid advances of pre-war manoeuvres. Holland, in short, was drawn by the illusion of the "breakthrough", the view that if the Germans could simply be pushed out of their trenches, they would turn and run; German resistance would progressively weaken, and the nightmare of trench warfare would suddenly evaporate.

*If the advance is continued with reasonable rapidity it is probable that the resistance will quickly lessen, and that we shall reach places in which there are no German troops other than those running away in front of us.*

Even granted Holland’s optimistic belief that the defences could be overrun in one great blow, what is it that led him to believe that once out of their defences the Germans would turn and run rather than do as they had done on every previous occasion, simply dig themselves in to a new position? Holland’s general disgust at Birch’s new controlled and methodical artillery preparation is clear from his statement that "the habit of digging a trench and getting into it, or of waiting for a scientifically arranged artillery barrage before advancing must be discarded". Holland repeats the remarkable claim that trench warfare was simply a bad "habit" created by "a few sticky company commanders". That his plan was not in any way new or revolutionary, that it was in reality, a return to the over-optimism and under-preparation that plagued British attacks in 1915, and would have turned the Arras offensive into another disaster like 1st July is clearly revealed by his acknowledgement that "the wire … is not likely to be thoroughly cut" owing to the brevity of his proposed barrage and the depth of the defences and his proposed remedy: "It is therefore important to ensure that all troops possess wire-breakers and wire-cutters". Repeated experience had shown that if the artillery did not clear the wire, no amount of wire cutters would save the infantry from being cut down by German machine-guns as they
milled around in no-man’s land attempting to pick their way through the wire entanglements. Fortunately for the Third Army, Holland was removed and replaced by General Lecky, who produced an artillery plan identical to the First Army’s Vimy Ridge proposal.

* * *

After the battle of Arras, General Horne wrote that "The 9th of April will be a historic day in the annals of the British Empire." Of course, 9th April 1917 was soon forgotten, its memory overshadowed by larger battles later in the year and generally swallowed up by the disgust military historians have felt when discussing the battles of that terrible year. But 9th April and the twin attacks launched by the British were indeed great triumphs and worthy of remembrance, for they revealed how much the British Army and the artillery in particular had improved in the less than twelve months since the debacle of 1st July 1916.

There is in fact a great deal of similarity between the overall size and frontage attacked on 1st July 1916 and 9th April 1917. In 1916 the British had attacked with fourteen divisions, just as they did at Arras. The frontage for the Somme, about 14 miles, was very similar to the 13-mile frontage arrived at if one views the two Arras assaults as a unified whole. The great difference between the two assaults, the difference between limited success at Arras and utter disaster at the Somme, lies in the artillery.

On 1st July 1916 the British artillery had at their disposal 427 heavy artillery pieces, of which 200 were obsolete or improvised weapons. On 9th April 1917 the two attacks had a combined heavy artillery force of 963 heavy weapons, all of them modern, or re-designed to correct defects observed during the Somme fighting. If the British had simply spread their guns evenly along the attack frontage, as they had done at the Somme, there would have been more than twice the density of guns at the previous attack. But the difference
was exaggerated by the improvement in intelligence which allowed the British to concentrate their weapons where they were most needed. In the Vimy Ridge attack it was observed that the Canadian Corps’ four miles frontage faced the very toughest part of the Ridge’s defences. The attack was allotted 377 heavies along a mere four miles frontage, that is more than were available for the entire fourteen miles of frontage in 1916. Ammunition expenditure was also vastly increased, the Somme’s preliminary bombardment consuming 1,732,873 shells, whereas the Arras assaults used 2,687,653. And, of course, the shells in 1917 were far more effective than those of a year before, with a detonation rate of 99% and prematuress occurring only one in hundreds of thousands of rounds. The British artillerymen of 1917 had at their disposal not only new instantaneous and percussion fuses but also the services of the sound-rangers, the flash spotters, and the whole new apparatus of artillery intelligence. It is not surprising then that the bombardments of Arras were immeasurably more devastating to the German defence than those on the Somme. The results of 9th April 1917 speak for themselves.

When the artillery groups of the Third and First Armies switched from destructive counter-battery fire to neutralizing, and from destructive bombardment to creeping-barrage on the morning of 9th April they were well-drilled in the procedure. They had in fact practised the full creeping-barrage and neutralizing attack several times during the long preliminary bombardment in the hope that when the actual attack came the Germans would be taken by surprise. Whatever else they may have done, the Chinese barrages, as they were called, had caused, by the repeated passage of the creeping-barrage over the German front line trenches, an almost complete destruction of the front-line defences, torn up the wire, and reduced the foremost trenches to a tangled ruin. The British infantry crossed no-man’s land largely unmolested by the machine-gun fire and artillery barrages that had devastated the attacking force on 1st July at the Somme. By the end of the day the Third Army had followed its creeping-barrage some three and a half miles into the German defences; the Canadians of the First Army had not advanced so far, but most of the heavily defended Vimy Ridge was in their possession. The Third Army had captured 7,000
prisoners and 112 German field guns that had been in advanced positions; the Canadians took 3,342 prisoners and captured 31 guns. Total German casualties cannot be established but they were evidently much higher than those of the British. The Germans were forced to abandon completely the high ground of Vimy and to retire to the only partially constructed rear lines behind it.

To achieve this advance, far greater than anything achieved on the 1st of July 1916, the British had suffered approximately 13,000 casualties, compared to the 57,000 on the first day of the Somme. The reason for this striking disparity was simply the greater destructive effects of the preliminary bombardment. The German battalions in the front line had suffered heavy casualties; the 10th Grenadier Regiment, for example, lost 181 men during the bombardment. The defending force had been isolated from reserves for the duration of the bombardment by the fire of the British heavies, and thus ammunition supplies had run low at batteries and wire could not be got forward to repair the damage inflicted by the new 106 fused British shells. Not only were the defensive batteries low in ammunition, the destructive counter-battery shoot had damaged or destroyed many weapons; in the German 11th Division not a single battery retained its full complement of guns.

It would seem that the British had won a great victory, one that might be converted to the elusive "breakthrough", and end the siege-war in the trenches. But six weeks later, after incessant attacking in which casualties rose to approximately 150,000, the British had barely added to the gains made on the first day. What those six weeks revealed was that the long barrage strategy pursued by the British could, if well organised and sufficiently heavy, produce a limited advance into the German defences, which inflicted great losses on the enemy whilst protecting the attacking infantry from the defenders' fire power. What it equally clearly could not produce was the sort of war-changing breakthrough that Haig and many of the senior G.H.Q. Staff believed to be the aim of a successful attack.
If the 9th had been a day of triumph, those that followed were to remove its gloss. Attempts to convert the advances made by the First and Third Armies into a thrust that would dislocate the entire German line ended, almost universally, in costly failure. Perhaps the most notorious of these was the attack by the Fifth Army on 11th April, called 1st Bullecourt. If Generals Horne and Allenby had realised the amount of preparation required to assault the German fortresses, it is clear that General Gough of the Fifth did not. The preparation for 1st Bullecourt can only be described as *ad hoc*. The orders from Gough, while terse and urgent, had none of the detail and organisation displayed by those of the two successful attacks. Rather than giving any elaborate calculation of the number of German guns or width of the attack, Gough simply stated, "*Every available heavy gun must be pushed up without further delay and got into action at suitable range. All risks must be accepted.*" But the Fifth Army's artillery was extremely limited, many of the field guns having been allotted to the Third Army for its initial assault on the 9th. The bombardment did not begin in earnest until the 5th and was fired almost exclusively by the heavy artillery of the Australian Corps. These guns were able to fire off only approximately 13,000 shells at the German position, and had little time to arrange sound ranging for calibration checks or forward observation posts for visual observation. Field guns could not be got up to range on the wire for lack of draught horses. As a result it became evident that the vast wire entanglements of the German defence would not be cut by the time of the launching of the attack. Gough pinned his hopes on the tanks, which, he believed, would crush the wire and allow the Australian troops through. The result was calamitous. The tanks were unable to get to the start-line on time, hampered by badly-shelled roads and driving rain and snow. Just as the attack was launched, orders for its postponement began arriving. Some units withdrew, but others, unaware of the new orders, advanced into uncut wire and intensive German machine-gun fire.

Next morning the entire exercise was attempted again. Although the tanks were now in position, they still failed to provide any assistance. Across the broken ground, many bogged or broke down; some were hit by the heavy German defensive barrage. There are
no records of any single tank reaching the wire to flatten it for the infantry who were mercilessly shelled and machine-gunned by the German defenders. The slaughter was reminiscent of the first day of the Somme: the 4th Australian Brigade, who were in the centre of the attack, suffered 2,339 casualties among a force of only 3,000. C.E.W. Bean, the Australian official historian, whose research into all Australian engagements was meticulous in the extreme, concluded after interviews with the survivors of the 4th Brigade that between one-third and one-quarter of the Brigade were casualties at or near the first German wire entanglement. Being "pounded by heavy artillery" and subjected to a "withering fusillade" of machine-gun fire, a further one-quarter of the remainder were hit before the second wire emplacement. Remarkably, those few remaining continued on across the open ground and some reached the German trenches to become involved in intensive trench-to-trench fighting with the German garrison. These hardy survivors soon became casualties or captives. The attempt to exploit the advance of the Third Army by using tanks was an unmitigated disaster. Tanks were emphatically no substitute, as Gough assumed or hoped they would be, for a carefully organised artillery bombardment, and the attempt to use them as such simply threw troops' lives away. On the frontage of the Third Army, an attempt to exploit the advance made on the 9th with the traditional weapon of mobility, the cavalry, had met a similar fate.

General Allenby attempted to turn the advance his army had made on the 9th into the breakthrough that both he and Haig fervently desired by ordering the cavalry to lead an assault from the newly won positions. Allenby clearly misunderstood both the nature of the German defences and the discipline of the troops holding them. "The A.C. [Army Commander] wishes all troops to understand that Third Army is now pursuing a defeated enemy and that risks must be taken." Risks were taken, but the Germans were most certainly not a defeated force; in fact the British had yet to meet the main body of the defence. Although they had advanced, at the furthest point, some three and a half miles into the defences, they were still in the heart of the German battle zone. When the cavalry advanced on the morning of the 10th, they found, not retreating Germans, but the uncut
wire and the machine-gun positions of the German rear zone. The rear wire remained uncut because it was beyond the effective range of the 18-pdrs. using the new 106 fuse. Later trials showed that beyond 3,000 yards range the 106 became increasingly ineffective against wire because at such ranges the shell plummeted down at a steep angle and shot was discharged into the ground.\(^5\) Whilst the fault may here appear to lie with the artillery’s planning, I would argue that it arose rather from the attempt to combine the newly effective artillery with the cavalry. The field artillery, which had been ordered forward to assist could not, of course, match the mobility of the cavalry; an advance moves as fast as its artillery pieces. Take, in this case, the 9th Division as an example.

This division was in the centre of the attempted break-out on the 10th but had only managed to get two of its seven artillery brigades forward by that afternoon. Of these only one had managed to dig the gun-pits, align the weapons according to the map, place forward observers to range on to the wire, bring up the ammunition, and actually begin shelling the wire by the time that the cavalry were due to attack. Of seven brigades of artillery, only one provided any effective fire for the attempted breakthrough.\(^6\) While infantry and cavalry could advance over broken ground, artillery brigades needed good roads and large draughts of horses to draw the weapons and ammunition. As the C.R.A. of 9th Division bitterly recalls, neither was on hand at Arras, the horses exhausted and floundering through the work of hauling ammunition before the battle, the roads completely destroyed by the British bombardment and covered with rain-filled craters.\(^7\)

This was the tactical impediment to breakthrough, the fact that the most crucial element of the attacking force, the artillery, could not get forward across a wasteland their own bombardment had created. No other weapon, such as the tank, was capable of replacing the guns and thus the attacks of 11th and 12th April were dismal failures. The army could advance only as fast as the artillery could move forward. But there was a further, broader strategic reason why, even when the artillery did finally get into position to shell the German wire, the Arras assault could not be converted into the general
breakthrough that the British Staff repeatedly tried to achieve. It goes back to the long-barrage approach that the British had decided upon before the battle.

When Allenby stated that the Third Army faced only a "defeated enemy" he could hardly have been further from the truth. Certainly, those Germans trapped in their forward trenches and subjected to shelling for days before the attack were defeated, which is why the British had overrun them with such comparative ease. But the main body of the German defence was not yet on the battlefield; it was waiting deep behind the German rear zone, out of range of the British guns, to be committed only when the British assault force had become disorganized by its advance and lacked the protection of its artillery. The build-up of German reserves around the Arras battlefield was an inevitable consequence of the massive preparations the firing of the long barrage entailed, preparations which the Germans could hardly have failed to notice. As early as March the German Staff had noted the work on roads and trenches and the arrival of new artillery batteries and ammunition dumps. When the heavy counter-battery programme began, three weeks before the attack, its size and location became obvious. The élite German Engreifen counter-attack divisions, each with a large complement of supporting artillery, were dispatched to the area; the 4th Guard Division, 16th Bavarian, the 111th Division, the 17th and 1st Bavarian Reserve Divisions were all ensconced behind the reserve positions before the British attacked on the 9th. As a German regimental history recalls, "There was a great arc of our batteries on a wide front behind our endangered positions". It was this great arc of defensive batteries and the counter-attacks of the reserve divisions that broke up any British attempt to continue their advance begun on 9th April.

The absurdity of Allenby's belief that the Third Army was in pursuit of a beaten enemy was brought home most clearly on 23rd April. After a pause of seven days to bring up the guns, the Third Army attempted to resume its pursuit. What it encountered was a German defence that was in fact considerably stronger than that which it had attacked on the 9th. Despite having destroyed a large number of German guns by counter-battery and
captured a number in the attacks, they faced, on the 23rd, a force of 864 field guns, compared with 659 on the 9th, and a heavy artillery force that had grown from 122 weapons to 341. These additional batteries were supplied from the "mountains of shells" which the Germans had stockpiled at Dovai. The British assaults, on the other hand, were hastily organised and poorly supplied. While the seven-day pause had allowed most of the guns to be man-handled to forwarding positions, there had not been enough time to dig stable gun-pits, recalibrate and range guns, dig new communication lines, or stockpile ammunition. Shells had to be brought forward by pack animals, as the roads were too broken and muddy for trucks to use. The result was that whereas on the 9th the British had carefully and methodically destroyed the German trenches and strong points and crushed the artillery with a three-week long barrage, on the 23rd they attacked, after a meagre ten-hour hurricane bombardment, defences that were held in greater strength. The result was over 8,000 British casualties for virtually no return.

Throughout the rest of May, the Fifth, the Third, and First Armies made repeated attempts to produce the breakthrough the Staff insisted on believing was possible. Hastily arranged bombardments, lack of ammunition supplies, and the increasing exhaustion of the attacking troops made any major advance impossible. Some, like the second attempt by the Australians to take the Bullecourt position, succeeded in penetrating the trenches and engaging in heavy trench fighting but the ever-strengthening German defence, particularly its superiority in heavy guns, made any attack costly and produced, at best, a gain of a few hundred yards. During 2nd Bullecourt, for example, it took six divisions fourteen days of intensive fighting, under a constant deluge of German shells, to capture two acres of ground. The Australian troops were shelled not only in the front lines, but as they debouched from the rail centres, as they marched to the front, in rest billets, and in rear positions. Their attacks were met by fierce resistance and heavy counter-attacks, seven counter-attacks of at least Divisional strength in eight days, each preceded by heavy bombardment. The concentrations of heavy artillery that both sides had now assembled in the area made any infantry movement near impossible. By the early part of May British
casualties stood at 158,660\textsuperscript{67}, and yet they had advanced a bare mile further from the positions captured on 9th April. While there is some controversy over the figures, German casualties must have exceeded 100,000.\textsuperscript{68}

At the battle of Arras, the First and Third Armies demonstrated the value of a carefully prepared and well organized heavy bombardment. By limiting the depth of the attack, and thus the area of bombardment, and by careful organization of the bombardment the two Armies were able to make significant advances on the 9th. After this, however, it would seem the British Staff came to the conclusion that trench warfare was over, and attempted to return to the tactics of mobile, open warfare. This proved to be a horribly mistaken assumption. Arras demonstrated that complete fire control and artillery superiority over the battlefield had to be maintained, not only during preparation but during the later stages of the attack as well.

On 7th May major operations on the Arras Front were halted, although heavy German counter-attacks continued to cause casualties. The reason that the attacks were halted was not that G.H.Q. had finally come to the conclusion that breakthrough was impossible, but because of the failure of Nivelle's catastrophic attacks on the Aisnee-Champagne fronts. The terrible slaughter of these attacks, and the sudden deflation of hopes that Nivelle had built up before the attack caused severe problems in the French army which rendered it temporarily incapable of launching a serious offensive. On 23rd May, Nivelle was sacked and replaced by Petain, who saw his task as the re-building of the French army while the British forces assumed the role of the dominant ally on the Western Front. This finally freed Haig from French strategic control, and enabled him to push ahead with the project that he had favoured even before the Somme attack of 1916, the Flanders offensive.
Arras is the forgotten battle of 1917, dwarfed by the huge summer campaign in Flanders that followed. But it marked a turning point in the Royal Artillery’s struggle with their German rivals. The mistakes and disasters of the latter part of the battle have obscured the fact that for the first time in the war the Royal Artillery finally achieved what Birch had promised they could achieve since early in 1916, the complete destruction of the German front-line defences, the obliteration of the wire barriers, and the suppression of the German defensive artillery. In the barrage that preceded the attacks of 9th April, the Royal Artillery, with no attempt at subterfuge or deception, had engaged two of the strongest sections of the German defences and shelled them into submission. This is precisely what they had failed to achieve in the June of 1916, leading to the calamity of 1st July. In 1917 the artillery not only had far greater destructive resources at their disposal but they made use of those resources in a far more rational and sophisticated manner.

The improvement in resources was not only in quantity but, more importantly, in quality; not simply that they had 963 heavy guns, as compared to 427 for the Somme, but that the guns were all of modern design or at least re-design. Increased supply of weapons had meant that older, worn pieces, those with inherent design flaws, and those which had been improvised in Britain’s desperation of 1915, were all weeded out. Recoil and sighting systems, the two major repair problems of 1916, had been improved. In the matter of gun ammunition, the story was the same, a vast increase in supply and a great improvement in quality. The Ministry of Munitions was finally producing shells with Amatol that were correctly fused and contained a smoke charge to assist observation. The 106 and 101 fuses had reduced the rate of duds to less than 1% and now premature were counted in one per hundreds of thousands of rounds. These greater resources were controlled by an artillery whose structure had been entirely reformed by the energetic artillery c at G.H.Q., Noel Birch. At Arras the command of artillery had been entirely centralized, with artillery commanders at Army and Corps level. The army artillery commanders were now involved in the highest levels of planning, as is evidenced by the dispute between the Third Army artillery commander, Holland, on the one hand and Haig and Birch on the other. Artillery
Staff had taken over control of artillery intelligence and communications as these tasks had become both increasingly complex and technical and of vital significance to the success of any attack. Arras had also seen the emergence of scientific gunnery, in the form of improved training and the technical services established to assist the gunners, the map makers, sound rangers, and meteorological services which were becoming of increasing value to the artillery. Once these new resources were brought together in a meticulously planned bombardment that began three weeks before the attacks and whose preparation and stockpiling had begun months before that, the Third and First Armies were able to storm the German defences in exactly the manner that Rawlinson had expected them to do on the Somme.

Having wrested two pieces of heavily defended high ground from the Germans, the British Generals, Allenby and Gough in particular, clearly believed that suddenly the nature of the war had changed, that trench warfare was over. The attacks that followed 9th April did not, as one might presume they should, follow the evidently successful formula used for the initial assault: they were entirely different. In Gough’s attack at Bullecourt and Allenby’s repeated attempts to continue the Third Army’s advance there is no semblance of the careful organisation that preceded the first attack. Bombardments were hastily arranged and, lacking in guns and munitions because of the problems involved in transporting materials over the wasteland the bombardment had created, weak and inaccurate. It was also evident from the later stages of Arras that the Germans had learned as much from the Somme as had the British, for rather than throwing their reserves into the maelstrom of the British bombardment, they were held back, ringing the battlefield, waiting for the assault by the British infantry. It was only when the British had advanced beyond the protection of their own barrages and were at the very extreme range of even their heavy guns, that the elite counter-attack divisions were launched at them.

The truth that Arras revealed was that even when well organised and tremendously destructive, the long barrage strategy did not and could not produce the sort of breakthrough
victory that Haig and many of his Generals desired. Repeated attempts to achieve such a breakthrough simply soured the victory the British had won on the 9th. Arras shows both the strengths and the limitations of the long-barrage strategy. Its strength was that it could, if well fired, avoid the appalling casualties in infantry lost in the attempt to cross no-man's land that Britain had suffered at Aubers Ridge, Loos and 1st July on the Somme. Its limitation was that, as its preparation could not be concealed from the Germans, and this drew every available German reserve of troops and guns to the area, any advance it produced could only extend as far as the effective range of the artillery. Fortunately for the British, there was a General to the North who, after observing the fighting at Arras, was fully aware of those limitations and was preparing to fight a series of battles that brought the long barrage to its final culmination, General Plumer of the Second Army. Unfortunately, those limitations would not be recognised by Haig who intervened in the Flanders campaign with disastrous consequences.

2 Ibid., pp. 329-30.
4 In the course of the battle of Arras two German Staff memos "Allgemeines uber stellenbau" and "Fuhrung der Abweh schaft" were found among captured papers. These outlined the nature of defence in depth. A review of the two documents and the acknowledgement that they were a response to the ever-increasing power of the Royal Artillery can be found in Georg Bruchmüller's Introduction to Die Artillerie beim Angriff in Stellungskrieg.
8 The surprise of the sudden withdrawal is clearly revealed by examination of the original plans for the Arras attack, submitted on 31st January 1917, in which no contingency arrangements in the case of withdrawal can be found. "Plan of Operations for First Army, 31st Jan. 1917", WO 95/365.
9 It was this process of destruction, including as it did many fine chateaux that led to Crown Prince Rupprecht's threat to resign. Operation Alberich, and Rupprecht's dispute are examined in Der Weltkrieg, vol. II, pp. 510-15.
14 Ibid.
16 Ibid.
20 A review of these changes can be found in the History of the Ministry of Munitions, vol. IX, chap. 4, part 1, which deals with the Design Department.
22 Figures from DMRS 2534, Mun. 4.
23 General Staff Notes on Artillery No. 3 and 4: February 1917, WO 33/756.
24 General Staff notes on artillery, June 1916: WO 33/756.
25 Anstey, History of the Royal Artillery 1914-1918, Anstey papers 1159/12, p.131.
26 Edmonds, who was himself an engineer, states a number of times throughout the Official History that what was wrong with British tactics in the Great War was that the Staff never came to terms with the fact that they were involved in a vast siege, rather than an aberrant form of field warfare. (See, for example, Preface to Vol. II, 1916). While this may be true of Haig and many officers at G.H.Q. it is certainly not true of Birch and the senior echelons of artillery command. By the end of 1916 Birch was convinced that the nature of artillery work on the Western Front was based on siege warfare principles, and the complete revision of tactics in the artillery notes is testimony to this.
27 General Staff Notes on Artillery No. 4: February 1917, WO 33/756, p.2.
28 Anstey, History of the Royal Artillery 1914-1918, Anstey papers 1159/12, p.135.
29 General Staff Notes on Artillery No. 3: February 1917, WO 33/756, p.2.
30 General Staff Notes on Sound Ranging: March 1917. WO 33/831.
31 This is acknowledged by Anstey in Section VIII "Artillery Training" p. 338, supplementary volume, History of the Royal Artillery, Anstey papers 1159/12.
32 H.H. Tudor, a senior C.R.A., provides an interesting example of the benefits of these schools. He reports that it was as Commander of the Third Army Artillery School that he was introduced to the ideas of "shooting by the map g un nery", the effects of meteorological factors, and the significance of accurate survey methods. Tudor, The Fog of War, Tudor papers.
34 First Army artillery plan: 8 February 1917. WO 158/193.
35 Ibid.
36 Ibid.
37 Ibid.
39 Ibid.
42 Ibid.
43 Ibid.
44 Ibid.
46 Figures derived from respective artillery plans.
48 Figures for the advances can be gleaned from the Third Army War Diary WO 95/365 and the Canadian Official History, Nicholson, op.cit., but as it does with most infantry engagements in the Great War, Edmonds, Military Operations France and Belgium 1917, vol. I provides a reliable and detailed account of infantry advances and British losses.
50 Ibid., p. 199.

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The great destructive effect of the barrage is noted by Rupprecht, *In Treue fest Mein Kriegstagebuch* (Munich: Deutscher National Verlag, 1922) vol. II, pp. 133-6, and in the German Official history *Der Weltkrieg*, vol. 12, Chaps. 1-2, which deal with the attack and the inquiry held by the Germans after the battle to find out what went wrong on the 9th. It concluded that the new system of deep defence had been incorrectly applied, with the counter-attack divisions placed too far back.


Fifth Army Order No. 49: Cyril Falls, the author of the Arras volume of the Official History devotes considerable attention to the failure of Bullecourt. All significant orders and communications are reproduced as Appendices to the volume. No. 49 appears as Appendix 34 of *Military Operations France and Belgium 1917*, vol. I.


Ibid.


Ibid. pp. 299-301.

Third Army War Diary: Telegram to all Corps, 7.40 April 10th from A.C., WO 95/365. This message, often quoted, is in Edmonds and Bean. The latter states that Allenby had "misread the situation" and that "the opportunity for such tactics had passed" (Bean, Vol. IV, p. 286). It was not just that the opportunity for such tactics (i.e. a cavalry break-out with little or no artillery support) had passed: it had never arisen.


H.H Tudor, C.R.A., 9th Division, Diary, April 1917, MO 1167, Tudor papers.

The complete break-up of roads and the effect of driving rain were exacerbated by the fact that the light 60-cm. railways which were, in 1917, to prove the only effective method of transporting guns and shells over broken, sodden ground had not been completed in the Third Army area by the time the Arras attack took place. A.M. Henniker, *Transportation on the Western Front*, p. 273 (a companion volume to the Official History written under the direction of the historical section, with access to official documents).


Ibid., p. 384.

Ibid., p. 199.

See Bean, op. cit., vol. IV, pp. 453-539.


As with all German casualty figures, an unresolvable question mark hangs over them. But Rupprecht's reliable estimate of Sixth Army casualties at 85,000 means German losses must have exceeded 100,000 and perhaps were as great as those sustained by the British.
CHAPTER FIVE

FLANDERS 1917 - THE PITILESS SCHOOL OF WAR

"In truth, the problems of semi-siege warfare and the large concentrations of guns necessary for the work had never been studied by the General Staff in peace, nor by any of the leading gunners or gunnery schools, so we had to learn our lesson in the pitiless school of war."

Noel Birch writing to Edmonds during the 30's.

"this carnival of death"

J.F.C. Fuller on the Flanders campaign.
The Flanders campaign, Passchendaele as it is more commonly known, had been developing in Haig’s mind long before its launch in mid-summer 1917. Almost as soon as he had assumed command, Haig’s eyes had turned northward to where General Plumer’s Second Army struggled to survive in the salient around the ancient town of Ypres, but in the summer of 1916 Haig had been induced to fight on the Somme because of Joffre’s insistence, and then in spring of 1917, Nivelle’s schemes had involved the British forces in Arras. Now, with the French Army in disarray, and its new commander content to rebuild it, Haig and the War Cabinet in London assumed strategic control of the Allied effort on the Western Front. Haig sought to put into effect the plans that filled the northern operation file, plans that had begun in 1916 and had been constantly revised and changed since. Many histories of this ill-fated offensive have concentrated their attention on the conflict that this decision generated between Lloyd George, Churchill and other politicians of the Cabinet, and Haig and Robertson representing the Staff of G.H.Q. The bitter attacks on Haig’s dedication to the Flanders offensive, made by both Lloyd George and Churchill in their war memoirs, and the defence of Haig in the official history, have shaped the nature of the debate on Passchendaele since.

There was, however, another conflict over the Flanders offensive and one that, in fact, had a more crucial impact on the nature of the fighting and outcome of the offensive than that between the G.H.Q. Staff and the Government in London. It was the debate within G.H.Q. and the higher echelons of the British Army concerning the nature of offensive tactics on the Western Front and, in particular, the artillery doctrine best suited to what were in essence artillery battles. Only from this debate and the effect it would have on the changing artillery tactics the British adopted during various phases of the campaign can the nature of the offensive and the reasons for its failure be found. While the official historian, Haig’s defenders, and Lloyd George and the critics have examined in minute detail the rainfall statistics for the various months of 1917, or attempted even closer accounts of vast casualty lists, they have ignored the most crucial and perplexing question
that arises from the Flanders campaign. Why was it that the British forces were on a number of occasions, such as 7th June or 20th September, able to attack with outstanding success, capturing all objectives, inflicting heavy casualties on the Germans and suffering comparatively few in return, when on other occasions, however, such as 31st July or the entire month of August, the attacks were repulsed, made no significant gains in territory, and suffered extremely high numbers of casualties. These failed attacks were so badly organized and so evidently lacking any possibility of success that they adversely affected the morale of the British Armies involved.\textsuperscript{5} The explanation of these disparities and of the shape of the entire campaign can be found in the voluminous papers of the northern operation file G.H.Q., much revised and amended and revealing the fundamental split on the nature of artillery preparations between Plumer, Rawlinson and operation section G.H.Q. on the one hand and Haig and his young supporter, General Gough, on the other.

Planning for an attack that would take the Second Army out of the terrible Ypres salient had begun in early 1916. Plumer proposed a series of attacks, each of limited scope, but each depriving the Germans of a portion of the high ground that ringed the town.\textsuperscript{6} The most notable feature of this early plan was its attempt to make use of the favourable conditions for mining on one particular ridge the Germans occupied, the Messines-Wytschaete Ridge. The proximity of the German lines, and their occupation of the forward slope of the ridge, involving the village of Messines, made a deep mining operation possible. Although the 1916 plan was shelved when approval for the Somme proposal was given, the mining operation continued and would finally achieve a remarkable fulfilment almost two years later. While the Somme fighting absorbed the attention of the British Staff, and the miners under the ridge slowly dug their way under the German position, the plans for a Flanders offensive remained in limbo.

Late in 1916 Haig began to consider the possibilities for the coming campaign season. He again turned to Flanders and requested a more detailed and up-to-date proposal
for a northern offensive. Plumer submitted his new plans on 12th December 1916. What Plumer proposed was clearly a product of his observation of the Somme offensive and his reading of Birch’s artillery notes drawn up after the Somme. Plumer’s plan was not an attempt to break out of the salient in one vast offensive; it was a series of highly organized and prepared, limited advances. Each of the major areas of high ground, Messines Ridge, Pilckem Ridge, the Gheluvelt Plateau, and Passchendaele Ridge were to be attacked in turn, with advances of only 1,500 yards at most, and each attack preceded by a long and accurate bombardment. Each of these assaults was to be on an eight or nine mile frontage and aimed to drive the defence off each ridge, depriving them of the artillery observation positions that made life in the salient below so difficult. With a series of such limited assaults, each taking some weeks to prepare, there was no possibility of a general breakout of the salient, for the German defence would evidently have ample time to fall back to newly built positions.

Haig was clearly unhappy with the conservative nature of Plumer’s plan and responded almost immediately. On the 6th of January Plumer received a letter from Kiggell, Haig’s Chief of Staff, who wrote that "the Commander-in-Chief desires me to draw your attention to the following points with a view to recasting the plan". Haig began by stating that, because both the British and French armies were conducting spring offensives, by the summer offensive

"it could be anticipated that the enemy will have been severely handled and his reserves drawn away from your front... under these circumstances it is essential that the plan should be based on rapid action and entail the breaking through of the enemy’s defenses on a wide front without any delay".

The object of the attack should not merely be the incremental improvement in position but the much grander objective, "to inflict a decisive defeat of the enemy and to free the Belgian coast."

"The immediate intention is to break through the enemy defensive systems on the approximate front Hooge-Steenstraate with the object of securing the line.
Plumer's response to Haig's request to recast the plans in light of Haig's evident desire for a more aggressive tactical approach was received at G.H.Q. on 30th January. While claiming to take Haig's points into account, Plumer in fact did nothing to alter the steady and methodical approach of his earlier plan. No attack was to be pushed more than 1,500 yards into the German defences, the attacks were still organized into several set-piece assaults on the areas of high ground, and each was to be preceded by a long, accurate bombardment and extensive counter-battery program.

Haig was evidently displeased with Plumer's refusal to modify the tactical approach of the proposed offensive. He turned to General Rawlinson and requested his plan for the Flanders attack. On 9th February Rawlinson put forward his ideas. Unfortunately for Haig they were almost identical to Plumer's and consisted of a series of comparatively narrow attacks, gaining only 1,500-2,000 yards in depth and based on long and overwhelming artillery preparation. The operational sub-committee under Colonel MacMullen also agreed with the two Generals and it seemed that Haig would have to bow to the combined options of his two most senior army commanders and the operation section of G.H.Q. But he did not. Instead, he turned to a much younger General and one more in agreement with his own views of tactics on the Western Front, General Gough. When planning had begun on the Flanders offensive it had been assumed that Plumer would command the entire operation. As it had grown in scope, it had been divided, with Rawlinson to command the northern army, Plumer the southern. It is clear from their conflict with Haig that these two Generals had very similar ideas on how the Flanders attack should proceed and that, together, they would resist Haig's attempts to turn it into another disaster like 1st July on the Somme. Haig now chose to drop Rawlinson from the main offensive and relegate him to a small coastal thrust to coincide with the main attack. Plumer was given control over only the first of his series of attacks, that on Messines Ridge. This was now to be a discrete
operation from the main offensive to the north, which would aim to break out of the salient in a single blow and drive to the coast. This breakout attack was to be led by Gough.

Haig’s decision would prove one of his most costly as Commander-in-Chief. Not only did it thrust a General with little experience of the salient into command over Plumer, whose knowledge was extensive and who had been involved in the planning and preparation for two years, but, more importantly, it led the Fifth Army to pursue tactics that led to huge casualties in completely failed attacks.

The story of the preparation for the great Flanders offensive is a tale of two Armies, General Plumer and his Second Army in their carefully and elaborately organized build-up to the attack on Messines Ridge, and Gough’s Fifth Army preparing just to the north for their decisive attack, the breakthrough to the coast. The Second Army’s attack was planned for 7th June, the Fifth Army’s just six weeks later on 25th July. Despite the fact that both armies were roughly similar in make-up and attacking very much the same defensive system, the difference in the tactics they employed and the results they obtained are so great that even though preparations for both attacks were occurring simultaneously, it is best to view them as entirely separate assaults. Firstly, there is the Second Army’s long prepared attack on Messines Ridge in what was to have been the first of Plumer’s limited advances into the German defences but which had become the consolation left to him when Gough was appointed over his head. Then there is Gough’s attempt to launch the decisive breakthrough assault that his commander so eagerly desired. What that separation reveals is the fundamental difference in tactical approach taken by Gough and the Fifth Army and that taken by Plumer’s Second Army assault. Plumer’s assault on Messines Ridge was in all senses an artillery attack, in that the senior officers of the artillery determined the scale, the location, the timing, and the objectives of the attack. Gough’s planning reveals no such recognition of the realities of the Western Front and, despite the criticisms from other senior officers, went ahead in conditions entirely disadvantageous to the British artillery.
timing, scale and direction of the Fifth Army’s attack was determined, not by considerations of artillery power, but by the strategic imperatives of Haig’s dream of a great breakthrough that would free the coast and possibly end the war.

Messines: An Artillery Triumph

Even those critics bitterly hostile to the British generals of the Great War acknowledge that Plumer’s attack at Messines represents a triumph of Staff organization. Their explanation for this unusual display of competence usually rests upon their assessment of Plumer as essentially a more careful, conservative soldier than the previous commanders of British offensives. What they fail to acknowledge is that the detailed and highly organized artillery plan for the battle upon which the success of the entire assault rested was not a product of Plumer’s mind but of Noel Birch, artillery c at G.H.Q., Franks, the M.G.R.A. of the Second Army, and the senior artillery Staff at Franks’ headquarters. What Plumer recognized was that artillery preparations and organization had become so vast and technically complex that they were best left to the experts. The artillery tactics of Messines were not created by Plumer but were the product of the artillery’s own consideration of its efforts at the Somme and Arras. The influence of Birch is clear, even from the plan’s early stage. When Franks and Plumer submitted their proposal for the series of limited attacks in December 1916 Birch, in his role as artillery c to G.H.Q., immediately responded with his own version of a limited assault and how it was to be planned. While it is not remarkable that Birch produced such a plan, what was unusual was that Plumer and Franks adopted every aspect of Birch’s recommendations.

The artillery plan for Messines was to be conducted along principles Birch had enunciated in his two artillery notes issued at the beginning of the year, and resembled in close detail the plan of the Canadian assault on Vimy Ridge which had also been based on those principles. But in this attack there would be no attempt to "exploit" the initial
advance, as had occurred so disastrously at Vimy Ridge and the Scarpe. Like Vimy and the Scarpe, the attack was to be preceded by a completely overwhelming artillery assault. The barrage was to be long and to continue until the German artillery, machine-gun positions and defensive infantry fortifications had been reduced to ruins. To achieve this the attack frontage would have to be narrow, in order to facilitate the concentration of fire, and the number of batteries required enormous. Plumer’s and Franks’ original requests to Birch for artillery had, in Birch’s opinion, been far too low and Birch responded by presenting the Second Army Staff with an entirely revised artillery estimate and a guide to how such estimates were to be made.14

There were essentially two calculations Birch made. The first established the number of counter-batteries the British would require in order to subdue the German batteries protecting the ridge. Because of the delays in launching the Flanders offensive, the Second Army artillery intelligence, for some considerable time, had been following closely the movements and numbers of German batteries behind the ridge. Their artillery boards, supplied with information from the Second Army’s sound ranging section, its flash spotting section, and extensive aerial photography and observation, had given the Second Army and G.H.Q. planners an accurate assessment of German artillery strength. Birch pointed out that the Germans had a total of 244 heavy guns along the 17,000 yards of attack frontage that covered the ridge and these would have to be matched gun for gun by the British. In the flanks, 9,000 yards on either side of the frontage, were a further 169 German guns which would have to be at least harassed by the British in order to detract from their assistance to the central group. Birch estimated that 42 British guns, or 25% of the German total, would suffice for this. This gave Birch a total of 341 heavy guns required for the counter-battery bombardment, which were to be organised into twelve counter-battery groups, four for each of the three Corps in the assault. For the bombardment of the trenches, strong points, and communications, Birch calculated that the British required a heavy howitzer every 44 yards. This was the ratio established at Vimy and had proved
adequate. Given a frontage of 17,000 yards, Birch arrived at a figure of 378 howitzers for the bombardment groups. The Arras experience had shown that long-range guns were often crucial for breaking up counter-attacks, or strafing distant batteries, and Birch added 35 super-heavy guns to his total to arrive at a figure of 754 heavy guns required for the attack.

Birch’s calculations thus determined the length of the frontage, and the scale of the flanking operations. Birch agreed with Plumer that 1,500 to 2,000 yards was the maximum depth the assault force could be taken into the German lines. Beyond this the increasing problems of observation and communication made accuracy difficult. Also, at these ranges the field guns of the British artillery, the 18-pdrs. and 4.5’s, began to drop out of the barrage. By limiting the depth of the attack Birch ensured that the fighting occurred in the area where the British artillery were able to employ their maximum strength and greatest accuracy. The limited depth also reduced the area that had to be prepared by the bombardment groups. Their fire could be concentrated on a narrow 2,000-yard strip of defences. But the bombardment groups were not Birch’s main concern. The most complex and most crucial artillery task, Birch stated, was counter-battery, and every aspect of the artillery preparations should be aimed at the prime task, the destruction of German artillery power around the ridge.

Birch’s plan emphasised accuracy as the key to the counter-battery’s effectiveness. The Second Army’s original plans had suggested that a body of reserve heavy batteries be held back under army control to conduct counter-battery, switching from one Corps to another as German reserve batteries began to arrive and threaten various locations. Birch rejected this outright. Accuracy could only be achieved by batteries housed in well-founded gun-pits, which had time to pin-point their targets on the 110,000 scale map, which had accurately fixed their own positions, and which had established good observation positions and close contact with their sound rangers, flash spotters, and aerial observation teams. A counter-battery group rushing from one Corps to another would be unable to complete its
preparations, and consequently its shoots would be rushed and inaccurate. Birch insisted that counter-battery groups remained fixed, that any German re-inforcements in artillery were to be met by drawing guns from the bombardment groups or fresh drafts from G.H.Q. reserve. Birch also insisted that at the moment of attack, and for thirty minutes thereafter, every heavy gun was to be turned on to the counter-battery-neutralizing barrage, using a stockpile of 120,000 gas shells Birch had set aside for the purpose.

The over-riding significance of counter-battery, and the influence of Birch as a genuine artillery commander at G.H.Q. rather than merely as Haig’s c, were revealed in the last major planning meeting for Messines, held at Pernes on 30th May 1917. All of the major figures in the planning attended, Haig, Plumer, Birch, Franks, Trenchard, and all their assistants. What they considered was using the mines below Messines Ridge to induce the German batteries to open up, revealing to British observers, flash spotters and sound rangers, the many German silent batteries - those which would not fire until the moment of attack, so as to escape British counter-battery fire. The mines had taken many thousands of man-hours to dig and had cost hundreds of lives in the bitter underground mining war. Many had been dug continuously since early in 1916 and now stretched hundreds of yards below the German front lines. They were to surprise the Germans at the moment of attack, by blowing up a long section of the ridge top, and the front line defences with them. Yet Plumer considered using them simply to assist the artillery’s counter-battery effort. At the meeting, however, Plumer announced that his Corps Commanders and artillerymen had come up with an even better scheme for forcing the Germans to reveal their silent batteries and yet retain the mines for the moment of assault, the false or Chinese barrage. Plumer proposed to the meeting that,

"The way in which he proposed to deal with the situation was to put forward his destructive fire (i.e. CB fire direct at German batteries) by two days to Z-7 and devote the last two days before the attack almost entirely to counter battery work. In order to locate all the enemy’s guns and discover where he intended to put down his barrage, he proposed to have a full dress rehearsal of his artillery bombardment as planned for zero hour, combined with a smoke demonstration along the front of attack."
All heavy guns on the Second Army front were to fire counter-battery after the false attack to "make as big a feature as possible" of the assault on the German artillery. Artillery tactics had certainly developed since the rival armies had scattered shells over one another before the infantry assault of 1915. By the summer of 1917 it was a matter of bluff and deceit as the rival artillery fought an ever more complex battle against one another, to establish artillery superiority over the battlefield. The details of these artillery feints and how the observers were to see them, and their timing and organization were not matters for Plumer or Haig. As Kiggell recorded, "During the conference matters of detail in connection with artillery fire and possibilities of observation were referred to... General Birch and General Trenchard". The matters of battle planning were becoming so technically specialised that it was these two men, Birch with his great artillery force and Trenchard with his fleet of observer planes, who handled the details of the most crucial aspect of the battle. When writing his final artillery scheme for Messines, Plumer told his Corp Artillery Commanders that they were to designate targets and rates of advance themselves, but they were to hold to the general principles laid down in "Artillery in Offensive Operations". While Plumer has been praised in all the accounts of Messines since 1917 for the tightness of the barrages and sophistication of his artillery tactics, in reality the most crucial and in the end entirely justified decision he made in regard to the artillery was to leave it up to Birch and the senior artillery officers of the Second Army to shape the artillery assault.

The field artillery, the 18-pdrs. and 4.5-howitzers of the three attacking Corps were strengthened by the field guns of the G.H.Q. reserve Corps. This gave the attacking Corps some 1,510 field guns along the nine miles of frontage. Together with the heavy groups, some 2,266 artillery pieces faced a German force of 468 guns. Preliminary estimates of the ammunition that this vast force would consume during an eight-day bombardment were over three million shells, over 110,000 tons. The task of simply moving such a large number of guns and shells into the Messines area was vast.
railway line was laid, and narrow gauge lines that ran shells from the rail-heads to the gun-pits were created. Hundreds of new gun-pits were dug, buried telephone lines sunk, and new roads built.\textsuperscript{20} It was impossible that the Germans, from their observation positions on the ridge, would fail to notice the constant activity in the British positions below them. In fact, the German Command had noted the build-up in late April, some six weeks before the attack's launch. They had considered the idea of a withdrawal, but, on the assurances of General Von Laffert, the commander of group Wytschaete, that it would be impossible for the British artillery to subdue his guns and from Lieut.-Colonel Fusslein, an engineer, that deep mining had not been undertaken, the German Command decided to stay on the ridge and fight it out with the British artillery force gathering below them.\textsuperscript{21}

The artillery duel began on 21st May when the British counter-battery groups began their systematic attack on all known German gun positions. As the German batteries were exclusively on the reverse slope of the ridge the Royal Artillery was again almost entirely dependent on indirect observation. To maximise the value of the information they could gain, artillery intelligence was completely centralised and controlled by specialist counter-battery artillery officers. Four miles behind the front line was the Second Army report centre at Locre Chateau, which acted as receiving point for all artillery intelligence. It was contacted via buried lines to the R.F.C. observation squadrons, the various sound-ranging and flash-spotting companies, the balloon observers, and all ground based observation positions. It also housed the central wireless and wireless interception stations.\textsuperscript{22}

As they had at Arras, the R.F.C. made a concerted attempt to drive the German planes out of the skies above the ridge. Since the slaughter above Arras, many of the fighter squadrons of the R.F.C. had been re-equipped with new, more powerful planes, the Sopwith Pup, triplanes and the SE5s, and these new squadrons were concentrated around the salient, to win air supremacy above Messines. Some 500 British planes were available for the offensive which, together with 100 planes from French and Belgian squadrons,
outnumbered two to one the German force of 300 planes. The air offensive begun on 20th May was a complete success. The R.F.C. fighters patrolled a line 100,000 yards forward of the British lines and up to an altitude of 15,000 feet. Along this perimeter the fighters engaged in intensive dog fights with German fighters and observation planes attempting to enter the area over the battlefield, shooting down 32 in the six days before the attack. But the true triumph of the fighter patrols was not measured in the number of Germans shot down but rather in the almost complete absence of attacks on hundreds of Allied observer planes which slowly traversed the battlefield, ranging guns or photographing the defences. Two observer planes damaged on 2nd June, and one shot down on the 7th, were the only casualties suffered by the artillery observer planes during the preliminary bombardment. The six observation balloons used from only 5,000 yards from the front line also survived unmolested. The observation program was also assisted by further modification and intensive training with the clapper break system introduced before Arras. At Arras radio equipped planes could operate at a ratio of 1 per 1,000 yards of frontage. At Messines, strict radio discipline had made one radio plane every 400 yards possible so that more than twice as many radio observer planes could operate at the same time as they could over Arras. By the day of the attack the R.F.C. had 280 radio receiving stations, each connected to the Second Army communication centre at Locré. Moreover, the R.F.C. was not completely at the mercy of the weather as it was during its preparation for the Somme. The reason for this was that unlike Arras, or the Somme, Messines was not a joint Anglo-French assault. Thus the Second Army was not forced to attack on a given day to ensure that their attack coincided with French efforts, but could if weather intervened postpone the zero day. Fortunately for the British the entire period of counter-battery preparation was blessed with almost unbroken fine weather. In the month before the attack, when the major effort to destroy the guns of Group Wytschaete was underway, only two days of poor visibility were encountered.
The constant fine weather, the well organized Second Army communications systems, and the new British fighters' domination of the skies, made the eight-day assault by the British artillery on the defences of the ridge the most accurate and destructive barrage the British had yet produced. The effect of the constant good flying and observing weather, compared with that which preceded the Somme and Arras and would subsequently plague later assaults in Flanders, was great. In the period from 15th May to the attack's launch on 7th June, R.F.C. observers directed the fire of the British counter-battery groups on to an average of 24 German batteries a day. In the intensive counter-battery effort of the seven-day barrage from the 1st, they averaged 63 engagements a day, but on the two cloudy days of the attack period, 16th and 17th May, the R.F.C. had been able to observe for only an average of 3 shoots a day. The significance of air observation to the counter-battery preparation was most evident in the two Chinese barrages fired on 3rd and 5th June. The British fired right through the full artillery program for the morning of attack - intensive neutralizing fire on known German battery positions, shelling of strong points with gas, the creeping barrage advancing through the defensive positions. These Chinese attacks served not only to familiarise the artillery with the attack procedure and allow battery commanders to check for short shooting but, most importantly, to force silent German batteries which were waiting for the assault before revealing themselves to open up, and thus allow air observers to spot them.

The significant feature of the organization of these Chinese barrages was that it was left entirely to the cluster of technical specialists that had emerged during fighting on the Somme and Arras. The timing of the false attacks was at the discretion of the R.F.C. for it was obviously vital to have the maximum visibility and optimum number of observer planes for the day of false barrage. But the R.F.C. deferred to the opinion of the meteorology section who predicted fine weather for the 3rd and 5th. The artillery intelligence section in turn worked closely with the observer planes of the R.F.C. and the balloon section. Each piece of information from the observers was to be sent back to the central intelligence
section at Locre Chateau to produce a comprehensive picture of the German artillery dispositions. Each battery was allotted its own observer planes, and exchanges of officers ensured that confusion of communication and codes was eliminated. The signals offices, the observers, the artillery intelligence officers, the meteorologists and counter-battery Staff officers worked together to orchestrate the vast counter-battery attack launched by the Second Army.27

The counter-battery duel before the attack at Messines reached new heights of intensity and technical expertise. It became obvious during the early part of May that the Germans were intercepting and decoding messages sent from aerial observers back to the communication centre and warning batteries before the British could open fire.28 To counter this the British began intercepting German radio messages from the wireless interception centre to the threatened batteries, tracking the batteries as they attempted to move to a new position. When a battery on either side had the misfortune to be spotted by an observer, intensive fire was poured upon it. On 2nd May, for example, the 187th siege battery of heavy guns received 300 German rounds in the space of one and a half hours; on 7th May the 124th heavy battery received a concentrated shoot of 600 heavy calibre shells.29 But the great superiority of the British artillery in sheer numbers of heavy guns and the organization and sophistication of their intelligence meant that the longer the duel went on, the weaker Group Wytschaete became. By the morning of the 7th, even before the last intensive crescendo of the counter-battery assault, Group Wytschaete had lost a quarter of its field guns and half of its vital heavy artillery. General Von Laffert, who had told the army commander that it would be impossible for the British to master the German artillery behind the ridge, had miscalculated horribly. Although he had desperately called for reinforcements at the beginning of June, as the magnitude and ferocity of the Second Army’s counter-battery assault became evident, it was too late. Nine heavy artillery batteries were en train from the Arras battlefield but could not arrive before the British barrage reached its zenith and the attack was launched. Not surprisingly, Von Laffert was dismissed

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immediately after the battle for his gross underestimation of the artillery strength of the British.  

The counter-battery duel before Messines, in which the Royal Artillery eventually triumphed over the guns of Group Wytschaete, ensured that the Second Army infantry would advance into the ridge position almost un molested by defensive artillery barrages from the German artillery. For the first time, the British artillery had engaged the German artillery in one of their strongest positions, and overwhelmed them. The essential features of the Messines preparation that had made this triumph possible were three-fold. Firstly, the scope and scale of the attack had been determined by the artillery themselves. The artillery and air resources that the Second Army would need to overcome the defensive position were calculated not from dubious assertions concerning German morale, as they were at the great Somme attacks, but from a rational and accurate assessment of German artillery strength and disposition. Secondly, counter-battery work was given, at all stages of planning, the highest priority. For the first time more guns were employed in counter-battery than in bombardment. The entire focus of the artillery work had changed since the Somme; rather than simply spraying shells into the German lines the R.A. attempted to pin-point and destroy the most vital element of the German defensive structure, their guns. To this end Plumer's Second Army used, on three occasions, every heavy gun at their disposal to attack the German batteries - on the two days following the Chinese barrages, and at the moment of attack. Thirdly, the organization, timing and duration of this concerted counter-battery attack had been left to various experts in their fields. Birch and Trenchard had drawn up the plans for the air/artillery cooperation; they had brought together the meteorological, sound-ranging and flash-spotting experts to coordinate the observation and timing of the Chinese barrages. The organization of the counter-battery groups themselves had been taken from the Corps infantry commanders and controlled by specialists from the artillery - the counter-battery Staff officers. The Second Army had expanded the Staff of the C.B.S.O prior to the battle and instituted daily conferences between the C.B.S.O. and
the heads of the meteorological, sound-ranging and flash-spotting sections, as well as the
R.F.C. and balloon observers attached to his group. This last factor, the control the
C.B.S.O. was given over his groups’ counter-battery fire, was claimed by the G.O.C.R.A.
IX Corps to be the most crucial in accounting for the Second Army’s unprecedented success.

"To my mind, the success which attended our CB is largely due to the fact
that control rested in the hands of one expert and his staff, who were free to
devote their whole time, energy and brains to the one end of defeating the
enemy guns."31

Except for the periods in which they were called upon to join the counter-battery
effort, the bombardment groups devoted the last eight days of the barrage to reducing the
German trenches, strong points and wire entanglements to ruins. While the 18-pdrs. using
106 fused shells attacked the wire, heavy trench mortars dealt with the numerous concrete
pill boxes the German defences contained. The mortars, while having only a very limited
range, could deliver an enormous explosive charge using their torpedo mines which left

craters up to six feet deep.32 Pill boxes and strong points further back were dealt with by
the heavy guns using aerial spotting to range onto their targets. Every night each division’s
machine-guns sprayed an average of 80,000 rounds into the German positions to harass
defenders and stop any working parties attempting to repair the damage of the daylight
bombardment.33 Long-range guns attacked the communications and supply systems behind
the German lines. The Lys River and Ypres Canal bridges were destroyed, as were the rail
lines into the ridge position. The most spectacular success came on 6th June, the day before
the attack, when the main German stockpile of shells was hit by British long-range guns.
The dump at Coucou erupted in a vast explosion, destroying the Messines Ridge artillery’s
main supply of shells. The gas shells in the dump also released a cloud of toxic gas, which
blew along the German lines adding to the misery of the defenders suffering under the
British bombardment.34
Von Laffert, realising that the British artillery assault was far stronger than he had anticipated, had taken desperate measures to counter the damage being done by the bombardment. While his artillery could not expect re-inforcements for some days, nor could it be protected from British counter-battery fire, Von Laffert ordered the trench garrisons to abandon their pill boxes during the day on 26th May. The boxes, stripped of their camouflage by the constant blast of shells, provided the aerial spotters with clear targets in the German lines. The fire they attracted made it safer for the garrisons to leave them and occupy trenches and craters some distance from their strong points. But, despite this move, casualties in the four German divisions which occupied the ridge continued to mount. By 31st May Von Laffert was forced to withdraw two of the divisions so weakened by the bombardment that they could no longer be expected to provide any resistance, and replaced them with the Eingreiffen divisions of his reserve. Laffert was forced to abandon the central plank of the new defence-in-depth system, that the trench garrison troops could absorb the punishment of the bombardment to leave the Eingreiffen divisions at full strength to lead the counter-attack on the disorganized attacking force. \(^{35}\) The two Eingreiffen divisions at Laffert's disposal were committed seven days before the assault, and were forced to endure the most intensive period of bombardment, leaving no reserve available for the commander to call upon when the assault was finally launched.

By the morning of the 7th the German fortress of Messines Ridge was in ruins. Half the heavy artillery had been destroyed, the remainder had little ammunition to work with. The wire had been cut away and the German trenches and strong points had been torn up by eight days of constant shelling. German reserves had already been consumed by the bombardment and front line troops had, for the most part, been left for a number of days without food, water or small arms supplies. All this was achieved before the Second Army used the one million tons of Amatol they had burrowed under the crest of the ridge.\(^{36}\) When the mines finally went off at 3.10 a.m. on the morning of the 7th, the last remnants of the German front lines were blown, literally, sky high.
Norman Gladden, a machine-gunner, was waiting in the British front line trenches near hill 60 when the mines went off.

"The ground began to rock. My body was carried up and down as though by the waves of the sea. In front the earth opened and a large black mass mounted on pillars of fire to the sky where it seemed to remain suspended for some seconds while the awful red glow lit up the surrounding desolation."37

The concussion of the exploding mines was distinctly heard in London and Paris and fifteen miles away, in the city of Lille, the apparent earthquake caused panic in the streets. Gladden, who was so close to the explosion that the sound wave passed over his head, heard only the sound of the British artillery as all the heavy guns joined in a thirty-minute neutralizing barrage of all known German gun-pits, using gas, and the field artillery opened its creeping barrage.

"There was a tremendous roar and a tearing across the skies as the barrage commenced with unerring accuracy. The skies behind our lines were lit up by the flashes of many thousand guns, while above the booming din of the artillery rose the rasping rattle of the Vickers guns, pouring from their carefully prepared positions a continuous stream of lead into the enemy lines. Never before had there been such a shattering bombardment, and for a brief moment my sympathies went out to the unfortunate enemy caught in such a storm of death."38

Gladden and the rest of assaulting troops scrambled from their trenches and forward into the German positions, shrouded in the dust and smoke of the mines. The creeping barrage that preceded them was identical to that used at Vimy Ridge, which was in turn based on the recommendations of Birch’s artillery notes drawn up after the Somme. Two thirds of all the 18-pdrs. formed up the curtain of shrapnel that led the infantry into the defences. The remaining 18-pdrs. and the 4.5-howitzers using H.E. shelled prearranged targets such as machine-gun positions in an area 700 yards before the shrapnel curtain. As the shrapnel wall rolled forward these guns jumped back to deeper targets, always remaining in front of the shrapnel. 400 yards in front of the shrapnel wall a heavy machine-gun
barrage was laid to keep the German machine-gunners' heads down. At each of the
prearranged objectives, at which the shrapnel wall stopped briefly to allow the infantry to
catch up, the H.E. barrage raked forward into the German lines, to collect Germans fleeing
from the attack or forming up for counter-attack. It became obvious, however, that
immediate counter-attack was unlikely, for the combined effect of the eight-day shelling and
the vast and completely unexpected explosion of the mines had left the ridge's forward
defences and battle zone in chaos and the defenders shell shocked. As T. Cantlon of
King's Royal Rifles recalled,

"They didn't seem to have any wits about them. We didn't even have to
bother to take them prisoner. We didn't have to trouble about sending
anyone to escort them back. We just saw them coming at us through the
smoke, running towards us like jellies. They didn't know where they were.
You just jerked your thumb backwards and they ran off towards our lines -
and on we went."41

Henry Russell of the Worcestershire Regiment recalls not only the desperate state of
the defenders, but the almost complete absence of artillery retaliation from the Germans.

"They were white, haggard and half crazy with fright. I felt curiously
helpless. The din of the guns behind and the shells in front prevented us from
hearing whether the enemy artillery were in action, but no shells appeared to
be bursting anywhere near. I fully expected to hear the sudden roar of high
explosives or the crash of shrapnel, but it was singularly absent and we
gained confidence with every step. We crossed the enemy front line, which
was but the wreckage of a trench system, and when nearing the second line
we opened up into extended order, just as we had done in the rehearsals of a
few days before."42

In fact, the entire morning of the attack had followed the rehearsals almost exactly,
with the three attacking Corps occupying the ridge and advancing into the German artillery
lines on the reverse slope in a series of 1,000-yard projections. As each of three distinct
lines of objectives was reached, the barrage halted and the foremost attacking infantry
divisions dug themselves in while the divisions behind them passed through to carry on the
assault. This "leap frogging" of divisions caused the only notable set-back for the attacking
force in the entire assault. The Second Army planners, having read the documents
concerning the new German defensive system, had made extensive preparations to receive counter-attacks during the afternoon. The bombardment groups of Corps and the divisional artillery had prepared SOS. barrages, a crash response to the front line infantry's flares or an observer's call that counter-attacks were forming up. In two cases this plan worked admirably. In the case of IX. Corps, its infantry called for a barrage by flare which was responded to immediately and a large German counter-attack from the Oosttaverne line was broken up. But on II. Anzac Corps' frontage the scheme was a notable failure. Both on the afternoon of the 7th and the morning of the 8th, Australian troops falling back to allow a unit to relieve them, or retiring to the prearranged defensive line, were heavily shelled by British artillery whose observers believed them to be German counter-attack troops. This arose because the various divisions' observers were not interconnected and because SOS. barrages were fired immediately on call, without the command travelling via the Second Army communication centre. The 4th Australian Division, having completed its advance with little loss and virtually no harassment from the German artillery, suffered heavy casualties from a sustained and accurate two-hour bombardment fired on them by British guns. The English divisions who had occupied the ridge had observed the 52nd Australian battalion withdrawing from their positions to allow its relief to move in. The observers, believing the Australians to be Germans, fired off their flares, and the 52nd battalion suffered heavily.

The intensive counter-attacks expected by the Second Army Command never eventuated for, as we have seen, the Eingreiffen divisions had already been committed to the battle zone defences during the preparatory bombardment. The Second Army had taken 144 officers and 7,210 other ranks prisoner, captured 218 machine-guns and 48 artillery pieces, and inflicted in the vicinity of 23,000 casualties on the divisions that had held the ridge. Total British casualties were 24,502, a great proportion of which had come from the mistakes with SOS. barrages during the afternoon. The II. Anzac Corps who had suffered
the most from the ill-directed fire had over 12,000 casualties, more than twice the figure for IX. Corps who had not suffered from the SOS. barrage mistakes.  

Even to those entrenched critics of the Staff, Liddell Hart, Fuller and Churchill, Messines represented a triumph of organization and of the "massed artillery" tactics of which they were generally critical. What has been overlooked, however, in their analysis of Messines, is that while Plumer and Harrington were, without doubt, able organizers and that their planning of battle preparations had been exemplary, the fundamental principles and tactical approach and preparation of the British artillery were neither unique nor a product of Plumer’s and Harrington’s analysis. They were derived from G.H.Q., not from Haig but from Noel Birch. The centralization of communications, the use of specialist artillery intelligence officers, the primacy accorded to counter-battery over bombardment duties, the rational calculation of guns required - these were not new ideas; in fact, all can be found in the Canadian Corps attack on Vimy Ridge. Other than in respect of the mines, Messines was not a unique attack, as the Staff’s critics wished to present it, it was simply the fulfilment of Birch’s designs for well organized, lengthy and completely destructive bombardments, based on the principles he had drawn up in the winter of 1916/17. The only difference between the Messines attack and those at Arras was that the British halted at the point at which their artillery protection began to thin. The victory of 9th April at Arras was obscured by the hasty and ill-prepared attempt to "exploit" the advance, to push troops on beyond the range of their artillery. The advance at Messines suffered from no such attempts and thus stands in stark relief, revealing that in 1917 the British artillery could engage the German defensive force at any point in the line, even the most heavily fortified and protected, and reduce the defences and their artillery to ruins. The carefully organized but slow advance the British made up the ridge, however, had allowed what remained of Group Wytschaete to fall back to the reserve lines they had begun constructing the moment they had first observed British preparations to attack. From these lines, beyond the effective range of the counter-battery and bombardment groups of the Second Army, the Germans
were able to stop any attempt by the British infantry to advance further. The evidence that the Second Army had on the 7th advanced as far as its artillery cover could extend was clear, even on the afternoon of the assault. At the very extreme of X. Corps’ advance was the spoil bank thrown up by the digging of a canal, which was to be X. Corps final objective for the day. The bank was given a four-hour shelling by the British heavy guns before the infantry assault at 7 pm. The range was so great, and the number of guns that could reach the target so few, that the bombardment failed to dislodge the German machine-gunners who had occupied it, or cut the wire they had hastily erected before the bank. As the assaulting units formed up they were heavily shelled by German artillery who had retired to positions well behind the bank and were thus beyond the reach of the British counter-battery groups. The rebuff was a minor one and Second Army H.Q. quickly called off the attack and left the Germans in possession of the bank.45

The problems that had emerged with the SOS. barrages were also symptomatic of the breakdown of artillery communications and accuracy at great ranges. From these incidents the tendency of successful attacks to degenerate into confusion and heavy casualties is evident. The great strength of Plumer’s plan, however, was that just at this point, where confusion was mounting and casualties rising, the advance stopped and consolidation began. Plumer had used the artillery techniques and organization developed by Birch during the course of 1916 and 1917 in an attack whose parameters and scope were determined by the range of the artillery’s effectiveness. The result was the capture and consolidation of limited but significant objectives, in what was the first major assault by the British Army that actually achieved all of the objectives outlined in the attack’s plan.

The day after the successful Second Army capture of Messines Ridge the Flanders campaign reached a crucial turning point, for while Plumer may have perceived that any attack on the Germans’ Flanders defensive position would have to be slow and methodical, Haig clearly did not. On the 8th Haig requested that the Second Army launch an attack on
the western part of the Gheluvelt Plateau to capture the Stirling Castle position and "exploit" the previous day's advance. Plumer replied that he would require three days at least to reposition and arrange his guns for such an assault. After this period he would be able to launch another relatively narrow-frontage, shallow assault and take the Plateau's western edge. What Plumer was in fact suggesting was a return to his original methodical approach to the Flanders campaign. Despite the success of Plumer's tactics at Messines Haig rejected Plumer's plans. Instead he offered two Corps of Plumer's Second Army to Gough and requested Gough's proposals for exploiting the Messines Ridge capture. Gough, after examining the positions, rejected Plumer's approach to the Plateau, that of step-by-step narrow attacks across the high ground. Gough informed Haig that he would simply include Stirling Castle and the entire Plateau in the initial objectives of the vast breakthrough assault he was planning against Pilckem Ridge to the north. This extended the frontage of Gough's assault to over 15 miles and meant that the plan called for the Fifth Army's artillery to overcome two of the German artillery's strongest groups, Group Ypres protecting Pilckem Ridge, and Group Wytschaete protecting the Plateau. Such was Gough's confidence, that the overrunning of the Plateau with its five distinct defensive lines spread over four miles and with the resources of Group Wytschaete's artillery (over 100 heavy guns), was allotted to but one British Corps, the II. Thus, despite the complete success of the Messines attack, the artillery-based tactical doctrine on which it was based was abandoned in the planning of the next great British offensive, the main attack of the Flanders campaign, the battle of Pilckem Ridge.

Messines was essentially an artillery battle. The duel that raged between the guns of Group Wytschaete and those of the Second Army for almost two months and the determined bid to destroy the fortress the Germans had made of the ridge in the last eight days should not be described as a preliminary bombardment. The notion of preliminary bombardments carries with it an idea that the main act, the decisive one, is yet to come. In fact, the bombardment was the decisive action and by gaining victory over the German guns, by the
destruction of the wire, trenches and pill boxes, and destruction of the German reserves, the bombardment ensured the successful passage of infantry into German positions. It would seem that at Messines the strategy pursued by the British at the Somme, that artillery conquers and infantry occupies, had been finally successfully fulfilled. With bombardments of ever-increasing length and ferocity, with ever-increasing numbers of guns, the artillery domination of the offensive tactics of the British G.H.Q. would seem to have reached the zenith. Over two thousand British artillery pieces had fired off over three and a half million shells. The cost alone was staggering, over £17,500,000 for gun ammunition. The heavy machine-guns, whose fire had been marshalled into the ever more complex artillery plans and timetables, consumed over 15 million rounds, merely to support and enhance the artillery fire. The numbers of artillerymen at Messines almost matched the number of infantry in the 158 battalions used in the attack, 125,680 artillerymen to 154,486 infantrymen. If one adds the 6,965 men of the machine-gun companies to the artillery total, they become even closer. But for all this, Messines did not mark a culmination in that latter stages of the Flanders campaign were to surpass it, but surpass it only in terms of sheer numbers, for tactically Messines does represent the zenith of the British long barrage philosophy. Messines shows that the tactics of "massed bombardments" was not an entirely sterile idea. It could produce victories like Messines, limited, slow and infinitely costly in munitions, but victories nevertheless. It may be claimed that the tactics of Messines could never have in themselves produced a decisive attack, a breakthrough that changed the war in a day, that the complete dependence on artillery power meant it could never produce an advance of more than a few thousand yards into the German lines. What Gough's attack six weeks later was to prove was that such a battle was in fact the best the British could produce, for the decisive breakthrough battle was still, in the summer of 1917, beyond the resources of the British Army. The failure of Gough and Haig to recognize this, and their attempt to fight a battle very different from Messines, was to end in terrible failure, and the condemnation of three generations of historians for the Commander-in-Chief.
General Hubert Gough took over the planning of the second stage of the Flanders campaign on 13th May. He immediately began recasting Plumer’s plans and by 16th June had drawn up a radically different scheme. Rather than recommending an infantry advance to the German 2nd line, some 1,500 to 1,700 yards from the British jump-off positions, Gough’s plan called for the infantry to rush all four defensive lines, advancing 5,000 yards in a single bound. To accommodate this, great changes to the original plan had to be made in respect of Plumer’s artillery dispositions. Having to cover four distinct and highly developed defensive positions, the bombardment groups faced a vastly increased number of targets. The artillery program to strike all of these targets would consume the entire attentions of the bombardment groups for the duration of the shoot. There could be no possibility of using the heavy guns to join the counter-battery groups in a combined effort aimed at crushing the German batteries.

At Messines, such combined shoots had taken place three times, after the two Chinese barrages and during an intensive shoot for 30 minutes after zero. Gough’s artillery plan, however, did the reverse, for it took guns from the counter-battery effort to assist the work of the bombardment groups. At 5,000 yards, only the heavy guns of the artillery could cut the wire, bombard trenches, and protect the infantry. At the moment of assault, all available heavy artillery were to fire wire-cutting shrapnel shells at the German fourth line or await SOS flares from the infantry when they reached that point; for if the Germans counter-attacked, only the heavy guns would be able to lay down a protective barrage. Gough’s intention, once the German fourth line had been reached, was to allow two or three days to draw up artillery and then to take the Passchendaele-Staden Ridge, thrusting out of the salient altogether.51

Haig approved the plan and left for London and the War Cabinet conference to explain his plans to an increasingly sceptical Lloyd George. While he was away the head of operations branch, G.H.Q., Brig. J.G. Davidson, drew up a memo critical of Gough’s new
plans and advocating a return to the tactics and doctrines of Plumer’s original ones. This was handed to Haig on his return.

Davidson’s dismay at Gough’s abandonment of all the lessons learnt from the bitter fighting on the Somme was evident.

"It has been proved beyond doubt that with sufficient and efficient artillery preparation we can push our infantry through to a depth of a mile or so without undue losses or disorganization and I recommend strongly that the operations for the capture of the Passchendaelé-Staden Ridge should be conducted on the principle of a series of such operations, following one another at short intervals."52

Davidson outlined eleven separate reasons why such limited advances were more likely to succeed than any attempt to pierce the defensive line in one blow. The most crucial of these points were that if the area to be taken was small, artillery fire could be concentrated on it rather than spread over four or five distant lines of defence, artillery fire could be continuous without the massive disruption involved in moving guns forward and troops would be less tired and better prepared to receive the German counter-attacks. But Davidson’s most compelling argument was his analysis of the German defensive tactics. He pointed out that it did not matter whether the British advanced a thousand yards or five thousand yards, the crucial engagement would come when the German counter-attack divisions met the attacking force. Surely, claimed Davidson, it would be best to meet these close to the British lines where British artillery could support the attacking force, rather than at extreme range where British artillery support would be thin and the German artillery at its strongest.

Gough responded to Davidson’s criticism on the 28th.53 The remarkable feature of the response is that Gough almost entirely ignores Davidson’s claims concerning the artillery and devotes himself to the question of the disorganization and exertion of the attacking infantry. Gough claimed that he and "the chief" had already prepared for this eventuality by putting reserve divisions close in behind each attacking division. Infantry reliefs could therefore be carried out quickly. The possibility that this might actually add to the
disorganization of the attacking force was not entertained. Gough also disagreed with Davidson's interpretation of the past British offensives and in his statements we catch a glimpse of Haig's reasons for choosing to return to the all out attack and his choice of Gough to command it. Gough claimed that "It is necessary to draw the correct conclusions from past operations" and Gough's own conclusion was that the British had previously failed:

"... too recognize in this war of masses and great depth of reserves, that immediately the organized battle has been fought, it is necessary to plan and prepare a second organized battle and after that, without delay, a third and even a fourth. Owing to this not being very clear in all minds, delays have arisen in some cases because of the tendency to stay on a good position once captured and not advance into this 'low ground' or into that salient."\(^54\)

Gough, like that other ex-cavalry officer Allenby, had at Arras believed that most of the problems in previous British attacks had arisen because of the inexperience of officers of the volunteer army. If they had simply pushed on, vigorously, all the trench warfare could have been avoided. This analysis was to have catastrophic consequences for the Fifth Army's attempt to break out of the Flanders salient.

The Fifth Army artillery preparation began on 16th July. The vastly increased production of the Ministry of Munitions is evident from the fact that the Fifth Army were able to assemble an even greater number of guns and larger stockpiles of shells than had been available to the Second Army at Messines. The Second Army had used 740 heavy and 1,500 field guns, firing 3,250,000 shells at Messines; the Fifth Army had at its disposal 999 heavy guns and 2,092 field guns and stockpiles of 4,250,000 shells. The deployment of those artillery resources was, however, very different and in those differences the reasons for the attack's failure is to be found.

The first, and most crucial difference between the Fifth Army's artillery preparation for what the official battle nomenclature calls the battle of Pilckem Ridge and that of the Second Army at Messines was concentration on bombardment tasks rather than counter-
battery. While Messines had an attack frontage of 9 miles, Gough’s plan was for a 15 mile frontage attack; but even more telling was the increase from 1,500 yards to 5,000 yards in the attack’s penetration. Thus the area of defences that had to be subdued was increased more than four fold. This, as has been pointed out, meant that neither the bombardment groups nor the counter-battery groups could complete their tasks with the sort of thoroughness that had been achieved at Messines. The Fifth Army plan ignored the first axiom of Birch’s artillery notes issued early in the year, that counter-battery fire was the most crucial aspect of artillery preparation and must take precedence over all other tasks. The sheer scale of the task Gough had given the bombardment groups meant that the greater proportion of Fifth Army’s heavy guns and ammunition reserves would be consumed in the impossible task of destroying the four defensive lines of the Germans’ Flanders defences.

The second point, and one that like the first was a product of Haig’s decision to launch an attempted breakout from the salient rather than to fight a more limited engagement, was that the Fifth Army spread its guns evenly along its 15 mile frontage. Again Gough ignored Birch’s notes which stated that the number and distribution of British guns had to be determined by the number and distribution of the German defensive batteries. Messines’ planning had displayed exactly how this worked, with the attack frontage divided into five zones and artillery allotted to each zone according to the number of German guns it contained. This failure in the planning of the Fifth Army’s attack appears most clearly in its preparations for the attack on the Gheluvelt Plateau. The fact that the plateau was the cornerstone of the Germans’ defensive position and that a great proportion of Group Wytschaete’s heavy artillery batteries were located behind it was known by Fifth Army planners. Army intelligence summaries from 7th July reveal that the nature of the defences, the number of batteries supporting the position, and its significance in the German defensive scheme were all fully appreciated by the Fifth Army intelligence section. Yet despite this, the assault on the plateau was assigned to but one Corps, the II., which received the same ration of counter-battery and bombardment-group fire as the other Corps. The field artillery
of II. Corps was strengthened by the addition of two or three field artillery brigades to each of its divisions so that they had eight or nine, but this was out-weighed by the fact that the strength of the defences they faced was immense, with multiple wire barriers and many machine-gun strong points, and that the equivalent of three German divisions with their field artillery occupied the plateau. This failure to match the British bombardment to the disposition of the defences was the major cause of the breakdown of the 31st July assault, for it was the failure of II. Corps to take the plateau that left all the other Corps under the enfilading fire of Wytschaete’s guns.

There was a third and crucial difference between the Second Army’s artillery assault on Messines Ridge and the Fifth’s on Pilckem Ridge, and one often pointed to by artillerymen themselves when explaining the Fifth Army’s failure. At Messines the Germans occupied a salient as the ridge bulged out towards the town of Ypres. The Second Army’s guns had been able to fire in at the German positions from three sides, and British fire was concentrated where German fire was dispersed as they fired out of the salient at the British. At Pilckem Ridge the situation was reversed, for the British occupied a salient around which the ridge swung. Having fire coming from three sides made the work of spotting German batteries more complex and made protecting British batteries in their gun-pits more difficult. Rawlins’ history of the Royal Artillery in France argues that the Fifth Army’s artillery was superior to the Germans’ in methods, organization and numbers56, but was significantly handicapped by its salient position - so significantly that it was unable to complete its full preparation. In fact, argues Rawlins, given the magnitude of the handicap imposed by being in a salient, the attack should be regarded as a triumph. What Rawlins and other historians who raise this point in defence of the Fifth Army’s effort ignore is that the location of the attack and the handicaps it brought were by the choice of the Fifth Army Commander and Haig. If the Pilckem Ridge position was so unsuitable for offensive operations as almost to preclude the possibility of successful artillery work then surely it was madness to attack there.
The reason the attack was launched there was, of course, because Haig wished to make his grand drive to the sea. If the attack were to be further south in a more propitious position the armies would have to advance around the Flanders defence to the sea and presumably face the Germans as they redeployed. Because of the grandiose strategic objectives that Haig had laid down to Gough, which rested on his belief that the Germans were about to collapse in the west, the scale, disposition and location of the attack were all disadvantageous to the British artillery. Both Gough and Haig, despite the multitude of Staff notes that emanated from Birch, despite two years of experience in the Western Front, had failed to recognize that this was a gunners' war, that artillery tactics were not merely an adjunct to an assault outline but that for an attack to succeed they must form the framework of the plan. This failure of Gough and Haig was to be revealed on two further occasions as the Fifth Army's vast bombardment reached a climax. Firstly, when the movement of German reserves revealed that the fundamental premiss upon which Haig had based his decision to hand the attack to Gough and attempt a strategic breakout, namely that the Germans were weakened to the point of collapse and had no reserves, was entirely false. Not only were the defences of Pilckem Ridge much stronger than those at Messines, but their reorganization during the Fifth Army's bombardment clearly revealed they had learnt a great deal from Messines and were actually attempting new dispositions to reduce the effectiveness of the Fifth Army's artillery. This, it seems, had no effect on either commander, each of whom simply continued on with his plan as if nothing had changed. The second occasion that their ignorance of artillery considerations arose was when, only a few days after the artillery program began, a steady and often heavy rain began falling across the whole Flanders region. Much has been made of the rain in Flanders by successive generations of historians, who usually provide detailed accounts of the gluey mud it produced. While it is true that the rain which would continue to pour almost without relief right up to and beyond the day of attack turned the battlefield into a nightmare of water-filled craters and acres of intractable bog, its most profound effect was on the
artillery. In rainy conditions aerial observation was impossible and without continuous aerial observation heavy artillery ranging, particularly counter-battery, was impossible. Although there were only three days of flying weather from the start of the artillery preparations and none in the crucial eight days leading up to zero, Gough refused to acknowledge repeated requests from senior artillerymen and the French General whose flank attack supported his own, to delay the attack in order to allow sufficient aerial ranging. The explanation is that Gough was driven by the design of Haig’s plan to reach the coast by the high tides of 7th/8th August. Again grand strategic goals had over-ridden the tactical imperatives of an artillery war with disastrous consequences for the accuracy of the Fifth Army’s guns and the fate of the entire offensive.

Constant raiding by the Fifth Army and an increasing number of German batteries noted in Fifth Army artillery intelligence revealed that the Allies’ spring offensives had not, in fact, destroyed the German reserves or fighting resolve in the way Haig had anticipated. Indeed, Messines had fully convinced the German Staff that Flanders was to be the location of the major British thrust for the year and thus caused them to re-inforce the position heavily and reorganize their defences. Attempts by the British to convince their enemies that they were about to launch a major offensive in the vicinity of Lens failed completely. Ten German divisions were transferred from the Lens front to Flanders in June, as every available reserve division of the German Western Front force was gathered around the threatened area. The area of the plateau was given three of the elite counter-attack divisions to support its defence. The nine brigades of heavy artillery that had been called for at the time of the Messines attack also arrived to supplement the defences. The air strength of the German Fourth Army had been doubled to 600 aircraft so that the Fifth Army air support of 748 planes barely outnumbered it. At Messines, it will be remembered, the Second Army enjoyed a superiority of at least 2-1 in the air.
After the capture of Messines Ridge, Group Wytschaete’s commander Von Laffert was sacked and his role taken by Colonel Von Lossberg who also assumed the role of Chief-of-Staff and had organized the defensive efforts against the British on the Somme and against Nivelle’s disastrous attacks. During June he made crucial modifications to the Flanders defence. He drew a number of heavy batteries back out of the range of the British counter-battery groups, so that they could be silenced only by the long-range 12- and 15-inch guns. He also insisted that many new gun-pits be dug for the German heavy batteries, at least three positions for each gun. As aerial observers could not tell whether a pit was occupied (because of the camouflage netting strung above them) this led to a vast number of targets for the Fifth Army counter-battery groups to fire upon. It also led to over-optimistic reports from the artillery who tended to report a gun destroyed with every successful shoot on a pit.

Von Lossburg’s reorganization of the Flanders defences and their strengthening with extensive re-inforcements was facilitated by the six-week pause between Messines and Pilckem Ridge. This delay was yet another product of Haig’s decision to give the major thrust to Gough while leaving Plumer with a merely preliminary operation. There can be no doubt that the British would have been better served by a single operation coordinated and planned by one commander. If nothing else, this would have reduced the time between Messines and Pilckem Ridges, time which the Germans put to extremely profitable use. What is remarkable is that the re-inforcement of the Flanders defences and the redeployment of the German batteries to deep positions, (clear indications that the Germans were preparing in strength to meet an attempted breakthrough by the British), did not induce Gough or Haig to modify their battle-plans. They were still intent on a deep push, resulting in a breakthrough of the defences. But perhaps even more remarkable was their ignoring of another vital factor in the attack’s success - the weather and the way that constant rain had rendered the task of the counter-battery groups, already stretched beyond their resources, almost impossible in the days leading up to the assault.
R.F.C. operation over Messines had been favoured by two crucial factors. The R.F.C. greatly outnumbered their foes and they were blessed with unbroken fine weather. For Pilckem Ridge they had neither. It has already been noted that the re-inforcement of the German Fourth Army after Messines had included a doubling of its air strength, so that the Fifth Army’s forces did not hold the dramatic two to one superiority in the air that the Second Army had at Messines. As a result, of this was that when the weather allowed flying the German air force were in a position at least to contest the air space above the Fifth Army with the R.F.C. The aerial battles of early July saw the largest concentrations of squadrons and the most intensive air battles of the war. Sixty to seventy planes were often involved in dog fights. On 26th June, above Polygon Wood, 94 fighters at various altitudes were engaging each other. While the R.F.C. with its new, faster fighters was tending to triumph in these contests, they could not entirely subdue the German squadrons in the way they had at Messines. While the fighters duelled above the wood on the 26th, for example, German observer planes were able to slip through and over-fly the British positions. British observer planes became embroiled in the fighting, forced to defend themselves rather than attend to their crucial ranging tasks. On the 27th, for example, when the counter-battery effort was at its most intensive, British FE2ds shot down six German fighters. While they lost only one plane themselves it is clear that the observer squadrons of the R.F.C. were not granted the luxury of uncontested and extended observation periods over the German lines.

The weather also played a crucial role in disrupting the aerial spotting program. The attack had originally been planned to take place on 25th July. Withdrawal of German batteries and proliferation of gun-pits at the very extreme range of the counter-batteries had caused a postponement until the 30th in order to allow British guns to be brought within range of these new positions. The weather, however, continued cloudy and overcast and intermittent showers made flying and thus ranging onto these new positions impossible. On
21st July General Anthoine, commanding the French First Army, who were to make a supporting attack on the Fifth Army's northern flank, wrote to Haig requesting a further delay. His reason was that only two days of observed fire had been possible in the week and thus the crucial counter-battery bombardment had been fired largely blind.\(^6a\) Despite the fact that all the experience of 1917 had shown that accurate and sustained counter-battery was essential in any attack, Haig resisted Anthoine's request. He reluctantly granted a further three-day delay until the 31st. The weather failed to improve; in fact it grew worse. By the 29th, only two days of observed fire had been possible since Anthoine's request. On the 30th, wild storms not only made life a misery for the troops now concentrated in their attack positions, but put flying out of the question. On the 31st, the day of attack, the rain did not clear.\(^65\) No flying was possible. The entire neutralizing barrage that was to suppress German gun fire while the infantry crossed no-man's land was fired without aerial observation. British counter-batteries fired at settings made from what little observed ranging had been possible and could neither correct their fire nor know whether the pits they fired at were occupied.\(^66\) On 7th July at Messines, the R.F.C. had observed neutralizing fire onto 153 batteries, while the infantry were out in the open crossing into the German positions. On 31st July the R.F.C. were unable to observe a single neutralizing shoot, and the German artillery that had survived the counter-battery effort reacted savagely to the British infantry's advance. This defensive fire was to have catastrophic consequences on the Fifth Army's assault.

Gough and Haig were not the only Generals who seem to have been infected with a degree of over-optimism before the 31st July attack. On the 25th Birch stated that he was "confident the upper hand over the German artillery had been gained."\(^67\) We know from Rupprecht that by the 25th, Group Wytschaete, which held the majority of attack frontage including the plateau, had lost 40% of its heavy and 10% of its field artillery.\(^68\) This was less than the Second Army had achieved at Messines (50% of heavies, 25% of field) but Rupprecht also points out that between the 25th and the 31st the Germans were able to
replace from the reserve, or repair, a great proportion of those losses. This was, of course, because of poor flying weather which made the last few days of the bombardment almost ineffectual in terms of counter-battery. Thus, when the infantry went over the top, the guns of Group Wytschaete were near full strength, unmolested by accurate neutralizing fire, and were able to form an impenetrable curtain of fire around what they regarded as the centre of the defence, the high ground of Gheluvelt Plateau. The German artillery were not dependent on aerial observation to produce this barrage, for not only did they have ground-based observers from their position on the ridges overlooking the British, but also the British were advancing into positions the German artillery had carefully prearranged on their artillery boards. The moment that SOS. flares were fired by the front line infantry, German batteries were able, after referring to tables of prearranged range settings, to drop a heavy barrage on no-man’s land without reference to observers at all.

II. Corps’ attack on the plateau was faced with numerous obstacles, not the least of which was the remains of three woods, Shrewsbury, Sanctuary and Chateau. These made the front line German positions a tangle of tree stumps and downed trunks with rain-filled craters between. As II. Corps advanced into this morass, it became immediately evident that neither the bombardment groups nor the counter-battery groups allotted to the sector had been able to complete their tasks. Intensive machine-gun fire from German strong points greeted the 73rd brigade’s attempt to pass through Shrewsbury forest, halting the attack and pinning down the centre of II. Corps’ advance. Machine-gun fire from Stirling Castle, Inverness Copse and Glencorse Wood held up the other brigades of II. Corps, but it was German artillery which devastated the attacking force. Units were shelled even before they jumped off. The 21st brigade of the 30th Division were unable to assemble for the assault as their dugouts and assembly points were under a constant rain of German shells. From 5 am the guns of Group Wytschaete dropped an intensive and extended bombardment on the line of the three woods, on what had been the German front line position. Forward movement by II. Corps was impossible, trapped by artillery and machine-gun fire in the
German front line. Their creeping barrage rolled on to the first objectives, second objectives, and over the plateau, while II. Corps remained trapped. The 30th Division, who were in the centre of this slaughter, reported that their creeping barrage was "thick, dense and perfect but undoubtedly too fast for such difficult going and such absence of light. It ran right away from our troops before they approached the black line." The bombardment by the Germans paralysed movement and destroyed communications. At 9 o'clock, four hours after the start of the German bombardment, II. Corps' Command still had no idea that the attack had been held up. Messages by pigeon from the front to call the barrage back failed to reach headquarters; overground telephone cables, unreeled as observers advanced, were cut; the rain made visual signalling impossible, and forward wireless stations were destroyed. Not only did II. Corps' creeping barrage roll on into the distance, but the troops for the 2nd and 3rd objectives were launched into the crowded trenches in the woods. The German artillery fixed with the great advantage of using known registered targets. Because the British were advancing into the German positions, every feature, such as the woods, had been carefully ranged and fixed by the German defensive batteries. Lieutenant J. Annan recalled to Lyn Macdonald the effect of this. Annan's battalion had, after a ferocious fight, overcome a German strong point and occupied it.

"Of course the Germans had every one of their own positions marked on the map and registered by their artillery so that if they had to get out of them and give them up they'd have the guns on them right away. So, just as we were coming up to Minty's Farm, the shells started falling all around. We got a slashing there alright." The tanks allotted to assist II. Corps across the plateau ran into the same obstacles as the infantry. Many of the still undamaged strong points contained anti-tank guns which, combined with the effects of the German shell fire, ensured that only four of the sixteen tanks allotted to lead the first wave even reached the woods and these were soon disabled or bogged. II. Corps' attack aborted completely, devastated by sustained barrages from German defensive batteries and unable to tackle the many German strong points that had
evidently survived the long preparatory bombardment. Haig’s and Gough’s hopes for a rapid and extensive advance out of the salient crashed in ruins.

The II. Corps’ attack failed because the artillery preparation in both bombardment and counter-battery was inadequate. While Gough’s and Haig’s over-optimism concerning the task given to the II. Corps’ guns was consistent with their previous attitude, the failure of Birch to assess the difficulties of the Plateau and the concentration of Group Wytschaete’s guns is more surprising. Birch left no account of his thinking during this crucial period and the account by Rawlins, his Chief of Staff, is nothing but an apologia for the R.A.’s conduct. Rawlins, after describing the Fifth Army’s artillery preparations as complete and thorough, claims that the attack was “successfully launched and made excellent progress”. The attack by II. Corps was however “less satisfactory”. This was not however the fault of the artillery, but the infantry.

"Up to the end of 1918 there was a constant tendency on the part of infantry with whom things in attack did not go too well, to complain that the barrage was too fast or too slow, as the case might be and as if the fault lay with artillery."

The real reason counter-battery was inadequate was because

"Infantry commanders, particularly battalion commanders and brigadiers are always prone, for very obvious reasons, to be more intent upon the destruction of the hostile defences immediately opposed to them than in any of the many other forms of artillery preparation."72

But it was to override these infantry commanders and supervise the artillery that Birch had been given the powers of Artillery Commander.

The notes drawn up by Birch after 31st July are perhaps more revealing than Rawlins’ explanations. In his notes Birch points out that

"Owing to constant changes of position on the part of hostile batteries, it is difficult to maintain counter battery information up to date. Counter battery programmes may best be based on the "N.F. " calls received during the early part of the day and be executed the same afternoon"73
In the lead up to both Messines and Pilckem Ridge the artillery had received its N.F. (now firing) reports from aerial spotters and the other ranging services and drew up a list of hostile battery positions issued each night for the following day's counter-battery program. But after Messines, under Lossberg's direction, the German policy was to dig a number of pits for each gun and move it after each day's work. Thus much of the Fifth Army's counter-battery program was directed at empty pits.

While II. Corps' attack collapsed shortly after jump off, the other Corps of the Fifth Army had been able to take the front lines of the German position. On these Corps' frontages the attack followed the course predicted by Davidson of the operation section. Advancing beyond the visual range of ground-based artillery observers, the XIX., XVIII. and XIV. Corps were, from about 2 pm, faced by heavy counter-attacks by the Eingreifen division of Group Ypres. Along the attack frontage the German artillery dropped a heavy barrage along the German second and third lines. The British artillery, its communication cut by constant German shelling, were unable to assist the attacking Corps' infantry whose location and situation was completely unknown to them. While the British guns continued to fire the creeping barrage into the fourth German line some 5,000 yards into the defences, some mile and a half back the attacking troops were in fact being driven back by the Eingreifen divisions and suffering heavy casualties from the defensive barrage. XIX. Corps was forced back with heavy casualties from their newly won positions, back to the Steenbeek stream. They would have been forced further back but for the fact that the counter-attack groups then ran into the standing barrage that their own artillery were dropping on the second line and this was so intensive as to paralyse any movement. All the strong points in the German third line were recaptured by German counter-attacks, Kansas Cross, Border House, Somme Farm and Hill 35, and many others. The three attacking brigades of XIX. Corps, which faced the counter-attacks and were forced back, lost up to 70% of their fighting strength. It was only when the British divisions had fallen back to the German front line positions that British artillery observers were able to fix the position.
of the British troops who were repeatedly firing SOS. flares, calling for a defensive barrage to protect them. At 6 pm the British artillery were finally reorganized and ranged for an SOS. barrage which they fired for four hours all along the German second line. With both the German and British artilleries now firing heavy barrages into the German second line, the possibility of movement by either infantry was extinguished. In pouring rain and rapidly gathering darkness, the infantries of both armies simply sought shelter from the crashing deluge of shells that smothered the battlefield.

It is interesting to compare the Fifth Army’s effort on the 31st to that of Plumer’s Second Army which carried out a small advance to protect the Fifth Army’s flank. The three Corps of the Second Army advanced between 500 and 1,000 yards each, capturing a number of strong points in the German first line. The New Zealand Division occupied La Basse Ville, X. Corps captured Hollebeke Village, and various other machine-gun positions around the Wambeek and Moozebeek streams were occupied. Here, still within the view of artillery observers, the Second Army’s Corps halted and dug in to receive German counter-attacks. These duly arrived at 3.30 in the afternoon. Unlike the Fifth Army’s advance units, the Second Army forces were in contact with their artillery as the counter-attack aimed at recapturing La Basse Ville was assembling. Second Army artillery and heavy machine-gun brigades were able to form a protective barrage for the New Zealand Division and the counter-attack was repulsed.76

Another counter-attack launched at X. Corps at 7 pm also failed under the combined fire from Second Army artillery and X. Corps’ own machine-gunners and riflemen. The difference in casualties between the Fifth and Second Armies’ Corps amply displays the disastrous consequences of the Fifth Army’s attacking tactics. The Fifth Army’s II. Corps lost 11,260 men whereas the three Corps of the Second Army lost only 4,849 in total, with IX. Corps losing the most, 2,003. Individual divisions of the Fifth Army had almost as many casualties as the entire Second Army. The 39th for example, had 3,871 casualties.
Of the total of 31,850 casualties the British suffered from 31st July to 3rd August, the Fifth Army contributed 27,001. Each of the Fifth Army’s divisions lost on average 2,700 men, whereas each Corps of the Second Army lost 1,616. This was the product of Gough’s and Haig’s decision to fight a breakout battle, to ignore the imperatives of the artillery war and plan an attack not driven by the tactical needs of the artillery, but by their own grandiose strategic ambitions. The attack on the Gheluvelt Plateau, the heart of the defence, failed so completely that Group Wytschaete and three Eingreiffen divisions were not committed, as Rupprecht exultantly recorded:

"the results of the day’s fighting were all the more satisfactory because the counter attack divisions of Group Wytschaete behind the Gheluvelt Plateau, had scarcely been used." 78

While the positions to the north of Gheluvelt had conceded some ground, the counter-attack divisions of Group Ypres had prevented any possibility of deep advance. The attack of 31st July can only be regarded as a complete triumph of the defence-in-depth tactics of the German Command. The remarkable feature is that the British Command were fully aware of the nature of this defensive scheme and yet fell into its trap, pushing the infantry beyond protective range of the guns and into the storm of German artillery fire and counter-attacks. One can assume that if Plumer and the Second Army Staff had conducted the operation, the results that they obtained on their limited frontage would have been translated across the whole attack frontage. A shallow advance, with few casualties, followed by an organized artillery assault on the counter-attack divisions, would have been a far more profitable result. While the advance would not have been spectacular, nor would it have seriously disrupted the German defence, it certainly would not have incurred the casualties of Gough’s ill-prepared and costly botch.

It rained heavily that evening. It became impossible to move guns or munitions, and wounded men in front line positions often drowned in rapidly filling craters and trenches. Most of the attacking divisions of the Fifth Army were still strung out along the ruins of the German first line, under persistent German shelling. Haig’s response to this situation
reveals his ignorance of the plight of the Fifth Army and of the nature of the artillery duels that dominated the entire Flanders fighting. He simply ordered Gough to carry out the attacks again, as if nothing had happened on the 31st. On 1st August, II. Corps' artillery were to crush the German artillery, (a task they had proved unable to perform in the ten days of counter-battery preceding the attack), then on the 2nd, the II. Corps infantry, reduced to 30%-40% of its original fighting strength, was to win all the positions not reached on the 31st. The grand scheme to reach the Belgian coast would then continue as planned. It was clearly an absurd plan and one bound to fail in the same costly manner as the piecemeal attempts to redeem the Somme attack had been, almost exactly one year before. It would seem that the bitter lessons of the Somme campaign, along with the advances in technique made at Vimy Ridge, the Scarpe and Messines, had been completely ignored by the Commander-in-Chief. The difference was that by mid-1917 there was a substantial group of senior officers who doubted Haig’s judgement and were willing to express their opinions. The disagreements that had arisen between the operations section of G.H.Q., Plumer and Rawlinson, and Haig and Gough, over the planning of the Flanders campaign, now re-emerged. On the morning of the 1st, the operations section of G.H.Q. presented Haig with their assessment of the situation. While the document does not directly point it out, it made clear to Haig that all of the section’s dire warnings concerning the attack had been justified. The response to this failure, in the view of operations section, should not be simply to press on with the disastrous tactics of the 31st but to ensure an extended pause while the Fifth Army reorganized. All the heavily mauled divisions needed to be replaced and most importantly,

"we want to make absolutely certain of the artillery preparation, which will require very careful control and accurate shooting, and two or more days good flying weather prior to the attack."\

The focus of this organized assault should clearly be the Gheluvelt Plateau, rather than on an attempt to break out north-east from the salient. This assessment by operations section clearly had some effect, since the orders for the attacks to be immediately resumed on the 2nd were cancelled.

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Gough recast the Fifth Army’s plans but the new ones were hardly better than the old, since he clearly ignored much of what operations section had to say. Gough planned for II. Corps to take the plateau on the 9th and then on the 13th the main attack, the breakout, could proceed. While Gough replaced II. Corps’ battered divisions, he gave them no further artillery resources. The Fifth Army artillery were still to fire along the full 12,000-yard frontage, to prepare for the main breakout attack, and just as they had done for the 31st, the artillery of II. Corps were expected to take the whole artillery force of Group Wytschaete. Gough also ignored operations sections’ warnings concerning the weather and its impact on flying, and thus artillery accuracy. The 4th was in fact the only fine day, the 5th was rainy again. By the 8th violent thunder storms and pouring rain had not only made any aerial observation impossible, but turned the shell-torn battlefield into a morass of mud and water. Despite this, Gough ordered the II. Corps’ attack to go ahead on the 10th. Not surprisingly, it failed completely. The German artillery fire was so intensive that two brigades of II. Corps were unable to attack because they suffered so many casualties from shell fire in their assembly positions. The fresh divisions of II. Corps had casualties of up to 50% of strength.

Gough simply carried on regardless. Even though II. Corps had failed, the major attack along Fifth Army frontage went ahead. Planned for the 14th, it had to be postponed because of wild storms and torrential rain. On the 16th when the attack went ahead, although the rain had stopped, visibility was down to 300 yards because of mist - flying was impossible. II. Corps again failed to move past the woods and take the plateau. Elsewhere, the other corps of the Fifth Army made small advances, but were met by constant and repeated counter-attacks. Every one of the German Staff’s reserves of Eingreiffen divisions had by this time been sent to the Flanders position, every shell stockpile stripped and reserve artillery moved to face what was evidently the major British offensive of 1917. The struggle on the plateau had degenerated into a series of vain assaults to capture machine-gun
positions in the ruins of Inverness Wood, while German artillery poured a ceaseless torrent of shells into the British assembly positions and trenches. First the 51st Division was thrown at the wood and when that had been destroyed by German shellfire, the 14th Division were ordered in. On the 24th a small foothold in the wood was lost to a concerted German counter-attack. Gough, undeterred, ordered new attacks for the 25th. The commander of II. Corps, General Jacob, took the unusual step of protesting directly to Fifth Army H.Q. He had no reserves, his divisions had been reduced by over 50% casualties, most had been under constant shell fire for ten days and they had failed on four previous occasions. Fortunately for II. Corps Haig underwent a radical change of mind on the 24th. On hearing that II. Corps had not only failed again but was actually being driven back by German counter-attacks, Haig decided to change both the command and tactical approach to the battle. Gough was informed that he was to hand over command of the battle to General Plumer. The second, disastrous stage of the Flanders campaign was over.

The fighting of 31st July and the subsequent appalling battle in the mud on the plateau have been responsible for making the very name of Passchendaele a byword for pointless slaughter and military bungling. The effect of the battle was greater than the 68,000 casualties the Fifth Army had suffered, as the official historian acknowledges, and the soldiers’ newspaper, the Wipers Times, amply bears out. The fighting of August severely affected the morale of the entire British Army. The defenders of Haig, the Official Historian, Duff Cooper, and to a lesser extent John Terraine, have with some justification regarded these engagements as Haig’s weakest point and have attempted elaborate justifications for it. It is vital to examine these for they have clouded and confused the analysis of this tragic battle ever since. An argument that all three of these writers use is that the attack of 31st July was simply another long barrage assault, a logical progression from the Somme, Arras, Messines and then Pilckem Ridge, with each using ever more guns in ever greater density, consuming ever more ammunition. Both the official history and Terraine’s White Heat contain lists of these assaults, together with the number of guns used
and ammunition consumed, to support this point. While it is true, as the official historian states, that the battle marked the "zenith ... of the protracted set piece bombardments"\(^8\), it is a zenith only in the material sense, not the tactical, a point which Haig’s defenders are eager to conceal. Despite the extent of the artillery preparation, the work of artillery was in fact a retrograde step tactically, a return to the failed approach of the Somme, to a belief in the miracle of breakthrough. After the Somme Birch had pointed out that the struggle on the Western Front was an artillery war and thus British attacks had to be determined by the needs of their gunners. Location of an attack, its size, the depth it could hope to reach, the disposition of the attacking forces and its timing should all be determined by artillery considerations. This had been done at Vimy Ridge and Messines with admirable results. But at Pilckem Ridge Haig and Gough turned their backs on these developments and returned to the false optimism of 1916. The disposition of the attacking force was determined by Haig’s desire to push north to the coast, ignoring the need to master the plateau and the artillery force it protected. The depth of the assault was chosen, not on the effective range of the British guns, but on Haig’s and Gough’s desire to break out of the trench systems and into open, cavalry-led warfare. The 5,000-yard-deep objectives for the first day made the work of the bombardment groups impossible; they simply could not destroy four, and in places five, distinct defensive lines in one bombardment. The timing of the attack was fixed, not by the artillery’s readiness but to fit in with Haig’s pipe dream of reaching the coast for the high tide of 8th August. As a result, the attack went ahead in a period of appalling weather, when the great majority of the millions of shells the British fired missed their mark because of the lack of an aerial observer to direct the fire. It was a battle fought to Haig’s grand strategic designs rather than the tactical imperatives of the artillery war and thus doomed to failure. While the attack does constitute a zenith in terms of material for the artillery it was, in terms of tactical handling of the artillery, the nadir.
The second argument used by Haig’s apologists to defend his conduct of the attack is to claim that breakthrough was not his objective. Edmonds wrote in his volume on Ypres that

"the Pilckem Ridge attack can be regarded as a qualified success for it achieved Sir Douglas Haig’s purpose to draw all available German reserves to the British sector... The French battle front had been left unmolested and German plans for an attack on the Russian front had to be postponed." 85

While it is true the Flanders offensive had absorbed the efforts of the German Command and did indeed draw the reserves from all other German sectors, this had not been Haig’s purpose, for his entire plan of attack was based upon the false premiss that German reserves had already been destroyed. This over-optimism by Haig was at the heart of the disagreement Haig had with Plumer and Rawlinson over the nature of the Flanders attack. When Plumer submitted his original proposals for a series of set-piece attacks of limited penetration and based on overwhelming artillery preparation, Haig, through Kiggell, stated that Plumer should "re-cast" his plans in light of a number of factors. The first of these, and one which underpinned Haig’s whole view of the Flanders campaign, was that the Nivelle attacks and Arras had meant that "the enemy will have been severely handled and his reserves drawn away from your front". It is clear that Haig did not regard drawing reserves away from the French front as the purpose of the attack, for its real purpose is revealed in the letter’s next point. "Under these circumstances it is essential that the plan should be based upon rapid action and entail the breaking through of the enemy’s defences on a wide front without any delay". Haig reiterated the point in the letter’s conclusion. "The object of these operations is to inflict a decisive defeat on the enemy and to free the Belgian coast". Haig’s plan was not for a simple holding or spoiling operation, it was for a "decisive breakthrough" attack against what he clearly believed was a mortally weakened enemy. This explains why the attack was launched on such an extended frontage of fifteen miles; why the objectives were so deep; why the attack’s focus was to the north of the salient rather than the plateau; and why the attack went ahead in appalling weather. Haig believed that his armies could crush the entire Flanders defensive position and pierce the four defensive lines in one determined assault. Driving out of the salient to the north, they
would link up with a naval operation on the high tide of 8th August. Thus separated from the coast, the entire German line would have been imperilled; it might even have meant the end of the war. Haig’s underestimation of the strength of the German defenses was grotesque, his over-estimation of British attacking power absurd, and the result catastrophe.

Plumer submitted his plans for the resumption of the Flanders offensive to G.H.Q. on 29th August 1917. Plumer proposed to abandon Gough’s attempts to attack along the long frontage of Pilckem Ridge and the Gheluvelt Plateau and to concentrate the entire energies of the Second Army on overcoming the plateau, where II. Corps had failed on 31st July and where repeated attempts by II. Corps to redeem their situation through August had been crushed by German artillery fire. Plumer proposed to take the plateau in three distinct steps, each advancing no more than 1,500 yards into the German defence and on narrow frontages of no more than four to five thousand yards. These assaults were to begin on 20th September with the first assault, the battle of Menin Road, followed six days later by the battle of Polygon Wood, and to conclude six days after that with the battle of Broodseinde. This third attack would complete the capture of the plateau, the three assaults advancing some 4,500 yards into the German defences. In other words, Plumer intended to use the entire resources of his army over eight weeks of bombardment and three distinct assaults to achieve what Gough had hoped the II. Corps could have taken in just one day, 31st July.

The artillery preparations for the first of the Second Army’s attacks began on 29th August. The counter-battery groups of the Second and Fifth Armies attacked the German guns of Group Wytschaete. The Second Army’s artillery intelligence communications headquarters at Locre was the focus of all reports and artillery information, as it had been for Messines. The artillery fire-plan was very similar to that used at Messines, with a long preparatory period in which all heavy guns engaged in a concerted effort to destroy the German artillery resources, followed by a seven-day bombardment of the German trenches, dugouts and strong points. False barrages were used, as they had been at Messines, to force
the disclosure of silent German batteries, which were destroyed by combined shoots from the counter-battery and bombardment heavy artillery groups. The only area in which the plan differed from that at Messines was in the artillery’s response to German counter-attacks by the Eingreiffen divisions. At Messines, it will be remembered, the artillery’s forward observers had mistaken Australian troops for counter-battery Germans and shelled them heavily. To overcome this problem, Second Army artillery planners issued an SOS flare to each infantry brigade headquarters. Rather than relying on artillery observers, the infantry would be able to call in a defensive barrage on any counter-attack that threatened them. The flare split into three on firing, producing a red, green and yellow burst that was distinctive and visible to all artillery observers.

The infantry assault was launched at 5.40 am on 20th September. The concentrated bombardment had turned most of the plateau into a crated wilderness. The infantry were preceded by a creeping barrage of great density and depth. Five distinct belts of fire, using heavy howitzers, field guns and machine-guns, covering a thousand yards, advanced before the infantry. The pace was much slower than that used by the Fifth Army in its repeated attempts to advance against the plateau, a hundred yards every six minutes rather than every four. After advancing six hundred yards the barrage halted for two hours to allow the infantry to catch up. After this pause, the attack continued and by midday all units had reached their objectives. The strong points of the German defence that had foiled the Fifth Army’s repeated and costly assaults were overrun, destroyed by the bombardment and by the crushing, creeping barrage. Polygon Wood, Inverness Copse, Hover Hamlets, and even the fortress of Glencorse Wood, which was said by the Australian 1st Division to "offer no impediment", were all captured. The advance troops then dug in and prepared to meet the German counter-attacks.

The first counter-attacks were spotted by aerial observers as they advanced towards the newly won positions at 3 pm. All heavy batteries within range fired upon it and the
attack was broken up. At 6 o’clock a counter-attack arrived at Polygon Wood, having evaded the aerial observers. The 9th Australian Division fired its SOS. flares and a forty-minute barrage was dropped in front of the Australian positions and this counter-attack also broke up. At 7 o’clock the last of the three Eingreiffen divisions protecting the plateau was launched into an assault. The 1st Australian Division spotted it advancing up the Reutelbeek Valley and fired its SOS. flares. The bombardment groups of the Second Army shelled the valley for an hour, ranging up and down its length to smash the attack. The artillery had decisively beaten the counter-attack tactics of the plateau’s defence. No further attacks were launched at the British positions during the evening or next day. The entire counter-attack resources of Group Wytschaete had been destroyed by the devastating SOS. barrages.

Casualties were minimal in the attacking units; the Second Army had suffered just over 9,000 casualties, some 3.4% of the infantry force committed to the attack. Compare this to the first day on the Somme where some 50% to 60% of the attacking units became casualties, or the attack by II. Corps on 31st July where over 60% of its complement had become casualties, and the efficiency of the Second Army’s assault is evident. The reason the Second Army had been able to take these positions with such apparent ease, where the II. Corps had repeatedly failed, was simply the overwhelming concentration of artillery Plumer had brought to bear on the plateau position. When II. Corps had attacked in July on their 6,200-yard frontage, they had 282 heavy and 576 field guns to support them in their rain-affected preparations. These guns had to prepare for an advance of 5,000 yards and thus shelled all three lines of German defence. Against a frontage that was shorter by 2,200 yards the Second Army comprised two Corps and 575 heavy and 720 field guns. The infantry were advancing only to the first German defensive line, some 1,500 yards, and thus the bombardment was confined to a much smaller area. The crushing bombardment and creeping barrage had destroyed the German machine-gun positions, extended counter-battery fire had silenced the German artillery, and the SOS. flares and artillery response had smashed the counter-attacks on which the German defensive method was based. Prince
Rupprecht, the German Army group commander, acknowledged that it was the narrowing of the frontage of attack and thus the concentration of artillery fire which led to the devastation of his plateau defences. The German official history also points out that the Second Army’s tactics, based on overwhelming artillery concentrations, had proved superior to the German tactics of counter-attack.

"The German Eingreifen divisions were at 8am assembled at their stations in readiness to move at any moment. In spite of this the counter attacks did not take effect until late in the afternoon, for the tremendous British barrage fire caused most serious loss of time and crippled the thrust power of the reserves."

During the evening of the 20th and the following day, the British artillery moved forward to begin preparations for the second assault. The tactical scheme was in almost all respects identical to that used on the 20th, although the main attack frontage was to be even narrower, only 2,000 yards. The main attack was conducted by the 6th and 4th Australian Divisions which were to advance 1,500 yards into the German positions. On their flanks the remaining divisions of the Second Army and V. Corps of the Fifth Army were also to make shallow advances to conform to the advance of the centre of the Second Army. Despite the heavy re-inforcement of the German position and repeated counter-attacks, the attack gained all objectives. Casualties were slightly higher than those experienced on the 20th, 15,375, but the number of divisions that attacked was also greater. German casualties were heavy; after the first two steps of Plumer’s advance they had sustained 40,000 casualties, many in the elite counter-attack divisions. Into an area of little more than four square miles, the artilleries of the Second and Fifth Armies had poured 1,722,059 shells. They had turned the eastern half of the plateau into a cratered wilderness, completely destroying woods, obliterating streams, and leaving a wasteland littered with the remains of German pill boxes that marked where the defensive lines had once been. Ludendorff admitted that the power of British artillery had, in the "failures of the 20th and 26th of September", overcome the counter-attack strategy he had developed. He ordered it abandoned in favour of holding the front line more heavily and holding Eingreiffen divisions even further back.
Unfortunately for the German Command, the orders outlining this new scheme were captured by a raiding party and thus fully anticipated in the planning for the third of Plumer’s assaults, the battle of Broodseinde.98

At Broodseinde, 2nd artillery staff modified the bombardment procedure they had used in the previous two steps. As counter-battery fire had been attacking Group Wytschaete’s guns for over a month continuously, and repeated assaults had destroyed most of the German strong points and communications into the plateau, it was thought that the third step could be somewhat more ambitious than the previous two. While the main attack frontage was still narrow, only 1,500 yards, considerable flank attacks were undertaken on either side by the remaining divisions of the Second and Fifth Armies. These were shallow attacks, penetrating less than the 1,500 yards the central thrust aimed at achieving, but they brought the total frontage of the assault to 14,000 yards.99 The objective was to drive the German defenders from their last positions on the plateau and consolidate the Second Army’s hold on the high ground. Since in the previous attacks, long-range fire had already wreaked such damage on the remaining German positions it was thought that the preliminary bombardment could be dispensed with. To gain a measure of surprise, Second Army artillery Staff ordered that at the moment of assault the 1,000-yard-deep creeping barrage should simply crash down on the German positions combined with an intensive shoot by the bombardment groups on the remaining strong points.

The attack was launched on 4th October and reached all objectives.100 Despite providing the plateau’s defences with artillery re-inforcements in a desperate attempt to keep the Second Army from completing its occupation of the high ground, the defenders were driven off completely.101 Second Army losses in the assault were 10,000 men with 1,000 gunners killed during the counter-battery duels. The Fifth Army lost a little over 4,000 men. German casualties are now impossible to establish but the Second Army captured over
4,000 Germans in its initial attack. Ludendorff describes the casualties suffered on 4th October as,

"extraordinarily severe and again we only came through it with enormous losses. It was evident that the idea of holding the front line more densely, adopted at my last visit to the front in September, was not the remedy."

The German official history confirms that 4th October saw a recognition in the German Command that Plumer's Second Army assaults, with their concentration of artillery fire and limited objectives, had presented an apparently unsolvable problem to the army commanders. "The new battle scheme had not stood the test on the 4th of October."

It would seem that by 4th October the Second Army, pursuing the tactics of concentrated bombardment and limited objectives, had redeemed the situation inherited from Gough's ill-fated attacks on 31st July and throughout August. The entire plateau was in British hands and thus German artillery observation over the salient, which had made it a costly position to hold for two years, had been removed. It was at this point, however, that Haig again intervened in the strategic control of the campaign with results as disastrous as those that flowed from an earlier direction to pursue a breakthrough under Gough. Making what has been described as the "most lamentable decision of his lengthy - and sometimes distinguished - command", Haig overrode the advice of his army commanders and attempted to press on from the plateau and capture the Passchendaele Ridge. The Second and Fifth Armies made three futile attempts to move up the ridge, the battles of Belcapelle, 1st Passchendaele and 2nd Passchendaele. The reason these three assaults failed has never seriously been queried by any of the multitude of historians who have examined the Flanders campaign. The reason was that rain, which had begun on the afternoon of 4th October, was to continue almost without break until late November. The downpour rapidly turned the shell-churned soil of Flanders into a vast bog which made any movement difficult and dangerous, and artillery work impossible. The conditions endured by the gunners of the Royal Artillery are beyond the capacity of those who did not experience them to describe.
Rather it is best to allow the survivors to explain the major problems of artillery work in the sodden and disastrous attacks of late October and November. After 4th October, forward movement of guns or shells became almost impossible, as recalled by J.W. Naylor, an artillery officer who fought in the attacks.

"It is difficult to get across that it's a sea of mud, literally a sea. You can drown in it. On the day I reached my lowest ebb I'd gone down from the gun position to meet the ammunition wagon coming up the supply road... Oddly enough, it was a quiet afternoon but they must have seen some movement on the road because just as the wagon came up a heavy shell came over and burst very close. There were six horses pulling that wagon and they took fright at the explosion, veered right off the road and down they went into the mud. We had no possible way of getting them out. In any event, they sank so fast that we had no chance even to cut them loose from the heavy wagon. We formed a chain and stretched out our arms and managed to get the drivers off but the poor horses just sank faster and faster and drowned before our eyes. The wagon and horses disappeared in a matter of minutes. One of the drivers was absolutely incoherent with terror. It was the thought of drowning in that awful stuff. It's a horrible thought. Anyone would rather be shot and know nothing about it. That incident depressed me more than anything else in the war. I just felt "what the hell's the use of going on? I don't care a damn who wins this war." Well morale can't get much lower than that. It was a nightmare. I have it still."106

Gunner B.O. Stokes recalls the impossibility of firing an effective barrage under the appalling conditions of October and November. After struggling for twenty-four hours under constant harassing shell fire, Stokes' battery had advanced the 1,000 yards to its new position for the bombardment of Passchendaele Ridge.

"It was 5 o'clock in the evening before we got the new position and then we had to start getting the gun in. We only managed to get four guns out of our six gun battery forward - and most of our other batteries were in the same state or worse, which didn't make the prospects for the morning look too good."

Indeed, the morning attack did not go well. After a scattered and thin bombardment the assault troops were unable to cross the mud and slime to approach the German pill boxes on the ridge top. Men under the weight of full packs fell into shell craters and drowned.

"All the morning up until about 11am we fired according to plan, raising our range at certain intervals to coincide with the advance the boys were supposed to make. Imagine the set-back we had when we were told to lay back to our original range. We realised then that the boys hadn't really been
able to move forward at all. We had bad trouble firing the gun. Every time we fired a shot the trail would dig deep into the mud, so with every shot we had to try to lift it back and re-lay the gun before we could fire again. It was a nightmare."\textsuperscript{107}

The question that arises from these three assaults is not - why did they fail? That was evident. The harder question to answer is - why did they go ahead in the first place? It might seem that at the end of August when Haig had relegated Gough to a secondary role and placed Plumer in tactical control over the Flanders offensive, he had abandoned the idea of decisive breakthrough attacks. The fighting of October and November revealed that he had not, and that he was so far removed from the reality of the battlefield as to be completely unaware of the conditions which made artillery preparation impossible. The first suggestion, that despite the success of Plumer’s limited operations Haig still entertained grander designs, came even before the third of Plumer’s steps across the plateau. As Broodseinde was being assembled, Haig informed Plumer and Gough at a conference on 28th September that he regarded this as the last of limited operations and that after the successful occupation of the plateau the exploitation phase could begin. To this end he had the cavalry Corps moved up to the British lines. Haig claimed that “the enemy is tottering and that a good vigorous blow might lead to decisive results."\textsuperscript{108} Both Plumer and Gough responded by urging caution. The warnings clearly had no effect, as Rawlinson recorded in his diary after meeting with Plumer on the 6th of October. "He [Plumer] was in capital form and very pleased but had some difficulty in resisting the chief’s endeavour to push on further beyond the agreed objective."\textsuperscript{109}

Why Haig insisted on pushing ahead with the attacks on Passchendaele Ridge after the weather broke has never really been satisfactorily explained by the writers who have attempted to rationalize his decision. Edmonds claims that Haig was driven by the certain knowledge that “conditions on the enemy’s side were much worse.”\textsuperscript{110} But by attacking, Haig forced his infantry and artillery to attempt to move and re-position themselves in the bog the battlefield had become, a task that proved impossible. A telling insight into Haig’s thinking was however provided by Birch in one of his private letters to Edmonds.
Reviewing British strategy over the entire war, Birch claimed that the British, at the outset of the conflict on the Western Front, had "*copied French tactics, which were childish, and [then] swallowed the German idea that if you pushed and pushed men at defences you would eventually get there and win.*" 111 It was only in 1918 that "*The artillery problem was really understood.*" 112

The attacks of the Flanders campaign are not, as presented by many historians, an indictment of the "massed bombardment" tactics pursued by the British. The massed bombardment had, under certain conditions, produced what were admittedly slow and limited victories over the German defence, but victories nevertheless. The conditions that needed to apply were firstly a period of fine weather to allow aerial ranging and transport of guns and shells, secondly, an attack of limited depth to concentrate the fire of the guns, and finally an overwhelming concentration of guns to allow both the counter-battery and bombardment tasks to be completely effective. At Messines, Menin Road, Polygon Wood and Broodseinde, these conditions had applied and heavy defeats were inflicted on the Flanders defence. On 31st July and throughout August, two of the conditions had not been met. The weather had precluded aerial ranging and the length of front and depth of objectives had meant the concentration of guns was too low for the success of either counter-battery or the bombardment. In October and November on the Passchendaele Ridge, there were sufficient guns and narrow frontages but the appalling conditions meant that they could not get forward to fire the barrage or those that did could hardly get their rounds away.

The entire Flanders offensive launched by the British was based on the power of the British artillery to destroy the fundamental elements of the German defences, the wire, the machine-gun positions, and the German artillery. When carefully organized, and under the appropriate conditions, the British artillery repeatedly demonstrated that it could achieve these ends. The sheer horror and obvious waste of the last three attacks has, however, obliterated the memory of victories like Messines, or Menin Road. In fact, the name of the
very last attack, Passchendaele, has now come to represent the entire Flanders campaign.
The failure on Passchendaele Ridge was not a failure of tactics - no tactics could have
succeeded in the mud and slush brought by the November rains. It was a failure of
command, of Haig’s distance from battlefield intelligence, and his unshakeable optimism
regarding the state of his enemies. Over a quarter of a million British soldiers were
casualties of the Flanders offensive. The ground around the salient remains so thick with
metal that it is in places still impossible to plough or cultivate; a testimony to the greatest
artillery battles that have ever raged in the history of warfare. The last bombardments of the
Flanders campaign were fired on 10th November, as the Canadian Corps managed to
squelch up the ridge and hold a small piece of the higher ground. Further attacks were
called off as preparations for an attack further south, near Cambrai, were already well
advanced. Cambrai was to be a revolutionary battle in artillery tactics for, by using
techniques developed in the long, grinding barrages of Arras and Flanders, Byng’s Third
Army hoped to change artillery doctrine completely and return to the short, sharp, surprise
barrages of 1915.

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1 Noel Birch to Edmonds, 8 July 1930, Cab 45/132.
2 J.F.C. Fuller, Introduction to Wolff, op.cit., p.11.
3 For a detailed account of these arguments see P. Guinn, British Strategy and Politics
1914-1918 (London: Oxford University Press, 1965) chap. VI.
4 The entire preface of 1917 vol. III of the Official History is devoted to rebutting the
analysis of the Flanders campaign made by Lloyd George and Churchill.
5 The effect of the Flanders campaign on the morale of the British expeditionary force
is, of course, extremely difficult to quantify. Much anecdotal evidence has been
provided by works such as Lyn Macdonald’s They Called it Passchendaele.
Compelling evidence that the fighting did in fact change many soldiers’ views of
the war and the Generals can be found in the trench newspaper, the Wipers
volt II, Saturday 8th September, 1917 and the editorial and poems concerning
the weather.
6 WO 158/214.
7 G 352 dated 12th December 1916, WO 158/214.
8 Plumer, like all the other army commanders, received copies of the G.H.Q. artillery
notes in late 1916. That Plumer both studied them closely and used them as the
tactical basis of his attack is noted by Anstey, History of the Royal Artillery,
1159/12, Anstey Papers, p.160.
9 OAD 268, 6 January 1917, WO 100/58/38.
10 G 868, 30 January 1917, WO 100/58/38.
11 OAD 311, 9 February 1917, WO 100/58/38.
Memorandum by Operations Section, General Staff, G.H.Q., 14 February 1917.


See Wolff, op. cit., p. 118.

Birch’s influence on the planning of Messines is evident from the correspondence between him and Franks. See M.G.R.A., Second Army, WO 100/58/38. It is also noted by Anstey, History of the Royal Artillery, p. 160.

The Second Army’s assessment of German artillery strength is in Summary of Operations, WO 95/275, PRO; its accuracy verified by Der Weltkrieg, vol. XII, p. 454. The meeting was called by Haig to discuss the implication of the defence-in-depth strategy being adopted by the Germans, and revealed to the British in documents captured at Arre, WO 158/215.

Summary of Proceeding of a conference held at Pernes, 11 am, 30th May 1917, OAD 464, WO 85/275.

Ibid.


Summary of Operations, Second Army, WO 95/275.


Der Weltkrieg, vol. XII, pp. 450-5.


Ibid., Appendix IV, p. 413.

Ibid.


Jones, op. cit., vol. IV, p. 117.

Anstey, History of the Royal Artillery 1914-1918, Anstey Papers, 115/12, p. 165.

Ibid., p. 163.

Ibid.


Summary of reports received from Second Army, Machine Guns, WO/95/275.


Detailed accounts of Von Laffert’s attempts to minimize the impact of the Second Army’s bombardment, Der Weltkrieg, vol. XII, pp. 450-51.

Ibid.


Ibid.

Summary of Operations, Second Army, Reports, 7 June 1917, WO95/275.

Summary of Reports received, Second Army, 7 June 1917, WO95/275.

Lyn MacDonald, They Called it Passchendaele, p. 44.

Ibid., p. 45.

Summary of Operations, Second Army, 7 June 1917, WO95/275.

Figures from Second Army casualty returns, Operations, 7 June 1917, WO95/275, and accurately reproduced in the Official History.

Summary of Operations, Second Army, 7 June 1917, WO95/275.


This step-by-step overwhelming of the Gheuvel Plateau was what the German command anticipated the British would do. Prince Rupprecht believed that against a sequence of narrow frontage Messines-style assaults the position could not be held. He anticipated that his forces would have to make a general withdrawal to the Flanders line, a reserve line some miles back from the Plateau and Plickem Ridge. G 868, WO 100/58/38. Rupprecht, op. cit., 19th June 1917. p.225.

Ibid., p. 49. Summary of Operations, Second Army, for week ending 7th June, 1917, WO/95/275.


G 686, WO 100/58/38.


Gough’s response is also reproduced in full in the Official History 1917, vol. II, Appendix XVI, p. 440.

Ibid.

Fifth Army intelligence summaries for the week ending 7th July. These summaries are noted, and the failure of Fifth Army planning, in the Official History 1917, vol. II, p. 130. In fact, the entire thrust of Edmonds’ analysis of Pilckem Ridge is that Gough’s poor planning cost the British any chance of success in the battle. By blaming Gough, Edmonds hoped deflection to deflect the criticism from Haig, whom Edmonds considered to have been unfairly treated by Lloyd George and Churchill. See Travers, op.cit., chap. 8, ‘The Official History, the Somme and Planning of Passchendaele’, WO 95/275.


The complete failure of the Lens front is noted in Edmonds, Military Operations France and Belgium 1917, Vol. II, p. 116. But, he does not examine the question of why this failure did nothing to change Haig’s or Gough’s optimistic view of the British prospects for breakthrough victory.

The German force included Richthofen’s four-flight fighter circus, the elite of the German fighter force. Jones, op.cit., vol. 3, p. 141.

Der Weltkrieg, vol. XII, p. 448.

Ibid.

Gough himself acknowledged that it was "a mistake" to not conduct the entire campaign under Plumer’s Second Army command, in a letter written to Edmonds in the 40’s. The letter was one of a number in a bitter exchange between Gough and Edmonds, who, Gough believed, was heaping all the blame of 31st July onto the Fifth Army command. (18th March 1944, Cab45/140, PRO.) Travers examines the arguments over the writing of the Official History’s volume on the Flanders campaign. See Travers, op.cit., chap. 8, p. 203.

Jones, op.cit., vol. IV, p. 156.

Ibid. p. 157.


The issue of rainfall during the battle of Ypres became of such central importance in the debate between Lloyd George and Edmonds that both produced detailed rainfall and weather statistics. See Military Operations France and Belgium 1917, vol. II, pp. 211-12; also Lloyd George, op.cit., vol. IV, p. 2207. Both authors ignore the effect the rain had on aerial spotting and confine themselves to an almost absurd analysis of mud, whether its consistency could be best described as “treacle” or “cream-cheese”, and whether the Flanders region was a “bog”, “swamp” or “low lying fens”.


Edmonds, Military Operations France and Belgium 1917, vol. II, p. 136. Rawlins, Birch’s Chief of Staff, confirms that Birch believed the German guns to have been fatally weakened. Rawlins, History of the Development of British Artillery in France, MD 1162, RAI, p.144.


Edmonds, Military Operations France and Belgium 1917, vol. II. The Official History provides a detailed account of the breakup of II. Corps’ attempt to attack.
OB 1782/0, reproduced from Birch’s papers in Rawlins, History of the Development of the British Artillery in France 1914-1918, Rawlins Papers, MD 1162, p.144.

Lyn Macdonald, They Called it Passchendaele, p. 99.


Ibid.

Ibid. pp. 143-45. Rawlins gives an account of the Fifth Army firing on the 31st, although he attempts to absolve the artillery of any failings and blames infantry commanders for going too slow and not following communications procedures.


… Official History of New Zealand Division.


See Haig Diary, 31 July 1917, WO 256.


Ibid. p. 189.

Ibid. p. 205.

See Footnote 5.


Second Army Operations, 158/215.

Second Army instructions of 29th August 1917, General Principles on Which the Artillery Plan Will Be Drawn, Rawlins Papers, MD 1162.

Ibid.


Ibid. p. 277.

Der Weltkrieg, vol. XIII, p. 75.


Ibid.

Ammunition consumption from Appendix T2, Rawlins Papers, MD 1162.


DA. 19Z, Rawlins Papers, MD 1162.


Second Army, Summary of Operations, 4 October 1917, 158/215.

Der Weltkrieg, vol. XIII, p. 79.


Wilson, op.cit., p. 477.

Lyn Macdonald, They Called it Passchendaele, p. 188.

Ibid. p. 206.

Haig Diary, 28 September 1917, WO 256. The Conference, and Haig’s decision to go on, are examined in detail and defended by Edmonds, Military Operations France and Belgium 1917, vol. II, pp. 377-79.

Rawlinson Diary, 6 October 1917, Rawlinson Papers.


Birch to Edmonds, 8 July 1930.

Ibid.
"When I was seeking recruits for sound ranging, I had only to ask for a parade at the depot and say, 'Bachelors of Science, one step forward', to get a generous response of eager aspirants to some job in which their knowledge could be used."

Sir Lawrence Bragg, recalling the expansion of the sound-ranging sections of Royal Engineers in 1917.1
The significance of the tactical innovations introduced by the Third Army at Cambrai has never been underrated. It has, however, been long misunderstood. On 20th November, shortly after the last of the desperate attempts by the Canadians to clamber up Passchendaele Ridge had petered out, Byng’s Third Army launched a violent surprise attack on a relatively quiet section of front near Cambrai. The attack was unlike anything the Second or Fifth Armies had launched in their many assaults in Flanders, or indeed like anything the British had ever launched. The two profoundly novel aspects of the plan were firstly, that the artillery abandoned the long preparatory bombardment and counter-battery duel that had been the corner-stone of its tactical approach to every other attack it had launched in 1917, and secondly, that the tanks, which in their previous attacks had been spread out along attack frontages in small groups, were assembled in unprecedented numbers (470) to form an organized and armoured spearhead for the attacking infantry.

In their many works on the Great War, Liddell Hart, Fuller and Churchill present Cambrai not only as a crucial turning point in not only the World War but also as “one of the land-marks in the history of warfare, the dawn of a new epoch”. This epoch was that of the tank. These devotees of the new age either ignored the revolution in artillery tactics that accompanied the birth of armoured warfare or dismissed it as merely a by-product of the new tank tactics. The war is generally divided by these writers into two phases. Before Cambrai, the cavalry-dominated Staff blindly hammered the Germans with the attrition weapon of the long artillery bombardment. The Staff ignored the potential of the new weapon, the tank, throwing away lives for three years in bloody fiascos like the Somme and Flanders until, forced by repeated failures, they allowed the Tank Corps the opportunity to show their wares. That opportunity was Cambrai. The tanks won a great victory (their failure to achieve total breakthrough being ascribed to Staff officers’ tinkering with the tank men’s plans) and then in 1918 the British resumed the offensive, using Cambrai-style tank tactics and won the war in short order.
This is what Churchill meant when he made his oft-quoted claim concerning Cambrai.

"Accusing as I do without exception all the great Allied offensives of 1915, 1916 and 1917 as needless and wrongly conceived operations of infinite cost, I am bound to reply to the question, what else could be done? And I answer pointing at the battle of Cambrai. This could have been done." 5

The significance of the Cambrai revolution in tank warfare was not limited to the Great War; it was part of a wider picture of Britain's effort in both world wars. Liddell Hart, Fuller and Churchill all go on to point out that even though the British Army won the campaign of 1918 because of the advantage they held over the Germans in tank development, after the war the Regular Army had let that advantage slip away. The German Army, having learnt a bitter lesson in defeat, developed tanks and tank tactics and thus in 1940 it was the British and French Armies which were destroyed by a tank onslaught.6 The evident truth of these authors' claims concerning Britain's deficiencies in armoured weapons in 1940 has obscured the more dubious nature of their assertions about Cambrai and the offensive of 1918.

The reality of the victorious campaign of 1918 was that only one of the many attacks launched by the British was able to employ tanks on a mass scale as had been done at Cambrai, namely the battle of Amiens in August of 1918. The heavy casualties in the Tank Corps at Amiens and further losses in pursuit of the German Armies afterwards, meant that by the time the British Armies approached the great field fortress of the Hindenburg system their tank force had dwindled to fewer than 200 machines. They did, however, have an artillery force even more destructive and sophisticated than that available in the massive offensives of 1917. It was by employing the artillery tactics and techniques first demonstrated at Cambrai that the British were able to storm the Hindenburg line in a
sequence of surprise offensives late in 1918. In relation to the tactics of the Second World War, Cambrai is indeed the most significant battle of the Great War, for it was the birth place of the armoured strategy that dominated the European and African campaigns, but in relation to the victory of 1918, the most crucial aspect was not the Third Army’s use of tanks but how they used their guns. What Cambrai revealed was that the Royal Artillery could now achieve what it had failed to achieve in 1915, an accurate and destructive bombardment of the German defences that both suppressed the machine-gunners and silenced the German artillery, yet which could be prepared without German observation.

Why has this revolution in artillery techniques that made possible the surprise barrage, never held the historians’ attention in the way that the emergence of the tank has done? Perhaps part of the reason is that the development of unregistered fire was neither as simple nor as dramatic as that of the tank. Unregistered fire, map-shooting or slide-rule gunnery, as the artillery technique demonstrated at Cambrai has been variously called, emerged incrementally with improvements and innovations in the munitions used, the ranging techniques, and the effects of meteorology on gunnery. What these developments made possible by the Autumn of 1917 was the abandonment of preliminary ranging registration by an observer. To understand the significance of this breakthrough and the tactical flexibility it gave to the British forces, we must step back briefly to 1915, for the idea of short, surprise bombardment was not a new one. It had, in fact, been abandoned after the disaster of Aubers Ridge.

If we recall Aubers Ridge, the last major attack using short surprise barrages, the British had secretly brought their guns up to the line and registered each gun in sequence. The observers had watched as each gun, in turn, had fired a few rounds at its target, the observer calling back the corrections until the shells fell on target. To ensure that the Germans did not note any increase in shell fire, the number of ranging shots each day was
strictly limited, and thus even with the small artillery force available to the First Army at Aubers Ridge, registration took many days.\(^7\)

When, after the 45-minute bombardment, the British had launched their infantry at the defences, they found them barely affected by the brief and inaccurate shelling. The troops of the First Army were cut down in swathes, milling around uncut wire barriers while German machine-guns played up and down the line. It was this catastrophe that had caused the abandonment of surprise as a major consideration in artillery preparation, in favour of longer, methodical destruction of the defensive system. As with all matters concerning artillery, tactics and technology are inextricably intertwined. After Neuve Chapelle the Germans made such lavish use of wire in their defensive positions that long preparatory bombardments were the only course the Royal Artillery could take. As they lacked an effective graze fuse, wire-cutting had to be undertaken with the compromise 80/40, which rendered much of the fire useless. Wire-cutting in the later part of 1915 and all of the summer campaign of 1916 took days. If wire-cutting was to reveal the attack anyway, there was no point in attempting subterfuge with the other aspects of artillery preparation. The longer preparatory period was also of benefit to the British heavy artillery which, hampered by the lack of guns, unreliable Amatol explosive, and the lack of techniques for directing long-range fire, needed a great number of rounds to destroy targets allotted them. In the long bombardments that preceded Loos, the Somme, Arras, and the Flanders battles, there was no attempt to disguise preparations for these major assaults, and the artillery were able to use as many ranging shots as required, as ground-based and aerial observers attempted to direct them onto their targets.

The short barrage surprise attack was, however, not completely forgotten and, on 14th July on the Somme, one was attempted with some success, although in circumstances so unique it seemed impossible to draw any tactical lessons from it. The attack on 14th July
was able to proceed largely because the preparatory bombardment for the main attack had cut much of the wire along the frontage. Allenby had promoted the idea of a surprise hurricane bombardment at Arras but this had been over-ridden by Birch and G.H.Q., who feared a repetition of Aubers Ridge on a massive scale. It seemed that through 1916 and 1917 the strength of the German defences, the acres of barbed wire, the hundreds of machine-gun positions, and a multitude of defensive artillery batteries made successful attack without preliminary ranging of the artillery impossible.

But gradually, during the bitter campaigns of 1916 and 1917, the impediments to rapid, accurate and destructive bombardments were resolved. The development of the 106 fuse dramatically reduced the time and shells required to cut away wire protection. The development of reliable, high explosive shells increased the effectiveness of destructive fire against strong points. Most importantly, the consistency of the munitions combined with developments in ranging techniques made possible very accurate long-range fire without the impediment of relying on air-borne observers. It is important to remember that in every one of the major attacks launched by the British, even in Flanders with its vastly extended bombardments, much of the fire by heavy guns was blind, that is, not directed by an observer. If the weather was too bad for flying and a heavy battery’s forward observer unable to see his target, the gunners simply calculated their target’s position from the map, set their sights and blazed away. During 1917 the ranging services to the artillery provided by the Royal Engineers, and the greater consistency of the guns and munitions made this blind fire increasingly accurate. What Cambrai revealed was that the artillery was no longer dependent on visual ranging and registration at all, that firing blind without an observer the gunners could produce fire as accurate as that provided by observer-directed weapons. They had even found a method to range on to that most difficult of long-range targets, hostile German batteries, without the assistance of an airborne observer. At Cambrai the artillery demonstrated that its efficiency in wire-cutting and ranging techniques had developed to
such a point that the long preparatory bombardment could be entirely dispensed with. This made possible an attack in which all the elements of preparation, the concentration of guns and infantry, could be concealed from the Germans and thus achieve tactical surprise. With surprise came the end of the trench deadlock, for it brought an end to battles like Verdun, the Somme, or Flanders where the rival forces had simply drawn vast numbers of guns and men to a battlefield and attempted to hammer their way through the defence. With the short, surprise bombardment it became possible to hit the defence at some weak point in the line where no concentration of guns or counter-attack divisions awaited forward movement by the attackers. Thus Cambrai marks the tactical solution to the trench-locked warfare since 1914, although this ending would not become apparent until the spring of 1918.

The officer who realised that by late 1917 long preparatory bombardments could be abandoned was General H.H. Tudor, the C.R.A. of 9th Division. His interest in short hurricane bombardments was an enduring one. It was he who planned the surprise bombardment of 14th July 1916 on the Somme and this interest had begun because of his contact with a group outside the artillery, yet crucially bound up with the development of unregistered fire, the ranging sections of the R.E., or as they were later called, the survey battalions.

"My interest began in January 1916 when Comdt. Senior Officers School Third Army. At each course I asked the top men from GHQ to come and lecture." 8

One such lecture was from the sappers and Tudor was informed of their developments. After this experience Tudor suggested that the Fourth Army attack of 14th July 1916 should be conducted without a preliminary bombardment. 9 Tudor pointed out that the long preliminary bombardment before the attack of 1st July had destroyed much of the trench network and machine-gun positions. By spreading wire-cutting and limited registration over a few days prior to the attack, and using the survey battalions to range the rest, surprise
could be achieved. The sudden descent of the bombardment at dawn on the 14th did indeed catch the defenders unaware and some success was achieved. The circumstances of 14th July were, however, unique and it seemed that the sort of occasion which allowed the abandonment of registration would rarely arise again. The 14th July surprise bombardment had the advantage of following a long destructive shoot, and thus much of the bludgeoning of field defences had already been done and much of the German wire had been cut, which would seem to limit the occasions on which the technique could be used. A second problem was that after 14th July, and increasingly throughout 1917, the German defence made ever more lavish use of wire. On 14th July wire-cutting, which required great accuracy and direct observation, was discreetly carried out in the days before the assault. With the great bales of wire the German used afterwards, it was impossible to cut them without using hundreds of guns and thus impossible to disguise the cutting from the defence. The third problem was, as we have seen, that throughout 1916 and 1917 the German defence came to rely more and more on the fire of its heavy artillery. By mid-1917 counter-battery fire was, in fact, the most crucial, time-consuming and difficult of all of the tasks confronting the gunners preparing an assault. German gun positions were such small targets, so well camouflaged, and at such great range it seemed there could be no substitute for direct visual registrations by airborne observers. But during the summer of 1917 the field survey battalions had perfected their greatest triumph. They developed a device that allowed them to fix the position of an enemy gun and range the counter-battery guns upon it without visual observation. The same device also allowed British gunners to establish rapidly and exactly the muzzle-velocity of their own weapons, to calibrate them and thus give unparalleled accuracy, limiting the need for any sort of ranging at all. How the survey battalions had made this possible is one of the most significant yet unknown stories of Britain’s efforts on the Western Front. While the evolution of tanks and their role in Cambrai has been analysed and made famous, the development of predicted fire has been ignored or misunderstood. It is a story of the application of modern science and engineering to military
problems and the methods developed are still the basis of artillery work in armies around the world today.

As Tudor makes clear, unregistered fire was not simply a tactical breakthrough produced by his own innovative thinking but the product of a gradual development in artillery methods which began in 1915. Although a number of elements in the artillery, and engineers, made significant contributions to the techniques of unregistered fire, there can be no doubt that the crucial advances were made by the field survey battalions R.E. To fire an artillery piece at a target some miles away, without direct ranging, a battery commander needed a number of pieces of information. Firstly, he needed an accurate scale map which showed the exact position of his own gun and that of his target. With this he could establish the range of the target by simple measurement of the map. Secondly, he needed to know that his gun was actually pointed at the target and that he had its bearing. Thirdly, he needed to know the exact muzzle velocity of his own gun, for that told him how far his shell would fly at each of the settings on the sights. Lastly, he needed to know the barometric pressure and wind speeds for all the layers of the atmosphere through which the shell would travel, for these would affect the flight of the shell. The first three of these problems were solved by the field survey battalions, the last by the meteorological office of G.H.Q. It is important to realise that the developments and inventions created to solve these problems were not conscious attempts to make unregistered fire possible, but simply independent and unrelated developments to improve artillery accuracy. It was Tudor who realised that, if brought together and applied to an entire army’s artillery, they made surprise bombardment possible.

The field survey battalions of the Royal Engineers had been founded in the summer of 1915 as the British artillery after Aubers Ridge struggled to hit German defences hidden on the reverse slopes of ridges and heavily camouflaged, often without any observer able to
see the fall of shell. To assist the gunners, the "First ranging section" was formed, the precursor to the survey battalions. Their first and immediate task was to produce maps of the British positions on the Western Front and those of the German defences facing them. On these, British batteries could be fixed and therefore some, albeit crude, calculations of range to German targets could be made. To complete their maps of the British positions the Engineers simply applied pre-war civilian survey techniques, pacing out with theodolite and chain, as shells fell around them. The German half of the picture was completed by using aerial photographs. Each battery received its own map, or artillery board (so called because when the first maps were issued in 1915 it was found the damp shrank and distorted the maps, making them useless; after that they were stuck on firm zinc-covered 'board' to fix them - thus - artillery board - with its own position in the centre and estimated ranges to German targets marked. By 1916 the survey battalions had completed their mapping of British positions and German defences. Each battery, on arrival in a new position, would receive its board and thus establish its position in relation to various targets. During the preliminary bombardment at the Somme the survey men also developed a technique for ensuring that guns were on the correct bearing, lined up with their targets, the bearing picket.

The first bearing picket was used for a 15-inch gun employed in the long bombardment of the road systems behind German lines in June of 1916. The gun, mounted on a railway carriage, fired great distances, obviously beyond the range of ground-based observers to range. The gun was so slow in its firing rate, however, that an observer plane would be able to observe only a few rounds before having to fly back, and the range was so great that radio communication was difficult. What the engineers did was to provide an aiming point so that the gun was roughly lined up on its target when it opened fire and thus the observer plane would have fewer corrections to make. They did this by driving a picket into the ground at some point convenient to the gun. They then took a bearing on
some well-known landmark in the German lines, a church spire or equally distinctive target, whose exact map coordinates were known. The survey men then calculated the relationship between the gun and the picket with the gun aiming at the known target. To establish the position of other targets it was necessary only to measure off on the map the difference in bearing between the known target and the desired target and adjust the relationship of the gun to the picket accordingly. The bearing picket system, first used on the 15 inch monster on the Somme, was increasingly used for all super-heavy and heavy guns. It reduced the number of ranging shots required and, although it required great exactness in the surveying and fixing of the picket, it could produce great accuracy against fixed targets. As we have seen, throughout 1917 the most crucial of targets for the British artillery were not fixed like a road or railway line, but small, mobile and hidden German artillery batteries. It was in this area that the field survey battalions made their greatest breakthrough. Two sections of the battalion evolved methods for fixing the position of German batteries on the British artillery boards with great accuracy. One, the flash-spotters, simply applied survey techniques to visual ground based observation. The second, the sound-rangers, pursued an entirely different path. They developed a device that could establish the exact position of a German gun simply by measuring the sound of its report and then range the British gun onto the target. As an unexpected benefit, it was discovered that the same device could be used quickly and accurately to establish the muzzle velocity of the British guns. With these developments, surprise, unregistered bombardments became a possibility.

Flash-spotting was based on traditional artillery spotting techniques to which the survey men applied new methods. The survey men did not search the German lines for gun batteries however, they waited for the flash that would disclose even the most heavily camouflaged gun when it fired. As the gun flash from large calibre weapons is enormous, often leaping thirty to forty feet from the barrel, even guns hidden in shallow valleys were revealed by their flash. On seeing a flash, spotters in a number of locations would take a
bearing and estimate the range of the flash. At a central station the bearings and range estimates of a number of spotters would be compared and a map reference given. Clearly the technique required long experience, firstly in taking a bearing on a momentary flash and most importantly, in estimates of range. In 1916 it is evident that the flash-spotters, only just developing a pool of experienced observers, acquired a poor reputation for accuracy. Even John Innes, a devoted advocate of the spotters and rangers, admits that in 1916 "ignorant but enthusiastic hostile battery locators" did much harm to the spotters’ reputation.12 Perhaps that is why Birch, writing a staff memo on new ranging techniques early in 1917 advising battery commanders to make better use of the spotters’ services, stated that the information could now "be relied upon"13, indicating that during 1916 it was less than reliable.

Most of Birch’s memo was not, however, about flash-spotting but about another ranging technique that had, in March of 1917, just been perfected. This was sound-ranging which could fix the position of enemy guns, night or day, irrespective of mist or rain, and at ranges far beyond visual observation of the gun flash. It was indeed a remarkable breakthrough. The sound-ranging device solved, in one stroke, the remaining obstacle to unregistered fire, for it not only fixed the position of deep-set German heavy artillery batteries, but it also proved the key to calibrating British guns accurately.

During the summer of 1915 a second lieutenant of the horse artillery was seconded from his unit and taken to a meeting at M15 Headquarters in London.14 The lieutenant was Lawrence Bragg, a Cambridge scientist who, together with his father, was awarded the 1915 Nobel Prize in Physics for their pre-war researches. What Bragg was told was that both the French and German artilleries were experimenting with methods of fixing the location of hostile batteries by measuring their sound waves. He was to go to France, collect one of their ranging machines and begin developing it.
In October of 1915 Bragg was sent to Paris to collect the Bull sound-ranger, so-called because of its inventor, Lucien Bull. The principle behind the device was quite simple. Three microphones were spread out along a section of front and connected back to central station. As an enemy gun fired, the difference in time between the arrival of the sound wave at the various microphones could be used to calculate the hostile gun’s position.

While the principles may have been simple, the practice proved to be another matter. Bragg soon found that the microphones of Bull’s system were entirely inappropriate for recording the dull boom of artillery pieces. Most large-calibre guns of the German artillery had a muzzle velocity greater than the speed of sound. The sonic boom caused by the shell triggered the microphones and fixed, not the position of the hostile gun, but rather the point in the shell’s projectory where it hit supersonic speed. Attempts to solve this problem marked the point at which British and French researchers diverged. The French pursued a system that attempted to develop a formula for using the sonic boom to fix the gun’s position by using various complex calculations based on estimates of the German gun’s muzzle velocity. While the French developed this method to a high level during the remainder of the war, it was inherently inaccurate as there were often wide variations in the muzzle velocity of guns of the same calibre. Bragg’s team pursued a different path and attempted to develop a microphone that ignored the sonic boom and fixed the true gun report which arrived after it. Early in 1916 this was achieved with the Tucker microphone. The new device did not actually record the sound but the great wave of air that the low-frequency boom of the gun report pushed before it. The gust of air passed through tiny apertures cut in an ammunition box and cooled thin platinum wires through which an electrical current was passed. The cool air made a marked increase in the electrical resistance in the wire, which was recorded on a timing device, a phonic wheel, and marked on a 35-mm. film which slowly turned through the wheel. When the film was developed
and the mark of the sudden change in resistance found, an exact measure of the time of the gun's report was produced.\textsuperscript{16}

By further modifications and improvements in the Tucker microphones, Bragg was able to produce a system that not only gave the location of a hostile gun, but its calibre and the position of the target it was shooting at. After demonstrations at the G.H.Q. Staff, the sound-ranging sections were authorized to expand. This proved to be a slow process as much specialised equipment had to be produced - Tucker microphones, the calculating machines to assist operators comparing relative times, galvanometers and sundry other specialist items. Bragg recruited officers for this new force by addressing depot parades, "\textit{Bachelors of Science, one step forward}".\textsuperscript{17}

In March 1917 Birch issued a highly confidential Staff note to senior artillery officers. It noted that trials in the overseas school of artillery and experience in the Somme fighting had confirmed that the sound-ranging sections could fix on a map the position of a hostile gun \textit{"within 50 yards with one good observation and within 25 yards with a series of observations"}.\textsuperscript{18} The ranging device could also fix the position of British batteries' shell fall, thus making it \textit{"possible to range our guns by the differential method"}.\textsuperscript{19} Throughout the battles of Arras and the Flanders campaign, the fledgling sound-ranging produced ever more information to artillery intelligence. In the Third Army's preparation for its attack at Cambrai, the majority of hostile guns were placed by either the flash-spotters or the sound-ranging sections. The value of the sound-ranging device was most apparent when misty, rainy or foggy weather prevented flying. As the Third Army prepared its assault at Cambrai, the weather had indeed closed in and flying was only intermittent. The IV. Corps, preparing for their part in the attack, were able to locate 86 German guns opposed to them during the period of bad weather, from 1st November to the 16th. Only 4 of the hostile guns had been found by airborne observers but 32 had been fixed by the sound-ranging
sections and a further 29 by the flash-spotters. The artillery’s own forward observers had fixed 18 and army observers 3. In its preparations for Cambrai, over 70% of hostile guns spotted had been observed by the field survey companies, the flash-spotters or sound-rangers. Because the Cambrai bombardment was to be a surprise most of the hostile positions were simply logged on the artillery’s hostile battery boards, to be shelled when the attack was launched. But a few selected guns, those in a position to hamper the attack or those that were ranging on to British batteries, were destroyed with concentrated shoots directed by sound-rangers without visual observation. The accuracy of these salvos was enhanced by the fact that the Third Army’s guns were firing with unparalleled accuracy. For the first time, all the Third Army’s guns had been calibrated electronically, giving a precise measure of muzzle velocity. This electronic calibration had proved to be an unexpected spin-off from Bragg’s development of the sound-ranging device.

When Birch issued his Staff notes in March of 1917, he noted in his paper on the potential of sound-ranging that "it may be possible to utilize the sound-ranging apparatus to give muzzle velocities". Further trials in the overseas artillery school had developed a system in which guns could be rapidly put through a calibration school based on the electrical timing equipment from the sound-ranging device. Two wire screens were set up 100 yards apart and a current fed through them. The gun then fired a shell through the screens, breaking the electrical current, the time of which was recorded on the accurate timing devices of the sound-rangers. By comparing the difference in time between one screen and the other, the precise speed the shell had travelled across the 100 yards - and thus the muzzle velocity of the gun - was established. Prior to the arrival of electronic calibration the older methods had been slow and inaccurate. Batteries had to be withdrawn from the line, taken to vast artillery firing ranges, and fired through numerous salvos which were measured out with chains. The electric calibration could be done close behind battery positions. It required only one round from each gun and numerous calibration units could
operate simultaneously. Electric calibration was, in fact, as significant a breakthrough as sound-ranging. Shooting by the map - unregistered fire - required great consistency and predictability in range. Accurate location of hostile guns and accurate maps would be useless if a battery commander could not ensure that his guns flung their shells the correct distance to the target. Direct measurement of muzzle velocity gave this accuracy.

Having established his own position, his target's position, his bearing to the target, and the muzzle velocity of his guns, a battery commander required only one more piece of information to fire accurately without an observer. This information was not supplied by the survey men but by the meteorology office. As with so many of the techniques and methods of long-range and large-calibre gunnery the Royal Artillery were in a state of almost complete ignorance concerning the effects of meteorological conditions when the war broke out in 1914. In fact, a suggestion that the artillery should make some study of meteorology was made during the pre-war preparations was dismissed out of hand. Even in June 1915, when the R.F.C. offered the artillery the weather reports it had drawn up to assess flying conditions, Du Cane, then artillery c to G.H.Q., replied "we cannot make any use of this information". Du Cane, like the majority of artillery staff, still regarded direct visual ranging as the only method of obtaining accurate shooting.

The effects of this ignorance were amply demonstrated at Aubers Ridge where British guns carefully registered in cold, misty and still days, before the attack fired their rounds on the sunny and windy day of assault, and found that their registration had been useless. With the 'promotion' of Du Cane to a position in the Ministry of Munitions and Birch's appointment as artillery supremo at G.H.Q., the attitude to meteorological factors changed almost immediately. In March 1916 Major E. Gold of the Engineers issued a memo to the artillery staff, "Notes on meteor. conditions that affect gunnery". On 12th April a G.H.Q. meteor. service to artillery was established and twice daily a meteor.
telegram, giving barometric pressures and wind speeds at 2,000 and 4,000 feet was issued. It was, in fact, the testing program for sound-ranging that demonstrated just how crucial wind information was and how accurate and immediate it needed to be. With more accurate wind readings, taken immediately before firing, accuracy of shot improved by 50%.

In January 1917 the number of telegrams was increased to three a day with speeds given for six altitudes ranging from 200 to 10,000 feet. In March this was increased to six a day with even more information, so that a battery commander had a report every four hours.

During the long battles of the Flanders campaign the organization and effectiveness of artillery intelligence improved. All the services that made possible accurate unregistered bombardments were available to the gunners of the Second and Fifth Armies. Sound-ranging and flash-spotting units were attached to every artillery group, meteorological telegrams arrived at four-hourly intervals and rapid, accurate calibration was introduced. The quality and consistency of munitions was high and the artillery had an effective wire-cutting fuse in the 106. No surprise bombardments were ever attempted in the Flanders campaign, for the long buildup to the offensive and the sequence of assaults starting with Messines had drawn every available German gun battery and reserve division to Flanders. The concentration of guns by both sides had made tactical surprise and significant advances in either direction impossible. The whole point of surprise attacks was to strike where the enemy was least prepared and where the attackers did not face retaliation from a heavy concentration of defensive batteries, nor counter-attacks in well prepared and deep defences. After Messines the British were committed to the long bombardment approach in Flanders at least. But during the long and bitter campaign in Flanders, with bombardments that lasted for weeks and expended shells by the million, developments in two areas set fertile minds in the artillery and Tank Corps thinking about an entirely different approach to attacking the German field fortress. The first was in the Tank Corps where senior officers realized that even with the faster and more reliable tanks available to them in 1917, in battles like those
in Flanders there was little they could significantly contribute to the attack. The boggy ground and intensive defensive artillery fire had ensured that few tanks survived the crossing of no-man’s land. Once across they had demonstrated their ability to crush wire barriers and overrun machine-gun positions but spread out along the long frontages of the major Flanders attacks, vulnerable to the fire of German field guns and often unable to move on the shell-churned ground, their efforts had been lost in the maelstrom of this offensive. In the Tank Corps there were developed plans for an entirely different attack using tanks - an attack with no preparatory bombardment to tear up the soil or to bring hordes of German artillery batteries rushing to the battlefield.

While the Tank Corps were speculating about surprise attacks using tanks, similar radical thoughts were occurring to senior artillery officers, in particular to General H.H. Tudor, C.R.A. of the 9th Division. Tudor perceived that by using tanks and a bombardment of 106-fused 18-pdr.s., wire-cutting, which had previously been one of the artillery’s most time-consuming tasks, could be compressed into a few hours. Using survey techniques and sound-ranging, counter-battery fire could be prepared without days of preliminary ranging and registration. The last element that made short, sudden but extremely accurate artillery bombardment possible was one that Tudor himself perceived the significance of only in mid-1917. It was the use of smoke shells in great numbers to shroud an entire attack frontage at the moment of assault. This would serve to hamper German counter-attack co-ordination, blind the German artillery observers and give the attack force time to scramble through the wire that short barrage could not clear entirely. Thus in the summer of 1917 two plans were circulated around Third Army H.Q. concerning surprise attacks along the quiet frontage that the Third Army held well to the south of the Flanders battlefield. One was a plan from the Tank Corps for a deep tank raid on the German positions with no artillery support whatsoever but using a spearhead of massed tanks. The other was a plan from Tudor for an attack using an unregistered surprise bombardment and
tanks to launch a major surprise attack on the German positions. In the final plan developed by the Third Army crucial elements of both proposals are evident. The Third Army scheme did indeed use an unprecedented number of tanks, over four hundred, to spearhead the assault. But unlike the Tank Corps’ original proposal this tank attack was combined with a surprise bombardment. While the contribution of the Tank Corp to Cambrai has been long proclaimed by historians of the war, the equally crucial role of the artillery has remained largely neglected.

It has often been claimed that Cambrai was originally conceived by the far-sighted visionaries of the Tank Corps and J.F.C. Fuller, the Tank Corps’ Second-in-Command, in particular. Indeed Fuller repeatedly made the claim himself in his many published works on the battle. In his most detailed account in Tanks in the Great War, published in 1920, Fuller claimed that "It must be realized that both the St. Quentin and Cambrai projects... were the home product of the Tank Corps and they did not emanate from higher authority". The reason that it was important to Fuller that this be made clear was that the entire purpose of his work, indeed of most of his later works, was to demonstrate that the higher authorities of the British Army in the great war, the Staff of G.H.Q. and Army H.Q., were intransigent buffoons who had wilfully obstructed the Tank Corps’ plans and misused their weapons. Fuller bases his claim to be the original planner of Cambrai on a plan he submitted to G.H.Q. on 4th August 1917, but close examination of the scheme reveals that the attack it proposed bears little resemblance to the actual attack at Cambrai and that the claim for this being the prototype of that battle is unfounded. Fuller’s plan was for a large tank ‘raid’ without artillery or infantry support. The tanks were to dash into the German defences, attack some strong points, and retire. This raid’s purpose was as a "tactical demonstration with tanks so as to convince the General Staff of their power and value". Fire support would come, not from the artillery whom Fuller despised for their
adherence to long destructive barrages which had so churned the ground in Flanders that the tanks had bogged and many tank crews had been lost, but from low flying aircraft.29

There are a number of points to be made concerning Fuller’s claim that this 'tank raid' plan represents the original idea behind the actual Cambrai attack. The first is that the operation by the Third Army was not a raid, but a full scale attempt to take and hold a section of the German trenches, the high ground of Flesquières Ridge; indeed, the eventual plan called for a breakout beyond the ridge. A second point is that, as Fuller makes clear, Cambrai was not the only location he suggested that a tank demonstration could take place; he also drew up plans for a tank raid on the First Army front near the old battlefield of Neuve Chapelle. There was also a plan for a raid near St. Quentin. Fuller had drawn up proposals for his tank demonstration for all of the areas of British front that had not been fought over repeatedly, and had firm, well drained soil.30 It was, in fact, from the Third Army that the original plan for Cambrai emerged, although the proposed tank raid plans which were available to Third Army H.Q. may have proved some inspiration. In the plan that emerged from Third Army H.Q., and was finally approved on 13th October by G.H.Q., the tanks were merely one element in a large scale surprise attack that aimed to capture Flesquières Ridge and perhaps even break out towards Cambrai. One thousand guns would be required to provide a creeping barrage and counter-battery groups, but these (even the field guns) would all be prepared using the survey battalions, and thus all preliminary ranging could be dispensed with. This Third Army scheme was the actual precursor of Cambrai, the first use of the tactical methods of 1918, but it came not from the Tank Corps alone but from the artillery plan suggested by Tudor.

In Tudor’s own account of how he first considered the surprise attack at Cambrai, he makes no mention of even seeing Fuller’s tank raid plans. Tudor explains that he had favoured abandoning preliminary registration and thus launching surprise attacks since the
success of the 9th Division’s attack on 14th July 1916. "This heroic attack was successful and ever since, we of the 9th Division have been against warning the enemy by a preliminary bombardment". This was confirmed in Tudor’s mind when he used survey techniques to range four field artillery brigades during the battle of Arras. The brigades were so far forward "it would have been suicidal for these guns to fire at all before zero hour. Brilliant success proved the efficiency of the survey method".

By the spring of 1917, after Arras, Tudor was aware that guns could be ranged onto targets - even such difficult targets as hostile guns - without preliminary visual registration, but, the problem of the dense wire protection of the Hindenburg line positions remained. Tudor began to consider the methods that might be employed to breach the wire rapidly when his 9th Division were transferred to the Third Army’s front after Arras. What he observed there provided the final element that made the surprise bombardment a possibility. He saw 18-pdr. batteries near the Yorkshire bank laying down screens of smoke, using the new ammonium chloride smoke shells.

During the entire Somme campaign of the previous year, British artillery had been hampered by the smokeless burst of Amatol shells and the chronic shortage of aluminium and phosphorus which were used as additives to improve the visibility of the burst. In February of 1917 a new and plentiful additive was approved to replace aluminium, ammonium chloride. This not only solved the problems of visual ranging with Amatol shells, but also freed the limited supplies of aluminium and phosphorus to be used in special smoke shells. These had become available to the armies in increasing numbers throughout 1917. In the Flanders campaign both the Second and Fifth Armies had made some use of this new type of shell. In the Second Army, at Messines and later on the Plateau, smoke shells were combined with the creeping barrage to give the impression that a gas shelling was descending on defenders thus causing them to don their masks just as the infantry
The British assault troops, knowing the smoke to be just that, could fight free of the encumbrance of the mask. In the Fifth Army, smoke shells were used to smother machine-gun nests that the artillery were unable to silence with H.E., blinding them while an assault closed up. The screening potential of smoke shells was, however, not exploited to a significant degree by either of the armies in Flanders, perhaps because the pall of gas, smoke, and dust thrown up by the weeks of shelling that preceded the many attacks made visibility limited anyway. But on the Third Army front, which was very quiet except for raiding, Tudor saw smoke shells being employed differently. Here they were used to shroud an entire section of front where a raid was in progress, advancing in front of the raiding party like a creeping barrage. The smoke shells would first cover no-man’s land and then the objectives in a thick, if temporary, cover of smoke. It was after seeing this demonstrated at Yorkshire bank that Tudor drew up the plan for Cambrai. He was temporarily the senior artillery officer in the corps and used the opportunity to press his own scheme.

"Geddes, the corp CRA, having gone on leave, I moved into 19th corps HQ to do his job whilst he was away. This 4th corps’ front is looked upon as more or less a rest area. But I was very intent on my plan to make a mass attack with tanks as visualized by Churchill."

Tudor brought Hugo Du Pree, B.G.G.S. of Third Army H.Q., to the area.

"I said to him, 'you have a sitter on this front', and went over the plan with the aid of the map."

It is interesting to note that Tudor does not mention Fuller’s plan, but refers to Churchill’s enthusiasm for tanks. Tudor was a long-time friend of Churchill. When Churchill resigned in disgrace in November 1915, it was to Tudor’s 9th Division that he came. Denver Gibb, in With Winston Churchill at the Front, describes his famous C.O. as "a great friend of General Tudor", and it was to Tudor that Churchill returned when he visited the front again in 1918. As Churchill’s period of service in the 9th Division in late
1915 followed his work on the prototype tanks, it is possible that Tudor's interest in tanks and knowledge of their capacities may not have come from the Tank Corps at all but from his private conversations with Churchill. Thus Tudor had been exposed to the elements that made Cambrai possible by mid-1917. From his time as Officers' School Commander he knew the latest developments in sound-ranging, survey and calibration; from Churchill he knew of the tanks and their potential, and from his own observations in the Third Army he saw the capacity of smoke shells to be used to shroud a battlefield. It was shortly after the smoke demonstration that he drew up his scheme.

There were three novel and crucial elements to Tudor's plan. The first was that there was to be no preliminary registration by the artillery; they were to be locked onto their targets by the survey men of the Royal Engineers, even the large number of field gun batteries of 18-pdrs. Only the guns that had been in position before the buildup of artillery force were allowed to continue firing and while they were to be carefully used to destroy as many hostile batteries as possible, their fire was to be strictly limited to the standard battery allotments for rest areas. The second innovative aspect of the plan was the unprecedented use of smoke shells. One third of the creeping barrage was to be smoke and the fire of eighteen entire batteries of 18-pdrs. was exclusively devoted to covering and maintaining a smoke cloud over the entire battlefield for the duration of the assault. This smoke was necessary because of the third innovation of Tudor's plan - the tanks.

A large body of tanks, (Tudor gives no numbers), was to be drawn up secretly to the attack position. As the bombardment suddenly descended on the German positions and the smoke covered the field, the tanks were to advance under its cover and crush the wire which the brief passage of the creeping barrage would have left largely intact. Through the lanes, the infantry would advance and join the tanks in an assault on the German dugouts, machine-gun nests, and trench positions. The purpose of the smoke cover was to protect the
slow moving tanks from German artillery fire, to which they had proved very vulnerable during the attacks in Flanders. Travelling at one and a half to two miles an hour over broken ground, the tanks had taken longer to crawl across no-man’s land than had the infantry. Their unmistakable form, and the accompanying deafening roar of their engines, had tended to make them a target for every German artillery observer in the previous attacks in which they had been employed. They were vulnerable, not only to long-range fire directed by German observers, but also to the short-range direct fire from forward field guns that the Germans placed in their battle zones. These forward guns, usually 77-mm., remained silent during any buildup to assault in order to avoid British counter-battery fire. When the assault finally was launched, and if the field gun survived the creeping barrage, it could then open up at close range on the attacking force. Tanks were particularly vulnerable to these forward, silent field gun positions. When one of these forward guns opened up the infantry could, of course, dive for cover or attempt quickly to outflank the position. But tanks were too large to hide and too slow to run and during the Flanders attacks, when a tank had encountered a well-positioned forward field gun, it had almost always suffered direct hits. The smoke shroud of Tudor’s artillery plan would avoid this. In the opening of the attack, the vision of German observers on whom the defensive artillery were dependent would be obscured, but the British gunners, using pre-set ranges and bearings fixed by the field survey battalions, would be unaffected, the tanks free to spearhead the attack. After the tanks had led the infantry through the wire they were to join the infantry in a coordinated assault on all three sections of the Hindenburg line’s defences. After this point, Tudor’s plan was rather vague. The attack was to "swing to the left and roll up the German line as far as the River Scarpe, whilst the cavalry will protect their right and operate towards Cambrai". This was to be no mere raid but an attempt to create a decisive breakthrough. Thus Tudor’s proposal was far more ambitious than Fuller’s plan for a hit and run raid. Tudor hoped that at a minimum it would result in the capture of the Flesquières Ridge and perhaps even in a complete penetration of the German defences. He
thought that such results might be achieved by a relatively small attack, because the German resources were so heavily engaged in the fighting in Flanders.

Tudor’s 9th Division was transferred to Flanders, but before he left the Third Army area he was “told confidentially that the scheme had been approved by G.H.Q. for action at some future date”.38 Tudor went through the plan with Geddes to ensure that he understood the methods to be employed.

The "some future date" proved to be a long and crucial delay. The Flanders offensive consumed the entire offensive artillery resources of the British Armies and the Third Army plan was repeatedly postponed. On 13th October Haig gave his approval to the scheme but fixed no date. Preparations for the attack were to begin but the Flanders battles were to continue to receive priority in supplies and labour battalion allotments. It was only on 13th November, when the last of the Flanders offensives was being closed down, that the final authorisation came and a date for the attack was set - 20th November. Rather than being an attempt to exploit the heavy commitment of German reserves in Flanders, the Third Army plan was now viewed by G.H.Q. as an attempt to win some success on the Western Front after the failure of Flanders. By the time the Cambrai attack was launched the defenders had received significant reinforcing artillery as the Germans redistributed their guns after Flanders. Most crucially for the success of the attack, the élite Engreiffen divisions, which had spent the summer fighting in Flanders, had been withdrawn to rest positions ready to respond to any new threat to the German line.39

The disposition of the German reserves was, however, not one of the concerns of the Third Army planners as they had already drawn up the artillery instructions for the attack. In mid-October, when the instructions were being drawn up, the Flanders attacks were at their most ferocious and it seemed that Plumer was making good progress. The possibility
that a sudden, surprise assault at Cambrai might produce a deep, strategic advance unopposed by German reserves, seemed to Third Army Command a real one. The Third Army Staff's major problem was translating Tudor's idea of the sudden surprise artillery bombardment into the practical reality of an artillery preparation. The instructions Geddes issued and the techniques employed to mount the surprise barrage at Cambrai were to provide the basis for the artillery methods, not just of this attack, but of all British offensives in 1918.

The first and most crucial task was to survey in all the one thousand guns that were to be used in the attack. Many of these guns were not in the Third Army's zone when the surveying began; indeed, many did not arrive in their positions from Flanders until the night before the assault. The survey teams therefore marked out gun-pits with pegs and then drove in the bearing pickets and drew up artillery boards for the positions. Thus, as each of the guns in the reinforcing batteries drawn from other armies arrived, it would be guided to its pre-arranged battery position and have immediately available its targets, ranges, aiming points, and fire plan. Surveying in so many guns was an unprecedented task for the survey section. The bulk of it was completed by the 3rd field survey company, commanded by Major Keeling, but additional surveyors were drafted in from other companies to help complete the mapping. Even with the assistance of these reinforcements, the task was only just completed in time. With only two hours before zero, at 2 o'clock in the morning and working by the light of torches, Keeling completed the survey for the last gun position.

Before the reinforcing batteries were ushered into the positions prepared by the survey teams, they were first-run through field calibration schools, using the electronic screens and the sound-ranging timer. This was the first use of new methods of calibration in the field and the first time that all guns in an offensive had been calibrated before an assault. After each gun fired its round and its muzzle velocity was established, the M.V. was
painted on the barrel of the gun. Guns with similar M.V.'s were then grouped to reduce the amount of calculating each battery commander would have to do to establish the ranges of his pieces. After Cambrai, this became standard practice.42

During the three weeks prior to the attack, as surveying was being completed and the reinforcing artillery calibrated, sound-ranging sections of the Third Army were plotting the position of enemy guns around the ridge. As has been noted, many sources were used to provide information on hostile gun positions, flash-spotting, F.O.O.'s and aerial observers, but over 70% of guns were fixed by the sound-rangers, and the cloudy and misty weather in the days prior to the attack, while hampering visual sighting, provided the ideal environment for accurate sound-ranging.

By the night of 19th November the Third Army’s assault force had secretly assembled. Nineteen divisions in five corps had been allotted but only two Corps, the III. and IV. with eight of the divisions, were actually involved in the assault. Of the other Corps, V. with two divisions was held back as the army reserve and the other two, VII. and XVII., formed the flanks. The attack frontage was just over 10,000 yards along which the one thousand artillery pieces and eight attacking divisions had been discreetly spread. The concentration of guns was, of course, far less than in any of the Flanders attacks, with approximately only one gun every 10 yards on average. In Plumer's attacks on the Plateau, he had employed a heavy gun every 4 yards and an even greater number of field guns along the same frontage, increasing the concentration to one gun for every 2 yards of frontage. But, of course, in Flanders the artillery of Plumer’s Second Army had to face and overpower the artillery power of the Flanders defence, whereas at Cambrai the Third Army hoped to catch the defence unprepared and with little artillery support. Four hundred and seventy six tanks were discreetly assembled around the front, 216 with III. Corps and 108 with the IV. Corps. 36 fighting tanks were held in reserve and 97 were fitted out as supply
tanks, 9 of which carried radios. It was by far the largest number of tanks the British had employed in a single operation.

On the night of 19th November the entire assault force was assembled. The tanks and many of the gun batteries had been hidden in the small woods that dotted the British line, many in the largest wood, Havrincourt. Between 500 and 1,000 yards from the most advanced positions, the German defences held by divisions of Von der Marwitz’s Second Army were scanned by Third Army observers for any sign that the attack preparations had been revealed. Most of the attack frontage was held by the 54th Division which had just arrived from the fighting in Flanders and their structural defences were, like all the positions of the Hindenburg line, extensively developed. As this area had not been attacked since being built during the winter of 1916/17, the layout represented an ideal model of the defence-in-depth systems of the Hindenburg defences. There were three distinct zones of defence spread over 8,000 yards depth. There was a comparatively lightly held outpost zone, well wired and containing many strong points and machine-gun positions. Behind the outpost was the main battle zone, with major strong points and ruined villages which had been turned to defensive positions. Within the battle zone there were four wire barriers, each about 3 feet high and 12 yards deep. Behind the battle zone was the support zone, where most of the artillery were ensconced in well-wired pits that had the support of machine-gun positions prepared in case of withdrawal from the battle zone. All of these were interconnected by a maze of communication and fire trenches. But the constant drain on reserves consumed in the intensive fighting of 1917 had forced the Germans to strip the quiet sectors of their defensive line of infantry and artillery.

The attack frontage of the two corps of the Third Army was mainly held by 54th Division, although the flanks of its neighbouring Divisions, 20th and 9th reserve, were also included. The 54th artillery resources were meagre, 36 field guns and 21 heavies. Of the
21, however, 11 were captured pieces, French 12-cm. and Belgian 21-cm. howitzers. As these were supplied from a limited stockpile of captured ammunition, they could maintain only a brief barrage.\textsuperscript{44}

The end of the Flanders fighting and the redistribution of resources that followed had provided the German Second Army with some welcome reserves. The 107th Division, complete with field and heavy artillery, began arriving in the Cambrai positions on 19th November. During the 19th, German artillery observers reported unusual activity in the British lines and the 54th Division went on alert. The 107th, rather than relieving the Division next to the 54th, was placed behind it to act as a reserve.\textsuperscript{45} The preparation of Byng’s Third Army had therefore not caught the German defenders entirely unaware, but certainly unprepared. Only two divisions faced the two corps of Third Army, fewer than 100 guns opposed the Third Army’s 1,000 in the entire area of bombardment. The careful preparation of the attack, the concealment of tanks, the hours of surveying, of calibration and calculation were now to reap a great reward. At 6.20 the following morning, the dawn stillness was suddenly shattered by the sudden onslaught of the Third Army’s guns and the roar of 470 tanks. The scale, ferocity and speed, and surprise of the attack simply overwhelmed the defenders of the 54th Division.

At 6.20 am the Third Army’s artillery assault suddenly descended on German defensive positions. Its counter-battery groups fired an intensive neutralizing barrage at all of the German gun-pits in bombardment areas. They used a combination of gas and H.E. shells so that if the pits were not hit the enemy gunners would have to don their masks. The small force of defensive artillery was overwhelmed. Hostile fire during the initial advance was slight and scattered.\textsuperscript{46} The creeping barrage, one third smoke, one third H.E. and one third shrapnel, advanced 300 yards ahead of the tanks, shrouding the already mist-covered
batttlefield in an impenetrable smog. British infantry followed the tanks through the wire barriers and, with the tanks, stormed the strong points of the outpost and battle zones.

By mid-afternoon the German defence was in disarray and the Third Army had completed the greatest penetration by a British Army in a single attack so far in the war. Along the 6-mile frontage of III. and IV. Corps, the Germans had fallen back some 3 to 4 miles, and at the deepest point of penetration had abandoned all three zones of defence and withdrawn the surviving elements of their battalions to the Hindenburg reserve line, a half constructed trench line behind the Hindenburg positions. The 54th Division had been almost destroyed, losing 5,785 men killed or captured, and its entire complement of artillery. The camp commandant from the divisional depot, 3 officers and 30 men had fallen back to the reserve position on the St. Quentin Canal. Along a mile of front these were the only defenders available.47 The divisions on either side of the 54th fared little better and they too had fallen back, either clinging to strongholds in the artillery lines of the Hindenburg position or abandoning the old defences completely and, like the 54th, retreating to the half-built Hindenburg reserve line. German casualties probably exceeded 10,000 with 102 officers and 4,109 rankers prisoner. British losses were around 4,000.48

This great initial success did not, however, produce the much longed-for and anticipated breakthrough. Attempts by the Third Army to exploit their advance, by opening up into mobile cavalry-led warfare, simply demonstrated yet again that the modern battlefield was no place for horsemen and that infantry could not advance without artillery protection, even against disorganized defenders. From mid-morning the cavalry had begun receiving its orders to move forward through the gap in the German lines created by the near destruction of the 54th Division. It had taken until late in the afternoon for them to begin arriving at the head of the advance troops, after picking their way across the trenches and wire of the German defences. They advanced towards the canal, passing advancing infantry
and tanks on the way. The leading elements of the cavalry found they could not cross the
canal, however, since it was protected by the machine-guns of the surviving members of the
54th. Wire barriers, untouched by the tanks, were enough to halt the cavalry which, milling
around the obstructions, were easy targets for machine-gunners. The cavalry were ordered
back after heavy casualties, to await the securing of the canal-crossing by the infantry and
tanks.49

This failure of the cavalry to turn the advance into a rout was followed by the failure
of the infantry to advance beyond the Hindenburg lines into the reserve positions, even
though resistance was disorganized. The reason these attempts at exploitation failed was
that the two elements that had combined to make the infantry’s advance possible, tanks and
accurate artillery fire, had by the late afternoon been much weakened.

The course of the afternoon’s fighting had confirmed both the tank’s vulnerability to
close range field gun fire and its mechanical unreliability. In the assault, 179 of the 378
fighting tanks had been put out of action, 65 by artillery fire, 71 by breakdown.50 The
remaining tanks were also at the limit of their fuel load after an advance, in some places,
four miles deep and were forced to turn back to the British lines. The attack was also
beyond the effective range of the artillery. The 18-pdrs. and field guns had dropped out of
the creeping barrage and, while the heavier guns could strike the Hindenburg reserve lines,
they could not at that range, and without observation, cut the wire. Thus, when the leading
troops of the Third Army, late in the afternoon, approached the reserve positions they were
driven off. With but a handful of remaining tanks, with no smoke shroud, no creeping
barrage, and facing multiple wire barriers, the attacks petered out as night fell.51

It is perhaps not surprising that Haig and Byng decided that the attacks should be
pursued in the following days. It seemed that breakthrough was so close. None of the
repeated attempts to capture the canal crossings, however, or the subsequent attempts to capture Bourlon Wood achieved much success. The artillery were forced to resume wire-cutting and bombardment at great range, and the tank force had diminished rapidly because of casualties and breakdown. Surprise was, of course, now impossible and without time to survey in guns in their new forward positions, ranging was achieved by the older methods of ground-based F.O.O.s. But the major problem that faced these increasingly feeble attacks was the rapid arrival of German reinforcements as the Germans poured divisions into the Cambrai battlefield. Having realised by mid-morning on the 20th that the Cambrai assault was no mere raid, German strategic reserves were entrained to Cambrai within hours of the attack’s launch. By evening the 107th Division was moving in to support the survivors of 54th Division; the equivalent of three other divisions had arrived in the rear areas from flanking armies, and three more were entrained and close to Cambrai. By 25th November the Cambrai battlefront was protected by thirteen German divisions. Moser, the Arras Group Commander who had moved in to control the defence of Bourlon, described the Wood as "ringed with artillery fire". The divisions of Third Army were now in a salient of their own making, under constant German artillery fire and with casualties mounting with each assault. Faced with counter-attacks of increasing power and size with each attempt to move against the remainder of the Wood, the last attacks were called off on the 27th. The majority of Third Army’s divisions were crowded around the Wood in the north-eastern corner of the 9-mile wide, 4-mile deep salient and exhausted troops had little time to consolidate their positions in seven days of constant fighting. The line they occupied was, in fact, the mangled remains of old German positions; little wire had been erected, ammunition stockpiles were low, and communications confused. The Germans did not let this opportunity pass.

On the 30th the major counter-attack struck. Despite considerable evidence that the attack was to come from the southern flank of the salient, Byng had not deployed the bulk of
his forces away from the north around Bourlon, where the exhausted Third Army troops were attempting to press their attacks. This German assault recaptured many of the Hindenburg line positions that had been lost, in fact advancing beyond them in an attempt to trap the divisions of the Third Army around Bourlon. Only desperate fighting and considerable withdrawals allowed the Third Army to stem the German attack. As the British had done on the 20th, however, the Germans outran their artillery support and British machine-guns and field artillery were able to halt the now unprotected German assault troops. The advance, and evident strength of the German forces around Cambrai had, however, put British troops around Bourlon in an untenable position. On 4th December they began withdrawing from the ground won on the 20th and the days after. After fourteen days of high drama, of successful advances by both sides, (the greatest made on the Western Front since 1915), the antagonists had ended up roughly where they started. At the expense of over 45,000 casualties, the British had retained some territory in the north of the battlefield while the Germans, having also lost around 45,000 men, gained a few thousand yards in the south. "It was indeed a terribly disappointing day for us all", wrote Haig. It was perhaps an appropriate note on which to end that terrible and bloody year of 1917.

* * *

The British Armies on the Western Front had been almost continually on the offensive in 1917, from the spring offensive at Arras to the summer in Flanders and finally at Cambrai. At Arras, in twin attacks, they drew together a vast mass of artillery along a wide frontage of attack and attempted simply to pummel the German defences to submission over an extended bombardment period. In both of these attacks the objective was first to occupy the devastated remains of the defensive position and then "break through", advancing into undefended territory in a cavalry-led manoeuvre. In both cases the initial
stages proceeded as planned and the mangled remnants of the defences were occupied. What followed was not, however, the expected breakthrough, rather complete collapse. German reserves, alerted by the long bombardment, ringed the threatened areas. Since they had now progressed beyond the effective range of their own artillery, attempts by the British to advance against these reserves were futile. Further British reinforcements were matched by German forces in a rapidly escalating concentration of artillery and infantry on the battlefield. Significant movements by either side became impossible.

The next attack the British launched was of a different sort; at Messines the British attempted a more conservative approach to the long bombardment strategy. Again the attack plan was based on the artillery’s power to crush the elements of the defences, the artillery and machine-guns, but in this case the infantry were limited simply to occupying the area devastated by the artillery. The German reserves were then dealt with by the full power of the Second Army’s artillery and infantry when they attempted to recapture the ridge. This assault can only be regarded as a complete triumph. But in their next attack, Pilckem Ridge, under Gough, the Fifth Army pursued the tactics of Arras with deep objectives well beyond the effective range of its artillery. This attack failed even more completely than Arras, for the Fifth Army’s objectives were spread over such an area that even the vast bombardment that preceded the attack could not crush the defences adequately. On the II. Corps’ front the Fifth Army failed even to get into the German defences, and the other corps of the Fifth Army were repelled by counter-attacks.

The British then returned to the more conservative approach of Plumer and through September and October enjoyed some success. The success was, however, very limited with each major assault the British launched gaining less than a mile in territory, providing no opportunity for decisive strategic advances. Despite this, Haig pursued the offensive long after winter rains had made the work of the artillery, on whom the entire offensive
tactics of the British rested, impossible. The battle continued with a series of bloody but pointless attempts to advance up Passchendaele Ridge and then ground to a halt.

In a desperate attempt to gain some final success for the year the British launched one last and experimental attack. They abandoned the long preliminary bombardment strategy and pursued a surprise attack with deep strategic objectives, attempting to exploit new artillery and tank tactics. Through these new artillery methods and the use of massed tanks they won a greater initial victory than they had ever achieved before. The counter stroke by the Germans was, however, equally successful and both sides ended the year roughly where they began it.

Looked at as a whole, 1917 had seen the British try three different styles of assault against the German defences with three different styles of artillery preparation. They had tried long bombardments with deep strategic objectives for the infantry, Arras and Pilckem Ridge. Also tried were long bombardments followed by limited infantry advances, Messines and the three steps across the Gheluvelt Plateau; then at Cambrai different combination surprise bombardment and deep strategic objectives. The attempts at breakthrough penetration were all bitter disappointments with initial success at Arras and Cambrai followed by devastating ripostes in the form of major counter-attacks. Pilckem Ridge was even more frustrating as the British failed even to enter the central strong point of defence. The limited assaults, Messines and the Plateau, while they achieved their objectives and did not succumb to counter-attacks, seemed to provide little prospect of rapid victory. With each advance of only a mile or so, and each so slow and ponderously prepared that the Germans had ample time to build reserve defences behind the threatened position, the prospect that the method could be used to drive the German Armies from the territories they occupied was very distant. While German casualties were great, British casualties and material losses were also heavy. From that one would have to conclude that
despite the various tactical doctrines tried and the vast increase in the size and technical proficiency of the British artillery forces, they had failed to solve the problem of entrenched enemy defences. Yet the remarkable feature of this conclusion is that by the time the anniversary of Cambrai came around, 20th November 1918, the war was over and the Hindenburg line in ruins, smashed by a series of vast attacks by the Allied armies. Even the Siegfried Stellung, the strongest of the positions that had resisted every British attack for two years, had been sliced open by the Fourth Army, and in that series of attacks, the British Armies involved used no artillery doctrine or techniques that had not been tried in 1917. The artillery doctrine of 1918 was, in fact, an amalgamation of the tactics of the most successful elements of the experiences of 1917.

The most crucial of these lessons had been that provided by Cambrai, that preliminary ranging could be safely done away with and that the short, sharp, surprise barrage was far preferable to the longer, more destructive one. No preliminary bombardment used by the British in 1918 was longer than 48 hours, which was found to be long enough to maximize damage, yet not so long as to allow strategic reserves to arrive in the defence. The other great lesson of 1917 had been that taught by Plumer in Flanders, that an attack’s objectives needed to be limited to the effective range of the artillery. Once that was reached, the attack halted and consolidated. No major attacks in 1918 had the rather vague, unlimited objectives that had characterized Arras, Pilckem Ridge and Cambrai. Thus 1917, while it has correctly been characterized by British historians as a year of bitter disappointment and military failure, was not as barren in tactical innovation as most writers characterize it. But the year had not only seen those tactical developments, it had also seen a great technological revolution in the artillery, a revolution that had in fact made surprise barrages a practical proposition. In the year of 1917 the Royal Artillery had caught up with and then overtaken the German Armies in the techniques and technology of
heavy artillery warfare. It was these advances in gunnery that had made the tactical innovations demonstrated at Cambrai and used throughout 1918 possible.

If we compare the Royal Artillery on the Western Front at the end of 1917 to that at the end of 1916 it is evident that it had increased, not only in sheer size and destructive power, but also in proficiency and sophistication. When the Royal Artillery began the Somme campaign it had fewer than 150 heavy guns, a motley collection of obsolete weapons and improvised pieces. By the end of the year the number was still less than 300. By the end of 1917 the heavy artillery force was over 1,500 guns and all old and obsolete weapons had been weeded out. By this time contracts placed by the Ministry of Munitions in America in 1915 were being fulfilled. All heavy guns now had hydraulic recoil and minor design flaws had been ironed out. Spare parts, such as new barrels, springs and breech blocks were plentiful. Despite constant fighting and severe losses in the counter-battery duels of Flanders, gun supply continued to out-strip the rate of attrition by wear or damage at an ever-increasing rate. Given that the winter months would see a diminishing of wear and damage it was obvious that by the opening of the 1918 campaigning season the artillery would be considerably stronger than it had been even at the end of 1917, and that a large stockpile of guns and parts could now be accumulated.

The same situation applied to munitions. Despite the fact that fighting of 1917 had consumed a vast amount of ammunition - the preparatory bombardments for Arras, Messines and Pilckem Ridge had expended over ten million rounds - shell stockpiles at the end of 1917 were even larger than at the year’s start. Shell production now out-stripped consumption to such a degree that factories were being converted from shell production to spare parts for guns. The quality of shells produced was also far superior to those used in 1916. The first major attack of 1917 had seen the introduction of the first shells fused with the new generation of fuses, the most important being the 106 instantaneous. By the time of
Cambrai, 50% of heavy shells fired were fused with the 106, the remainder with the new delay fuse; the 4.5-howitzers alone fired 30,000 rounds of 106-fused shells. The new fuses and filling techniques of Amatol shells had dramatically reduced both duds and prematures. With the new fuses, blinds were reduced by September 1917 to less than 1% of shells fired and prematures to one in over 250,000 rounds. The re-introduction of pre-war inspection and testing standards had improved the consistency of shells arriving at the front; all were now measured and weighed and grouped according to their slight variation from standard. Any that varied by more than strictly followed guidelines were discarded. 1917 had also seen the variety of munitions available to the gunners improve. The development of a cheap smoke indicator for Amatol shells had at one stroke improved aerial ranging and freed the supplies of phosphorous to be used as specialized smoke shells. As we have seen, the surprise bombardment developed at Cambrai was utterly dependent on these, 93,000 of which were used. Gas shells had also become available in large numbers. In the latter part of 1916 the first generation of gas shells were available in small numbers, but by the time of Flanders, Plumer would expend over 100,000 at Messines and six weeks later the Fifth Army used a similar number at Pilckem Ridge. The real significance of Cambrai was that it revealed the tactical flexibility these improvements in the quality and diversity of munitions and methods of ranging and gunnery had made possible.

When news of the initial four-mile advance made on the first day of Cambrai reached England, Church bells were rung for a great victory. After the German counter-stroke ten days later, there were bitter recriminations in Parliament and Haig established a military Court of Inquiry to find scape-goats. Yet, despite the inquiries and questioning, since 1918 Cambrai has been used by critics of the Staff to berate Haig, not for his failure to anticipate the counter-attack and provide reserves, but for his failure to employ the tactics of Cambrai long before; thus Churchill’s statement quoted earlier:
"Accusing as I do without exception all the great Allied offensives of 1915, 1916 and 1917 as needless and wrongly conceived operations of infinite cost, I am bound to reply to the question, what else could be done? And I answer pointing at the battle of Cambrai. This could have been done."

For all its Churchillian ring, this is in fact an entirely nonsensical answer. What made the surprise attack at Cambrai possible, the unregistered yet accurate bombardment and the mass of tanks and neither of these was available to the British Army planners before mid-1917. It was only in the summer of 1917, after the Flanders attacks had begun, that a large force of tanks with crews was created. It was during that summer that the last elements that made unregistered bombardment possible came together, the sound-ranging device used to establish muzzle-velocity, the smoke and the gas shells. If Churchill is suggesting that without tanks or the artillery techniques of late 1917, the British should nevertheless have pursued surprise bombardment tactics, the events of Aubers Ridge prove him wrong and reveal why the British abandoned that approach. Further consideration of Churchill's statement reveals its full peculiarity. Cambrai can hardly be considered the most successful British attack of 1917, considering the appalling riposte that followed it. Why does Churchill not point to Messines rather than Cambrai? That would indeed be a telling and justified criticism of Haig. To understand why Churchill would make such an obviously absurd claim concerning Cambrai one must see it in the context in which those violent critics of the Staff, Churchill, Lloyd George, Liddell Hart and Fuller perceive 1917, the war on the Western Front and military history in general. The reason these historians all ascribe such crucial importance to Cambrai is simply because, as stated by Liddell Hart, "tanks were first used en masse", thus "pointing and paving the way to the victorious method of 1918 and to take a still longer view, it is seen to be one of the landmarks in the history of warfare, the dawn of a new epoch". The sun rose fully on this new age in 1939 for the tactics of Cambrai also "foreshadowed the methods that dominated the course of the second world war, particularly the opening stages that were so eventful".68

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Both of these claims by Liddell Hart are true, but there is an important consideration that he has failed to mention. 1918 was no blitzkrieg, for although massed tanks played an important role in one engagement, Amiens, their rapidly falling numbers meant that after that, they played an ever-decreasing role. The British Armies succeeded in smashing the Hindenburg systems in 1918 without a significant massed tank attack. What they did employ, however, was what Liddell Hart so assiduously ignores, new artillery methods. Thus Cambrai did indeed "point and pave the way" to the tactics of 1918, not in terms of a tank-led blitzkrieg, but in terms of new and revolutionary artillery tactics. This is not, however, to deny the truth of Liddell Hart’s second claim, that Cambrai did indeed "foreshadow" the blitzkrieg tactics of 1934 and 1940. The Germans, during their rearmament of the 1930’s, made no secret of their close study of British tank tactics and of Fuller’s work in particular. If one recalls the original plan for the tank ‘raid’ originally drawn up by Fuller before Tudor’s plan for a major attack was developed, one can perceive the germ of the ideas that grew to be blitzkrieg. In that original raid plan Fuller had dispensed with any artillery support at all, instead counter-battery, bombardment, and close support bombing was to be conducted by the R.F.C. This was in 1917, and indeed throughout 1918, an impractical idea, for the bombers of that period had neither the accuracy nor bomb-load to carry out those tasks. Throughout 1918 ever-increasing use was made of aerial bombing, but in counter-battery fire and the destruction of the fortified strong points of the Hindenburg line it could not replace accurate and heavy shell fire from the guns. By 1939 the Germans had developed the air power to carry out all of the destructive tasks required, stuka dive bombers for tactical battlefield support with great accuracy, and heavy bombers to attack defences and disrupt communications.

The ignorance of the Staff critics of the changing nature of artillery tactics on the Western Front is never more apparent than in their analysis of Cambrai. Fuller dismisses the developments in the Royal Artillery in 1917 as mere "artillery competition which was
more or less mutual, stagnation [which] became still more complete". The arguments between Haig and his army commanders over artillery tactics, the emergence of counter-battery as the artillery’s most important task, sound-ranging, electronic calibration, the possibility of surprise barrages, are all dismissed as stagnation. Yet, in the great Allied offensive that began on 8th August, 1918 and ended with the armistice in November, it was not Fuller’s beloved Tank Corps that led the British Armies through the Hindenburg defences that had foiled them so many times before, it was the Royal Artillery. The bitter lessons of 1917, learnt at Arras, Flanders and Cambrai, had forced the development of the tactics, techniques and artillery methods that would, in 1918, allow the British to prise the German defenders from their fortified positions permanently.

3 See Fuller, Tanks in the Great War, p. 153. Fuller states that the Tank Corps, a body of only 4,000 men had “replaced the artillery wire cutting and rendered unnecessary the old preliminary bombardment.”
4 Liddell Hart explains that the Cambrai assault’s only hold up was on the front of the 51st Division, because of the intransigence of the commander, Harper, who Liddell Hart claims “had resisted the development of machine guns and now was equally sceptical of tanks.” History of the First World War, p. 344. Harper is the villain of the piece in most of the tank devotees’ many histories of Cambrai.
6 Liddell Hart describes Cambrai as: “The battle that foreshadowed the methods that dominated the course of the second world war, particularly the opening stages that were so eventful”. Introduction, R. Woolcombe, The First Tank Battle: Cambrai 1917 (London: Barker, 1967).
7 See chap. 1 of this work.
8 Tudor, The Fog of War, Tudor Papers, p. 32.
9 Ibid.
10 Despite the almost universal acknowledgement that the Great War was a “sappers war”, the various sections of the Royal Engineers received scant attention in the official and unofficial histories of the Western Front. One of the few accounts of
survey battalions and histories of the developments of the battalions sections, such as the "Maps", "Topographical", "ranging" and other is in Innes, op.cit.

11  Ibid. p. 23.
12  Ibid. p. 21. One of the most prominent failures of the fledgling ranging sections had followed Charteris' (Chief of Intelligence, G.H.Q.) claim on 13th July 1916, that the field survey sections had located 60% of the German guns. Subsequent German defensive barrages showed the German fire to be undiminished. Charteris to Macdonogh, 13th July 1916, WO 158/897.
13  General Staff Memo, March 1917, Sound Ranging, WO 33/831.
14  An undated monograph on his own part in the development of sound-ranging was written by Bragg and included as Annex L in History of the Royal Artillery 1914-1918, Anstey Papers, 1159/12.
15  Ibid.
16  This is, evidently, a crude account of the complex machine’s workings. The problems of timing, instant film development, the muffling of extraneous gun reports, were all crucial problems that Bragg’s team slowly overcame in 1916 through trial and error.
18  Birch, G.S. Memo, Sound Ranging, WO 33/831.
19  Ibid.
20  IV. Corps Summary: Counter-Batteries, IV. Corps, from 12 noon 31st October 1917 to 12 noon 16th November 1917, WO 95/731.
21  Ibid.
22  Birch, G.S. Memo, Sound Ranging, WO 33/831.
23  For a history of the introduction of calibration using the timing mechanism from the sound rangers see R.H. Chapman, Calibration of Guns and Howitzers by the Direct Measure of Muzzle Velocity, R. H. Chapman Papers, OGENC46 RS, 1922, Barr Smith Library, Adelaide University. Chapman was an Engineer officer who was involved in the establishment of the calibration rangers. The paper was a report requested by the Australian Government to outline the state of calibration technology in 1918, in case of future eventualities.
24  Du Cane, quoted in Anstey, History of the Royal Artillery, Appendix IX.
25  G.S. Notes on Meteor. Conditions that Affect Gunnery, reproduced in Anstey, History of the Royal Artillery, Appendix IX.
26  G.S. Notes, Sound Ranging, WO 33/831, p.7.
27  J.F.C. Fuller, Tanks in the Great War, p. 139.
29  Fuller gives an outline of the tank raid plan in Tanks in the Great War, pp. 136-8 and the tactical thinking behind it. The original Tank Corps papers are held in Cab. 45/200.
30  Various Tank Corps offensive plans, Cab. 45/200.
31  H.H. Tudor The Fog of War, p. 31.
32  Ibid.
34  Tudor, The Fog of War, Tudor Papers, p.27.
35  Ibid.
37  Tudor, The Fog of War, p. 28.
38  Ibid. p. 29.
39  Introduction, Der Weltkrieg, vol. XIII.
40  Heavy Artillery, IV. Corps, Instructions No. 32, 16th November 1917, WO 95/731.
Ibid.
Reports on the nature of the German defences and 54th Division's resources, G.H.Q. Intelligence Summary, 3rd December 1917, WO 157/26.
The G.O.C.R.A. IV. Corps in his report to Corps H.Q. at noon reported, "Hostile artillery activities were very slight and did very little damage." 20th November 1917, WO 95/724. The reports of the G.O.C.R.A. III. Corps also report little German defensive fire in the morning, 20th November 1917, Noon report, WO 95/612.
Ibid.
Summary of Operation, Third Army, III. and IV. Corps, Appendix F, Third Army General Staff War Diary, 20th November 1917, WO 95/367.
Tank Corps, Reports on Operations, 20th November 1917, WO 158/431. Of the 65 direct hits, 28 were inflicted on but two battalions, D and E operating with the 51st Division at Flesquières. The destruction of tanks at Flesquières has since 1917 developed something of a mythology. After the war, Fuller promoted the idea that this hold-up prevented the Tank Corps from carrying out a breakthrough attack on the German defence. He blames this, rather mysteriously, on General Harper, commander of 51st Division, an officer who apparently did not take to tanks and instead adopted his own pattern of attack for them rather than the one outlined by the Tank Corps. The reality was that the hold-up of tanks at Flesquières was not a product of Harper's tinkering with the Tank Corps plan but because Flesquières was the strong point of the most deadly weapon to the tank, a battery of 77-mm. guns in forward, silent positions. The only forward battery of the defensive position was that of the 108 field artillery Regiment. They avoided the fire of the counter-battery assault by remaining silent up to the point of attack. Their position was deep enough, such that the smoke shroud was beginning to thin as the tanks approached; firing over open sights at close range they destroyed tank after tank. The hold up was a product not of Harper's intransigence, but of the fundamental weakness of the slow moving tanks to field gun fire. One can just imagine the havoc the German field artillery would have created if Fuller's original plan, for a tank attack with no artillery support or smoke screen, had gone ahead. Flesquières would have been repeated up and down the line.
Summary of Operations, Third Army, III. and IV. Corps, Appendix F, Third Army General Staff War Diary, 20th November 1917, WO 95/367.
Lessons from recent operations, Field survey companies, Third Army, November 1917, WO 158/316.
Ibid.
Report on artillery arrangements, 29th and 30th November 1917, WO 95/692.
Disposition Reports, R.A., 29th and 30th November 1917, WO 95/692.
General Staff, War Diary, Third Army, 30th November 1917, WO 95/365.
Ibid. 3rd and 4th December, 1917.
A review of the many minor design changes made in the whole range of artillery pieces used by the British during 1917 is contained in the History of the Ministry of Munitions vol. X, chap. 4. First, improvements were introduced in the pistons of the recoil systems. In 18-pdrs. a new split ring piston was developed which improved smoothness of fire. In the heavier guns, a new floating piston was introduced. Secondly, new firing mechanisms were also introduced in most calibres of guns. New stronger breech rings were also introduced.

The crucial turning point in inspection standards came after the Somme in 1916. Revelations concerning the number of duds and premature forced the Ministry to take over inspection from War Office officials and to establish the Ministry's own Department of Inspection. Although it took until the end of 1916 to get the new department manned and equipped, by 1917 it had created a system to test all the shells being produced.
CHAPTER SEVEN

THE END GAME: 1918

The German offensive and British counter-attack at Amiens

"Begin with defence, end with offence. A quick powerful changeover to the attack - the lightning stroke of retaliation - that is the most brilliant act of the defence."

Clausewitz

"The calibration hut, ...became one of the show spots to which visitors to Corps were taken, to be overawed by the scientific methods of our gunners".

Monash - Australian Corps Commander, recalling preparations for Amiens.
Perhaps the greatest irony concerning the events of that extraordinary year of 1918, is that it began with the German armies on the Western Front surpassing the combined rifle-strength of the Allies for the first time since 1914 and ended with the complete triumph of the Allied armies in the west. It is clear that at the time, none of the rival Governments was prepared for, or anticipated what was to unfold during the spring and summer. In the first months of the fourth year on the Western Front the political and military leaders in Germany were planning not for defeat, or even stubborn defence, the policy rigorously pursued since Verdun, they were planning for victory, total victory through a vast offensive on the Western Front. The Governments in London and Paris were now determined to restrict their Generals to a defensive strategy on the Western Front in 1918. As late as July 1918, the British Military Policy 1918-1919, drawn up by Sir Henry Wilson, considered that a decisive Allied offensive on the Western Front would not be possible until 1919; indeed it suggested that a final campaign in the summer of 1920 might be needed.1

The possibility that a mere five months after the writing of that memo, the Hindenburg Line would be in ruins and abandoned, as the German armies trudged home in defeat, watched over by exhausted but jubilant Allied troops, seemed not worth considering. Yet this is what transpired. In an offensive that began on 8th August and ended a mere one hundred days later, the Allied armies achieved what had proved beyond them in their repeated attacks since the trenches of the Western Front were dug in the winter of 1914. They smashed open the German defences and forced the German armies into a retreat from which there could be no recovering. The defeat was so sudden, so complete and so unexpected that historians, and indeed whole nations, struggled to come to terms with it.

In the twenties and thirties the belief arose in Germany, encouraged by the Nazis, that the collapse was the product of a conspiracy of liberals, socialists and financiers in the government - the stab in the back. Among British historians, generally critical of
Haig’s conduct of the war, the struggle is to explain how the instigator of the Somme and Passchendaele could also be responsible for the advance to victory in 1918. To reconcile these, authors like Liddell Hart and Fuller have claimed that Haig was not the real instigator of the British Army’s advance in 1918 but that Foch, appointed Allied Generalissimo in the middle of the year, was the guiding light. They also agree with German analysts not only that it was Germany’s internal political and economic difficulties that brought her armies to their knees, but that victories in the near east, for example Allenby’s in Megiddo, were crucial in bringing about German surrender.

However, the most influential argument they have produced in the attempt to reconcile Haig the butcher of Passchendaele with Haig the victor of 1918 is the claim that such limited victories as the British armies won in 1918 were due to the use of the tank. The tank, these writers claim, was actively opposed by the hidebound staff. "Let it be said of those on the general staff opposed to the tank, that if they had not the ingenuity to devise means of beating the Germans, they were fertile in devices to beat the sponsors of the tank".

But

"...happily the younger regular soldiers who had taken charge of the tanks at the front had overcome their first doubts and, realising the stupidity of Passchendaele, fought for the chance to give the tanks a fair trial".

This was of course Cambrai. "1917 was the year of unification, so 1918 proved the year of triumph." "The numbers manufactured under the reduced programme of 1917, sufficed to bring victory."4

1918 was indeed a year of triumph for the British Army, but not a triumph exclusively created by the Tank Corps and the tanks’ ardent advocates. The reality is that within four days of the opening of the hundred-day offensive, the majority of the Tanks Corps’ machines were disabled. The rest of the campaign, including the great victories in breaking the Hindenburg Line, were accomplished without major tank assaults. What the British Army did have in late 1918 was an artillery force of
unprecedented power and flexibility. The ammunition factories built in 1915 and 1916 were in full production and the contracts placed in America and Canada were finally being fulfilled. While British rifle strength in 1918 never actually reached the full complement for all its divisions, nor was Britain able in 1918 to create a general reserve of new Infantry divisions to launch an attack after the terrible losses of 1916 and 1917, the artillery of her armies was at greater strength than ever before. It was through the correct application of this artillery power to the rapidly changing circumstances of 1918 that the British armies on the Western Front were able to win the remarkable, and world-changing battles of the hundred-day offensive.

During 1917 events were unfolding in Washington and Moscow that would have a profound effect on the Western Front in 1918. In March, some three weeks before the British launched the first of their 1917 offensives - Arras - the full seriousness of the situation in Russia was revealed to the other allies by the abdication of the Tsar. By May the prospect that a Russian Government would sign a separate peace with Germany was real enough for the British War Cabinet to consider what the implications of such a peace on the balance of power on the Western Front would be. The Cabinet's worst fears were realised after the complete failure of the Kerensky offensive, and the triumph of the Bolsheviks. The truce of Focsani on 9th December ended formal hostilities on the Eastern Front, and freed the German divisions that had been employed there to be transferred to the Western Front. Even before the treaty, the evident weakening of Russia's resolve to continue fighting had led to German divisions transferring from east to west across Germany. Despite the great strain and casualties caused by the later stages of Flanders and then by Cambrai, the number of German divisions on the Western Front actually rose during November and December of 1917, from 150 to 171. After the Treaty of Focsani the figure rose dramatically, so that by March 1918 and the beginning of the fine weather, the German armies in the west had 192 divisions under their command. The number of Allied divisions on the Western Front fell from 176 to 169 during this period.
There was however a light at the end of this tunnel of ever-diminishing Allied divisions in the arrival of the first American troops in France. Since April the USA had been officially at war with Germany and prospects of a vast American army numbering millions of men arriving on the Western Front was now a major consideration in the deliberations of the German and Allied Commands. The prospect was, however, not an immediate one, for the U.S. had only two divisions of regular soldiers and two divisions of National Guardsmen that could be sent to France. The rest would have to be raised, trained and equipped before American forces could exert a decisive influence on the struggles on the Western Front. The German Command was presented with what in modern military parlance might be called a 'window of opportunity'. In the spring and summer of 1918, the Germans would have, for the first time since 1914, a superiority in absolute numbers on the Western Front in guns and men. The superiority would never be great and would constantly diminish as the year progressed and more Americans arrived, but it was an opportunity the German Command would not pass up. The result was 'Die Kaiserschlacht', a vast sequence of offensives launched by Ludendorff which aimed at nothing less than the separation of the French and British armies, and the driving of the latter into the sea. For the first time on the Western Front since the spring of 1915 the Royal Artillery were faced with a searching examination of their defensive arrangements.

There are two points that arose from the period of the great German offensive that require examination. The first concerns the nature of the offensive artillery tactics employed by the Germans in their spring attack and the relative sophistication of those tactics compared with those employed by the British throughout 1917. The second area concerns the Royal Artillery’s defensive arrangements and how, instead of relying on their own limited experience of defensive battles, the artillery, indeed the entire British Command, chose instead to mimic the tactics of their enemy.
Comparisons between the offensive tactics of German and British armies on the Western Front are complicated by the small number of offensives launched by the Germans, compared with the almost continuous offensives launched by the British from 1915. If we discount the two German attacks whose tactics were determined by unique and unrepeatable circumstances, the attack on Ypres in 1915 where the tactics of surprise were determined by the use of gas for the first time, and the spoiling attack at Nieuport on 10th July 1917 whose arrangement was determined by proximity to the coast and the tides, we are left with but two major German offensives to examine - Verdun in 1916 and the Kaiserschlacht in 1918. It is clear that at Verdun German artillery tactics were the same as those employed by the British at the Somme and throughout most of 1917. The German barrages were long, there was no attempt at disguise, and the entire offensive philosophy rested on a belief that given enough time heavy artillery could render a fortified zone uninhabitable.8

At Verdun Falkenhayn attempted to bring the French Army under the hammer of the German heavy artillery so that "the forces of France will bleed to death."9 The French responded by drawing more and more reserves to Verdun, and replying to German artillery power with ever heavier and longer defensive bombardments. The Germans found themselves bleeding as much as the French, as each limited advance brought thunderous concentrated bombardments and vast casualties on both sides. It was in many ways a battle similar to the Somme in 1916, though at Verdun the Germans were demonstrating a heavy artillery power and organisation far superior to Britain’s in 1916, as the disaster on 1st July demonstrated. During 1917 the German armies maintained a rigorous defence in the west, but it is clear that experience in the east had considerably modified their offensive artillery tactics by 1918. The barrage employed by the Germans to launch their spring offensive in March 1918 was similar to that used by the British at Cambrai in that it was brief, lasting only five hours before the attacks were launched, and was in some parts prepared as a surprise attack without preliminary registration.10 This surprise bombardment was arranged by Oberst George Bruchmüller,
Ludendorff’s artillery adviser. Bruchmüller had first experimented with the techniques of unregistered fire and short surprise bombardments on the Eastern Front at Riga, some months before Cambrai. This has led historians since, including Edmonds in the Official History, to credit Bruchmüller and the Germans with initiating the change from long destructive to short surprise barrages.11

A number of points need to be made concerning this claim. The first is that the tactics of Riga can hardly be compared to those employed in Western Front battles. The Russians at Riga had no barbed wire, no trenches, and hardly any artillery. The major challenges facing the artillery on the Western Front when attempting short barrages, namely counter-battery and wire-cutting, were entirely absent at Riga. The surprise bombardment by the British at Cambrai was more complex, more technically demanding, and vastly more destructive than Bruchmüller’s at Riga. When Bruchmüller arrived on the Western Front some months after Riga he did not believe it possible for the German artillery to employ surprise tactics on the gun-choked battlefields of France and Flanders.12 The events that changed Bruchmüller’s mind occurred in January 1918. Shortly after arriving from the east, General Von Kohl, Rupprecht’s Chief of Staff, related to Bruchmüller the effect of the surprise bombardment used by the British at Cambrai. The accuracy of the British guns in counter-battery fire without visual registration led Bruchmüller to charge the Artillerie-Prufungs-Kommision (Artillery Experimental Committee) with investigating methods of unregistered fire. This committee instituted a number of changes in February of 1918, which made unregistered fire by the German artillery on the Western Front a genuine possibility. The most important of their innovations was the creation of a meteorological service, daily meteor. telegrams, and a vast increase in the number of sound-ranging units.13

When the German artillery fired its surprise barrage in the March offensive it attempted to employ, on a vast scale, artillery tactics used by the British at Cambrai. Along a frontage of over 50 miles Bruchmüller massed over 50% of the artillery
available to the German armies in the west, almost six and a half thousand guns, two and a half thousand of which were heavies. On 21st March these guns fired an intensive bombardment of over a million shells in a mere five hours into the defences of the Fifth and Third Armies. The short barrage achieved, as it had for the British at Cambrai, tactical surprise. The defences of the Fifth Army were certainly the weakest and least prepared of any of those of the British armies, with their twelve infantry and three cavalry divisions spread over 42 miles. There were, however, two crucial differences between the artillery techniques used by the Germans in March 1918 and those demonstrated by the British at Cambrai.

As they did with most techniques of long-range, heavy artillery fire, the German artillery began the war with a distinct advantage in sound-ranging. Even before Bragg began experimenting with the Bull Electronic Recorder, the Germans had developed a crude sound-ranging system. In the German sound-ranging units trained observers were positioned in the front line and each was armed with a pair of large ear-trumpets and a stop-watch. These observers would attempt to take a bearing on a hostile gun report and time its firing with the watch. A central recording centre would intersect the bearings from various observers to fix the hostile gun. The German system, while simpler than the British, had a number of crucial defects which emerged as the artillery duel between the rival forces reached unprecedented intensity in 1917. Even highly trained observers could not match the accuracy of Bragg’s electronic timing and as more and more guns became involved in the counter-battery duel and the range of the guns increased, the observers were unable to distinguish their particular gun in the general din of bombardment. This was Bragg’s conclusion when he studied the German sound-ranging units after the war.

"I think they were committed too early to a simpler but crude system and it was too late to change it when ranges increased and greater accuracy was essential".14
The German system could not record the arrival of shells at their targets, as Bragg’s did, and thus, to be absolutely sure a hostile gun was being hit, an aerial observer was still required. If no aerial observation was possible, as was the case in the surprise bombardment in March, the German guns would have to fire at a number of different range settings, hoping to hit the hostile gun on one of them.

The Germans used gas almost exclusively in their counter-battery fire to offset the inaccuracy of their unregistered fire in a surprise attack. Once they had the general location of the British battery positions they smothered the entire area with gas. The British, while using one-third gas shells in counter-battery fired two-thirds H.E., aiming to destroy the gun and its crew. Unless the German barrage caught British gun crews entirely unaware, its only effect was to hamper the gunner’s movement and vision because of the mask. Even if the British were forced to withdraw, most of the guns and crews survived to fight another day. If British counter-battery fire was successful the German guns were destroyed and crews killed. This was the essential difference the greater accuracy of British counter-battery fire allowed them: to "shoot for destruction" rather than simply temporary neutralisation.

The lack of electronic timing devices also meant that the German method of sound-ranging could not be used to calibrate guns quickly as Bragg’s could, and thus throughout 1918 the German guns still had to be dragged out of the line and put through calibration ranges behind the lines prior to enemy attack. The German system was also vulnerable to casualties in its pool of expert receivers. If a receiver (Tucker microphone) from Bragg’s machine was hit by a stray shell, or crushed by a passing tank, it could be instantly replaced. If the Germans lost one of their receivers (personnel), it took months to train a new expert in differentiating a single gun’s report in the cacophony of battle and estimate its range.
Essentially the Germans had begun the war with techniques of unregistered fire far superior to those of either Britain or France and this had made them somewhat complacent. It was only the experience of Cambrai and the realisation that the Royal Artillery had not only caught up with but had surpassed the German artillery in the techniques of unregistered fire that led the German artillery to re-examine their old methods. This was not only the case with sound-ranging but with the use of survey methods as well.

When war broke out, the German artillery had a survey department in advance of anything the French or British artilleries had available to them. German gunners had accurate scale maps and artillery boards for their heavy batteries from 1914, which in no small part accounts for the accuracy of the German heavy guns, like the 5.9-inch, which in 1914 British gunners found almost beyond belief. The Germans, however, did not develop the bearing-picket system using surveyed datum points to give a bearing, and relied instead on compass bearings taken by the battery commander. On the Eastern Front the German artillery, under the direction of Bruchmüller, developed a survey section which used survey techniques to create bearing-pickets as the British artillery did. These were used to fire the surprise, unregistered barrage at Riga. When Bruchmüller came to the Western Front with Ludendorff and organized the bombardment for the March offensive, he insisted on using the short barrages that he had used in the East. Only one of the armies in the 21st March assault was able to employ the bearing-picket system however - Oskar Von Hutier’s Eighteenth. Hutier had, like Bruchmüller, come from the Eastern Front; in fact he had commanded the Riga attack. From the East, Hutier had brought his own Staff and Army Corps experts, including his survey departments. It is interesting to note that on 21st March only Hutier’s Army made a substantial advance, driving the British Fifth Army back out of their positions and into a headlong retreat. The use of the survey system was not the primary reason the Fifth Army collapsed, it was merely one of the factors contributing to it. The retreat was largely a product of the overwhelming superiority in numbers that the Germans achieved.
by concentrating their forces against the weakest of the five British armies. Gough’s Fifth Army had a mere twelve infantry divisions, supported by 1,312 guns along a frontage of over 42 miles; approximately one division every 4 miles and a gun every 70 yards. Against this the Germans flung forty-three divisions, backed by over 400 guns, four times the density of guns and four times the concentration of infantry. One need look no further than these figures to find the reasons for the collapse of the Fifth Army on 21st March.

To review German artillery tactics in attack so far, the most notable feature was that by the spring of 1918 the Germans had arrived at very similar tactical conclusions to the British. Through 1915, 1916 and the spring of 1917, the Germans, like the British, had placed their faith in the power of heavy artillery to completely annihilate a defensive system. Surprise and deception were abandoned in the cause of heavy artillery, as bombardments became ever longer, heavier and more destructive. Then in the summer of 1917, just as the British were doing, the German artillery began experimenting with shorter barrages that allowed the possibility of surprise bombardment. While the German experience largely had followed the same path as the British, in terms of technology and techniques the German artillery had fallen behind their British counterparts. In terms of assessing the comparative successes of German artillery tactics in the offensive it is more illuminating to examine the German Seventeenth Army’s assault on the British Third Army as being more typical than its overwhelming assault on the Fifth. The German Seventeenth Army held a far smaller advantage over the Third Army. On 21st March eighteen German divisions faced the fourteen divisions of the Third Army (although only six divisions of the Third Army were actually assaulted). The German Seventeenth Army had over 2,000 guns at a concentration of 80 to the mile. In the original plan drawn up by Ludendorff, the attack by the Seventeenth Army was the “strategic pivot” of the entire offensive. Hutier’s Eighteenth was merely to protect the southern flank of the forward push. But on the 21st, when the attacks were launched, despite the Seventeenth Army’s two-to-one superiority in guns, it
was unable to suppress the fire of the British Third Army’s defensive batteries. Combined defensive barrage and infantry fire inflicted heavy casualties on the German assault troops and halted any significant advance by the German Seventeenth Army. Along much of its frontage the Third Army abandoned its outpost forward positions, but resisted all German attacks on the second position, the battle zone. As Rupprecht recorded of the Third Army’s artillery forces:

"in spite of apparent lack of plan in the British artillery fire there was said to be serious losses of material in the artillery of the 17th and 2nd armies which probably took place during the forward charge of position".

What this reveals is that in 1918 German artillery techniques, particularly in the crucial area of counter-battery fire, were not as effective as those of the British. Despite outgunning the Third Army two-to-one, the Seventeenth Army’s short surprise barrage could not smother the Third Army’s artillery power owing to the lack of an accurate method of sound-ranging and to the use of older and less accurate methods of taking bearings. On the frontage of the British Fifth Army, however, not only was the numerical superiority of the German forces greater, but one of the two armies, the Eighteenth, employed techniques more akin to those of the British. It was this Army that sliced through the Fifth Army’s defences on 21st March causing, a few days later, the Third Army to withdraw as the Fifth collapsed on their southern flank.

The successful advance of the Eighteenth Army, compared with the lack of progress by the Seventeenth, caused Ludendorff to change completely the focus of his attack. The Seventeenth Army received no reinforcements on 21st or 22nd March, while the Eighteenth Army was given six fresh divisions to carry on its attacks. With these it turned the retreat of the Fifth Army into a rout. The reason the Eighteenth Army was able to achieve what many previous British offensives had not, that is, turn a promising attack into a fully-fledged breakthrough of the defensive system, was that while the British had attempted to mimic the defence-in-depth tactics of their foes they had omitted a number of crucial elements in their adaptation. The British had attempted to copy
slavishly their defences from the German arrangements because of "the enemy's wide experience of the defence". German staff memos on defensive tactics captured at Cambrai were translated in full and supplied with the new British defensive instructions issued in mid-December 1917, but on 21st March British defensive dispositions differed greatly from those employed by the Germans for defence-in-depth. While the British armies had copied the tactical layout of the German system, dividing their defence into three wide zones with outpost, battle and reserve lines, and had copied the German artillery arrangements with pre-arranged S.O.S. barrages and a number of pre-arranged barrage zones between the infantry positions, they had ignored the crucial element that had made defence-in-depth such a success, the employment of tactical and then strategic reserves in counter-attack. The Fifth Army had but one weary division in reserve to attempt to halt the advance of the Eighteenth Army. The only arrangement for a strategic reserve was in the form of a vague verbal agreement between Haig and Pétain. When the Fifth Army collapsed and lost touch with the Third on its northern flank and the French to its south, French reserves were slow in arriving, the French believing an attack on their own front to be imminent. As a result the Fifth Army and then the Third Army continued to fall back. This is not to suggest that Pétain betrayed Haig as some British historians claimed, but clearly Allied arrangements for the mutual use of reserves to plug a breakthrough were ill-defined and had not been pre-arranged with sufficient care.

The headlong advance by German armies continued until 28th March. At the deepest point they had advanced some 40 miles across the barren wastelands of the Somme battlefields and the desolation left by the German withdrawal in 1917. Allied resistance increased as more French divisions from the south and British divisions from Flanders arrived around the edge of the vast salient. The decision to follow the initial successes of the Eighteenth Army rather than the original plan had led to a deep penetration of the British position, but one that seemed to have no strategic goal. Now, on the 28th, the 40-mile advance had brought the great rail centre of Amiens within sight.
of the advancing German armies. Here the British Third Army made its determined stand against German forces weakened by fatigue and the problems of supply. The German bombardment on the 28th was a pathetic shadow of the five-hour barrage on the 21st. German batteries, whose daily ammunition ration had been halved on the 25th because of supply problems, could maintain their shelling only for 45 minutes. The attack was driven off and the German advance halted. The German Command, recognizing the troops to be now too weak to continue attacking, turned their attention north to Flanders. Their attack here followed a similar course to that on the Somme although the initial advance was less spectacular and deep. After surrendering Passchendaele Ridge, Messines Ridge, Mont Kemmel and other landmarks from the year before, the Second Army regrouped and halted the German advance. The last German attack in Flanders petered out on 29th April. Ludendorff’s vast effort to "beat the British" had failed. After April Ludendorff turned his offensive efforts against the French with three great offensives in May, June and July. All three achieved limited success, but were halted after French reserves arrived on the battle fronts. On 18th July the French launched a counter-attack against the positions gained in the last German attack, the Reims-Soisson offensive. The French counter-stroke, like that launched by the Germans after Cambrai, ruptured the back of the salient the German advance had created and forced the Germans to make a mass withdrawal. The offensive against the French had failed. Ludendorff intended at this point to return to the offensive against the British with further attacks in Flanders, called Operation Hagen. Hagen, however, was never launched for before German troops could be transferred north, the British, who had recuperated and re-armed for three months whilst their Ally absorbed the German offensives, now launched a devastating riposte to the German advance towards Amiens. The attack at Amiens on 8th August by Rawlinson’s Fourth Army was indeed, as Ludendorff later described, der Schwarztag for the German Army, the black day.

The British Army that returned to the offensive in the summer of 1918 was in a number of crucial aspects a different force to the one which had conducted the great
Flanders offensive the summer before. Even before the shock of the German attack in March, criticism of the conduct of the Flanders campaign together with the German counter-attack at Cambrai had forced changes in Haig’s Staff at G.H.Q. Both the Chief-of-Staff, Kiggell, and the Head of Intelligence, Charteris, who were cavalrymen who had come with Haig from the First Army Headquarters in 1915, were dismissed. Charteris was given a position as Deputy Director of Transportation and Kiggell the command of the defence of Guernsey. Both men had provided Haig with over-optimistic accounts of German casualties during the great offensives of 1916 and 1917 and continually understated the disastrous effect the offensives were having on British troops. This was perhaps most vividly highlighted after Charteris’ repeated assurances in November of 1917 that the entire German Army was on the point of collapse, a claim the counter-attack at Cambrai and the rapid buildup of German divisions revealed to be nonsense. Events during the March German offensive had also demonstrated the folly of dual Allied command. The lack of co-ordination of reserves between the French and British armies facing the Fifteenth Army’s headlong advance forced Haig to accept a Frenchman, General Foch as strategic co-ordinator of the Allied effort. Another effect of the German offensive was the sacking of Gough. After the war Gough complained of the injustice of this, pointing out that the decisions to leave the Fifth Army with such a long frontage and no clear arrangements of the use of French reserves were Haig’s. Gough’s complaints have great justification but his reputation had already by March 1918 been ruined by his conduct of the attack at Bullecourt and Pilckem Ridge.

When the last of the German attacks had petered out in Flanders and the German offensives against the French begun, the British Army began to rebuild and consolidate in its new positions. During the height of the crisis the Government in London had released 170,000 troops, who had been held in Britain, for service on the Western Front. With these replacements the armies were able to bring divisions back to full strength but were not able to create any new divisions. While British manpower resources remained limited the artillery losses from the retreat, which had been heavy,
were made good within one month of the March attack in what was the Ministry of Munitions' greatest triumph and one that had a crucial bearing on the battles to come.

On 16th July 1917 Churchill made his return to the Ministry and was given the still rapidly growing Ministry of Munitions. During his reign production continued to expand at a remarkable rate and during the year five new shell factories were completed and two others converted to gun repair.

Churchill also instituted a program of stockpiling a reserve of completed guns and shells and of unassembled parts. The March crisis and retreat and consequent loss of equipment caused Churchill to break open the reserves. He had promised the army that "all losses in material would be immediately replaced" and to get this done the two-and-a-half million workers

"toiled with a cold passion that knew no rest. One thought dominated the whole gigantic organisation, to make everything good within a month. Guns, shells, rifles, ammunition, Maxim guns, tanks, aeroplanes, and a thousand,artilleries were gathered from our jealously hoarded reserves."

As far as the artillery were concerned Churchill more than fulfilled his promise. By April he had made available over 2,000 new guns, although only 1,200 had been lost in the retreat and had delivered shell stockpiles greater than those lost. The vast buildup of artillery resources meant that the proportion of artillerymen in the British armies grew rapidly. By April, 30% of the entire fighting strength of British forces were Gunners. While the infantry divisions were being returned to full strength through April, May and June of 1918 and the new conscripts trained, the artillery was taking the fight to the German forces.

After the replenishment from the Ministry's stockpiles the Royal Artillery launched a co-ordinated effort to destroy the German artillery forces opposed to them. In this counter-battery attack the Royal Artillery enjoyed a number of advantages that it had not had when attempting to gain artillery superiority in 1916 and 1917. The heavy artillery force was larger and the weapons of modern design, the shell stockpiles vast and
the shells reliable in size, weight and detonation. In the effort to locate German batteries the British now had reliable air-to-ground radio communication, air superiority and a complex ground-based locating system employing field observation groups, F.O.O.'s and sound-ranging. Also, in the summer of 1918, the German batteries were not ensconced in elaborately fortified gun-pits deep in the reserve lines of well-positioned artillery lines. They occupied a line that merely marked the high tide of the German attacks. German heavy gun batteries that had not been stripped from the British front to assist the attack on the French, were in recently dug pits, in forward positions ready to resume the offensive against the British the moment Ludendorff finished with the French. Thus the German artillery were in the most vulnerable and weakened position they had ever been in relation to the Royal Artillery, and the counter-battery assault that began in April amply demonstrated that vulnerability.

From April, every German battery located by the sound-rangers or any other observation group along the entire British frontage was shelled with at least 200 rounds from 6-inch howitzers, the most accurate and destructive gun for counter-battery work because of its great range, weight of shell and rapidity of fire. By the end of May, Rupprecht, whose army group faced the British, ordered that the German batteries were to dig further dummy and alternative pits because of the "very heavy losses of material through enemy counter-battery work". Birch countered this tactic with a letter to the artillery on 30th June ordering all German gun-pits to be hit with heavy destructive fire, not only to find the occupied pits but also to destroy the shells stockpiled in alternative positions. The German artillery was unable to withstand the losses inflicted by French counter-attacks in the south and by the Royal Artillery in the north. In July the German artillery on the Western Front lost 13% of its guns and an even larger proportion of its shells. A report from an artillery staff officer who examined the pits after the British had overrun them later in the year, found widespread destruction.

"I went round some Boche battery positions yesterday in XI Corps' counter-battery area. Practically every one had been engaged for
While German artillery resources declined by 13% a month, the Royal Artillery was growing at 20% per month. While the German shell stockpile was consumed by the destructive fire of the British and in the vast barrages used against the French, the British stockpiled over 10 million shells in the lines of communication. With this vast force, over 2,000 heavy guns and millions of high quality shells, the artillery prepared itself to spearhead the last and greatest of the British offensives on the Western Front.

The first attacks launched by the British in 1918 were small, limited operations which aimed at localised improvements of position and at probing the German defensive lines. For the first time since the summer of 1915 British forces faced defences that were not the product of careful deliberation by the German Staff and extensive labour by the army. In the salients created by their spring attacks, the German trench lines had been hastily dug, the position determined not by tactical considerations but by the point at which the spring attacks had finally ground to a halt. The German defences in these newly occupied positions had little wire and no ferro-concrete bunkers. During June and July the British armies probed these positions, perfecting the method of attacking shallow defences. The most significant of these attacks was launched by the Australian Corps and elements of the American 33rd Division at Hamel and provided a model for the major assault the British planned to launch in August.

The plan for the attack at Hamel showed the benefits of the British artillery’s and indeed the Staff’s experiences in 1917. What Monash, the Australian Corps Commander attempted, was to duplicate the opening assault at Cambrai, yet not expose his attacking force to a German counter-attack. To this end he prepared an elaborate surprise barrage, with a tank force to cut the wire, but set strict limits on the penetration the attack was to make. Hamel was a ruined village sitting atop a slight ridge, which provided the German artillery observers an extended view over the Australian Corps’
communication lines. The attack was launched on a 7,000 yard frontage, with 628 guns in support, 326 field guns (1 to every 21 yards) and 302 heavy guns (1 to every 23 yards). The assault was to capture Hamel village, Vaire Wood and the entire ridge, penetrating 2,000 yards at the deepest point. This limited advance meant that all British guns, including the 18-pdrs., would be able to range beyond the infantry, to halt any counter-attacks. Sixty fighting tanks were to be employed, with twelve supply tanks to follow them. The supply tanks were to carry bales of barbed wire, machine-guns and small arms ammunition to consolidate the newly won position. As at Cambrai, the reinforcing artillery was brought up during the nights before the attack, arriving at prepared gun-pits, with artillery-boards and bearing-pickets already supplied. All guns arriving at the pits were first calibrated by the Australian Corps calibration unit, using the electronic timing method, and all sights were tested for accuracy against the muzzle velocity and adjusted. All ammunition to be used was sorted by weight at the gun-pits, so that only shells with near identical weights were used. The meteor officer prepared to issue an artillery telegram to all batteries one hour before the assault, so that last minute alterations to ranging could be made. The sound-rangers and flash-spotters of the corps fixed the position of all German batteries on the artillery boards.

The artillery plan for Hamel was not identical to that at Cambrai, for that battle had not only taught the British to limit their objectives but had also revealed other lessons. At Cambrai, standing barrages of smoke and 50% smoke in the creeping fire had proved more than ample. The creeping barrage at Hamel was 60% shrapnel 30% H.E. and only 10% smoke. This rolling barrage began some 200 yards ahead of the infantry's jump off points and advanced at 100 yards every three minutes for 1,000 yards and then at 100 yards per four minutes up to the 2,000 yards of the final objectives. In front of the main creeping barrage was another rolling barrage of heavy howitzers, using 90% H.E. and 10% smoke; this fire was to destroy machine-gun-pits which the shells of the field guns might not penetrate. The recently built defences of Hamel Ridge contained none of the substantial structural fortification such as those faced by the Third
Army at Cambrai and thus at Hamel a far higher proportion of heavy guns could be allotted to counter-battery, rather than to general bombardment. At Hamel 66% of the heavy guns were to fire counter-battery at the moment of attack to silence the German artillery and avoid the heavy tank casualties endured at Cambrai. To enhance the counter-battery fire the counter-battery shelling was to begin eight minutes before the infantry/tank assault jumped off, drenching the German gun-pits with gas, before using H.E. and smoke once the assault got under way.47

The attack was launched at 3.10 am on 4th July, chosen partly to mark the first combined operation with the Americans. The attack caught the defenders entirely off guard and within four hours the entire ridge had been overrun and all objectives reached.48 The German artillery was entirely smothered by the Australian Corps’ counter-battery fire, only one German field battery of 77-mm. actually firing on the assault force during the attack.49 This almost complete suppression of German artillery fire and the reliability of the new Mk. V tank were demonstrated by the absence of severe tank casualties. At Cambrai over 50% of the fighting tanks in the initial assault were disabled by the end of the first attack, either by hostile fire or breakdown. At Hamel all but five of the sixty fighting tanks were able to rally at 11 am to consolidate the defence. Of the five, only one had actually been hit by German artillery fire during the attack, another was hit by misdirected British fire, a third hit by a stray long-range German shell and two by German heavy guns during the consolidation.50 Losses in the Australian/American assault force were also light, while the Germans lost 1,472 men as prisoners, 2 field guns, 26 workers, 171 machine-guns and 2 anti-tank guns, as well as casualties that were never established but were presumably heavy.51 German counter-attacks were driven off by heavy artillery fire, the attacks’ depth being so limited that the British artillery did not have to move forward to range onto the assembling counter-attack forces.52
The attack at Hamel was but one of the minor attacks in June and July, as the British armies positioned themselves for their main attack against the German salients. XI. Corps of the First Army also launched a small attack at La Becque and the 9th Division under Tudor attacked at Meteren. In both of these attacks the artillery arrangements were nearly identical to those at Hamel, although no tanks were used in the other two assaults. Tanks were dispensed with, as the wire protecting these positions was slight and could be cut by hand. These attacks were as successful as the Australian Corps’ efforts, capturing good observation positions, inflicting heavy losses in prisoners and material on the Germans while neither attacking force suffered more than light casualties. These were, however, mere manoeuvres compared with the main attack being planned at Fourth Army Headquarters for 8th August.

The original suggestion for the Amiens attack surfaced in early July, the day after Hamel revealed the vulnerability of the German defences at the apex of the salient which bulged out towards Amiens. The orthodox method of attacking salients was to attack on either flank at the base, attempting to trap the defenders. This approach was employed by the Germans in the counter-attack at Cambrai.

The outline of the battle was decided upon at meetings between Haig, Foch, Rawlinson and Debeney, the Commander of the French First Army. The attack was planned for 8th August, close to the battlefields of the Somme campaign in 1916. Like that battle it was to be a combined Anglo-French assault at the junction between the two forces and was to be launched along a frontage of almost 20 miles. But here all similarities to 1916 end. The Fourth Army’s 1918 assault on the Somme was based entirely on surprise and in its tactical approach attempted to replicate Hamel and Cambrai before it, on a vast scale. The British frontage of attack spanned some 30,000 yards, of the overall 45,000 yard front. The British frontage was divided in half: on the northern half, along 15,000 yards, the III. Corps launched a flank attack to protect the centre where the Australian and Canadian Corps made the main thrust. The southern
flank was protected by Debeney’s First French Army. The 15,000 yard frontage of the
Australian and Canadian Corps received the majority of the artillery available for the
attack, 1,328 guns, a field gun every 17 yards and a heavy every 24, similar to the
proportions of guns used at Hamel. III. Corps were allotted only 672 guns with a field
gun every 33 yards and a heavy every 67 yards. 55 III. Corps were allotted only 36
fighting tanks, the new Mk. Vs, and 12 supply tanks for their assault. The
Australian/Canadian assault had the remaining 306 fighting tanks, 108 supply tanks and
72 light tanks (whippets) that had recently been made available to the Tank Corps. 56
The Allies concentrated their air power around the Somme area. By the day of the attack
Rawlinson had 1,904 Allied planes supporting his assault, opposed by 365 German
planes. 57

The artillery instructions issued by the Fourth Army on 31st July simply repeated
the formula used by the Australian Corps at Hamel. 58 The proportion of guns to be
used on counter-battery, 66%, was the same, the pace of the creeping barrage also, as
were the proportions of smoke, H.E. and shrapnel shells in the various rolling barrages.
The instructions also emphasized the crucial importance of preparing the artillery to fire
the unregistered barrage. The Fourth Army’s sound-ranging capacities were improved
by the reinforcement of the Army’s field survey company with two additional sound-
ranging sections, so that five sections were available to the three corps in the assault, as
well as four flash-spotting groups. 59 Surveying in the gun-pits, the drawing up of
artillery boards and the positioning of bearing-pickets was completed by 1st August. 60
During the last days before the attack the 2,000 odd guns of the Fourth Army were run
through the calibration schools and had their sights tested, while the gunners sorted shells
arriving at the pits. The lack of any preliminary bombardment meant that gunners could
check for and repair any wearing parts on the guns, in breech-blocks, buffers or trails.
The result was that at the moment of attack 98.5% of artillery allotted to the attack were
able to fire to their instructions, the highest percentage achieved in any battle up to
Amiens. 61 The lack of bombardment duties also allowed time for the weighing and
sorting of shells and meant that at the moment of attack gun crews were alert and well prepared, rather than exhausted by weeks of work as they had been in the long bombardments of 1916 and 1917. All movement of guns, shells, tanks and infantry occurred at night, while during the day German observers watched over a quiet and apparently benign British position. Monash, the Australian Corps Commander, recalls the "feverish activity" at the calibration ranges on the night before the attack:

"battery after battery of guns could be seen route-marching to the testing ground, going through the performance of firing six rounds per gun and then route-marching back again the same night. So rapid was the procedure that long before he reached his destination the Battery Commander had received the full error sheet of every one of his guns and by means of it was enabled to go into action whenever required without previous registration."

The electronic screens were connected to the timing device from the sound-ranging mechanism and had been improved by the addition of calculating machines to assist the operators in their computations of muzzle-velocity. Monash recalls that

"the calibration hut in which this mechanism was housed became one of the show spots to which visitors to the Corps were taken to be overawed by the scientific methods of our gunners".

The barrage opened suddenly, on the morning of the 8th, finding the German Second Army entirely unprepared. Despite warnings from Divisional Headquarters in the threatened area that tanks had been heard on the previous night, the Second Army had received no reinforcements nor had it even been put on alert. It had at its disposal fourteen exhausted and battle-worn divisions and only the divisional artillery to support them. Von der Marwitz rated only two divisions battle-worthy; the rest were reduced to less than half by casualties from the spring offensive. The divisional artilleries were "completely fought-out" with worn guns, a shortage of shells and no pack animals to move the guns in the event of rapid withdrawal. The best German divisions and the majority of their heavy artillery were still deployed against the French after the last of the German attacks. Of the artillery facing the British zone, the heavy batteries were
deployed in Flanders preparing to launch Hagen, the last and supposedly decisive attack against the British. In the centre around Amiens, von der Marwitz’s Second Army had no Eingreifen divisions to counter-attack with, no pool of heavy artillery with which to ring a threatened outbreak, and a mere four divisions in his army reserve to plug any breakthrough. This is what the unregistered barrage could provide, complete tactical surprise. For the first time on the Western Front the British caught the German defence unprepared and unable to make an immediate and decisive response.

While II. Corps in the flank attack made limited progress, the Australian and Canadian Corps simply swept across the German defences behind an intensive creeping barrage. German artillery fire in the initial stages of the attack was almost non-existent. Many of the guns captured later in the day still had muzzle covers on, the neutralising barrage of gas and H.E. having killed the crews before they could even get to the guns. British casualties were less than 9,000 and most were caused by German riflemen and machine-gunners in desperate stands against the onrush of the two Dominion corps. "During recent operations" the head of Fourth Army medical services stated in his report on Amiens

"it has been noticed that there were very few cases of shrapnel wounds among British troops, about 70% being rifle and machine gun bullets and about 27% shell wounds. On the other hand, the wounds among German wounded prisoners show an exceptionally high percentage of shrapnel wounds".

This must stand as a great testament to the improvements in tactics and techniques by the Royal Artillery since the summer of 1917. In the long and bitter slog in Flanders, over 70% of the hundreds of thousands of British casualties were from German shell fire. By 1918 the Royal Artillery, by surprising the German forces, and by its improved counter-battery techniques, reduced that to 27% of a total which was in itself less than ten thousand. Casualties on the German side were devastating as the Second Army virtually collapsed in the face of the Allied onslaught. By 11 am the British and French overran the entire defensive system, advanced some 13,000 yards and were consolidating
in the old Amiens defensive line. Von der Marwitz' Army had suffered 27,000 casualties, 15,000 of whom were now prisoners of the British. Almost the entire complement of the Second Army’s artillery had been destroyed or captured - over 4,000 German guns and over 1,000 motors were being trundled back to the artillery’s captured weapons parks. The German front line divisions had been almost destroyed; the 41st reported

"all the front and support battalions as well as the entire artillery down to infantry remnants had fallen sacrifice to the enemy. Of the reserves only seven infantry and three machine gun companies remained".

The effect of this crushing blow to the morale of the German soldiers has been much discussed by historians since. The regimental historian of the 152nd, who occupied the crucial central section of the defence, records the devastating attack and the near destruction of a regiment that had endured for years on the Western Front.

"Heavy morning fog was lifting when the English suddenly opened a gigantic rolling barrage at 5.20 am. ... Through the thunder and crashing of the rolling barrage, suddenly a wild cry was heard "gas" - in the fore-field heavy casualties were already being suffered, all communication was cut".

There was no gas in the rolling barrage, only smoke, which obviously succeeded in deceiving the Germans and inducing them to don their masks. The attack rolled over the 152nd’s forward zone and into the battle zone.

"Anyone who even now put a finger on the trigger fell in the next second into the immense fire storm... There is nothing left to do. Only individuals remain behind, they are fighting through, but all have the same destiny. They met the enemy in the rear zone and were shot at, attacked and then wounded or exhausted, were taken prisoner."

The regimental headquarters were overrun, the entire Staff captured, even the regimental hospital and doctor.

"Dr Froese who was bandaging wounded under the supervision of Australian bayonets. Men who had stood against the enemy for the entire war were taken prisoner."
After the battle only one officer, commanding a mixed unit of Company strength and a lone lost machine-gun Company remained out of the entire regiment. The 152nd, which had taken key roles in the German defence at the Somme and Flanders, was destroyed, never to be reconstituted for it had lost its entire pool of experienced officers.\textsuperscript{72}

As the German monograph 'Die Katastrophe der 8 August 1918' records

"as the sun set on the 8th August on the battlefield the greatest defeat which the German Army had suffered since the beginning of the war was an accomplished fact. The position divisions [by this the author means the trench regiments as opposed to the elite storm trooper regiments] between the Aire and the Somme, which had been struck by the enemy attack, were nearly completely annihilated."\textsuperscript{73}

The Second Army's reserve divisions had been flung into the defence and destroyed during the mid-morning, and von der Marwitz had nothing else with which to halt the Fourth Army. He ordered the withdrawal of his remaining troops, while the British occupied their old trenches from 1916.\textsuperscript{74} German divisions and heavy artillery batteries in the north around Flanders abandoned their preparations for Hagen and were entrained for the Somme to meet the Fourth Army's breakthrough. This was a crucial moment in the war, for in this decisive year of 1918 the offensive initiative had been torn from Ludendorff's grasp. With his best troops positioned for attack rather than defence, with long sections of his line poorly defended, with his troops tired and his guns worn after six months of incessant attack he now faced a sudden British offensive, better organised and more powerful than those beaten off in 1915, 1916 and 1917. All hope of German victory was now gone.

While the successes of the British may have convinced the leaders of Germany that decisive battlefield victory was now beyond them, it did not cause them to abandon all hope. Attack was now out of the question, but Ludendorff and other senior army leaders believed that by returning to the defensive, the territories won in the advance of 1914, including Belgium, might be retained.\textsuperscript{75} It was crucial then for the German
Command to reinforce the shattered remnants of the Second Army who continued to fall back during the afternoon and evening of the 8th in the face of Australian and Canadian probing attacks. During the 9th, twelve German reserve divisions arrived at the Amiens battlefield from the north to face the ten attacking divisions of the Fourth Army. British attacks now met increasingly stern resistance as the power of the British artillery diminished because of increasing range and the tanks fell prey to German field guns and breakdown. As had happened on so many other occasions the artillery were simply unable to advance with the infantry when a deep penetration was made. With the leading troops now some 75 miles from their original jump-off points even the longest range British guns could not protect them. Sound-ranging sections did not get forward to the new line until 13th August and the flash-spotters came into operation only that same afternoon, some five days after the original assault. The Fourth Army’s heavy artillery did not get to the new positions until the 14th and then only four batteries of six-inch guns were actually ready with good gun-pits, artillery-boards and bearing-pickets. Thus, when the British attempted to exploit the great advance made on the 8th by attempts to push through with cavalry or tank and infantry assaults on 9th and 10th August, they were unable to make significant advances and suffered heavy casualties. By the afternoon of the 10th only 85 fighting tanks remained out of the original force of 400.

On the 11th Haig made a crucial decision and one that marks a great change in his strategic thinking. During 1917 the British Army had won great single-day victories, Vimy Ridge and the Scarpe in the battle of Arras and Cambrai in November, but these had turned sour as attempts to extend the advances into breakthroughs were driven off with heavy losses. The reason for this, as we have seen, was that the initial victory created by the devastating use of artillery could not be consolidated in the following days as the artillery struggled to get forward to support new attacks. Haig had simply refused to acknowledge the complete dependence of his assaults on well prepared artillery barrages and had continued these attempts at exploitation until all value from the original
attack had been lost. This was never clearer than at Cambrai when attempts to achieve breakthrough after the initial attack so weakened and disorganised the British forces that German counter-attack was able to win back almost all the territory lost on the 20th. At Amiens Haig showed that he had finally learnt from these bitter lessons, for on the 11th he called off the Amiens attack and he did this in the face of opposition from Foch, supposedly the Supreme Commander of the Allied effort. Rather than continue at Amiens Haig decided to take up the attack with another of his armies whose artillery were well prepared and positioned and thus allow the Fourth Army time to consolidate and also to draw British reserves rushing to Amiens to another front. It had taken Haig four years to recognize the dependence of his attacking forces on their artillery, but perhaps it is a case of better late than never.

The Third Army began the process of widening the battlefield on 21st August. Ten days after Amiens had been closed down, they attacked on the northern flank of the Fourth Army between the old battlefields of the Somme and Arras. The tactics used were virtually identical to those of the Fourth Army on the 8th, with only minor modifications. The percentage of guns in counter-battery work was increased from 66% to just over 70% and the smoke component of the creeping barrages from 10% to 17%. Registration by the old methods, directed by ground or aerial observers with numerous ranging shots, was now actually forbidden. S.O.S. barrages, fired when the infantry were being faced by counter-attack were modified. Rather than being long and steady, these were changed to short but intensive barrages. Apart from these fine-tunings of the artillery’s work, the Third Army assault on 21st August was simply a small scale version of Amiens. It was a limited advance to a pre-arranged line, one that was suitable for defence against counter-attacks. On the 22nd the Fourth Army surprised the Germans again with another intensive unregistered barrage, the guns now having been brought forward, and advanced another mile and a half. On the 23rd, 24th and 26th, the Third and Fourth Armies launched a joint attack, again pushing back the now crumbling German defence a further mile and a half. While these gains were consolidated the First
Army launched an attack, capturing Monchy-le-Preux. The methods used were again identical to Amiens - unregistered barrage, tanks leading the attack, 70% of guns in counter-battery, 10% smoke in the creeping barrage. Now that the British had found a successful formula, they stuck to it.82

The ever-widening battle frontage and the repeated successes of British attacks against the German armies exposed to the power of the British artillery without the protection of deep defences, brought an end to any hopes Ludendorff retained of launching Hagen. Before Amiens on 4th August, Ludendorff had assured the Kaiser that not an inch of captured territory would be surrendered and that he had ordered his armies to dig in on their present positions.83 The successful attack by the Fourth Army at Amiens and the subsequent advances by the Third and First Armies made that impossible. After some days of debate Ludendorff accepted that reserve divisions could not be brought to the ever widening breach in time to avoid a general rout. On 27th August he accepted a report from the Crown Prince's Staff that a general withdrawal by the army groups facing the British was inevitable. It said in part

"we must restore sector by sector according to a definite plan. This retirement according to plan is only a temporary expedient. It must find its end in a strong permanent position which offers favourable conditions for a stubborn defence."84

The report then outlined a number of defensive positions that might be exploited in a fighting withdrawal: the old position the Germans had occupied in 1916 along the Somme river and even further back, the great Hindenburg line Stellungen constructed in 1917, the positions the German armies had jumped off from in their spring offensive. Ludendorff's reply to the Staff note agreed with the argument that the armies facing the British were now in an untenable position, and that a fighting withdrawal was inevitable. But Ludendorff also pointed out that genuine efforts would have to be made to halt the British on the line of the old 1916 defences because if the armies were pushed back to the Hindenburg line it would force a desperate last stand.
"I regard in any case, the retirement into the jumping-off positions of last March - the Hindenburg position - as the very furthest we can go."

Ludendorff knew that behind the Hindenburg line there was not another defensible position. The Hindenburg reserve line, begun in 1917, was mostly incomplete. As Ludendorff penned his reply to the Crown Prince's Headquarters, the British Commander-in-Chief was assuring Foch that he was not only willing to carry on his offensive but was in the midst of actively preparing to do so. His plan was simply to force the Germans back at the greatest speed all along the British frontage. Rather than attempting to pierce the line at one point, thus attracting what German reserves remained, this continual pressure would drive the Germans back to the Hindenburg line. There, Haig would attack them before they had time to fully reorganise their old defences and win the war before winter. Thus, on 27th August, only eleven days after the attack at Amiens, the stage had been set for the final climactic act of the Western Front. Ludendorff had committed himself to a defence along the Somme where perhaps his armies could stand for the winter and draw a compromise peace from the Allies. On the other side the Allies and their armies, the French, American and British, were poised to force a decision before the weather broke.

According to Liddell Hart, The Allies were preparing for the decisive battle of the Western Front.

"August 8th 1918 is a date which grows ever larger on the horizon of the historian", wrote Liddell Hart and it certainly loomed large over his own account of 1918.

"one event of the campaign in the west can be regarded as decisive, it is the great surprise east of Amiens that occurred on this day."

It was decisive because "it unhinged the mind and morale of the German supreme Command." This unhinging occurred because of "the shock of perhaps the most complete surprise of the war", a surprise whose "foundation was loosing of a swarm of tanks, 456 in all, in place of any preliminary artillery bombardment."
Liddell Hart quotes the German General Kuhl to substantiate his view of the crucial significance of tanks at Amiens. Liddell Hart then dismisses the British offensives against the Hindenburg line, preferring to examine in his concluding chapters the battle of Megiddo in the Middle East, and the failed American offensive in the Argonne. The Hindenburg line, the British September offensive, is never mentioned. The reason the September battles are ignored is primarily that they were not massed tank battles, like Cambrai and Amiens and so, by Liddell Hart's definition, could not have been in any way decisive. This view of 1918 is echoed by Fuller, who was quoted by Orgill as claiming that Amiens marked "the strategical end of the war, the rest were minor tactics." Both Liddell Hart and Fuller argue throughout their works on the war that surprise was the essential element in a decisive attack and that on the Western Front surprise was only possible for the Allies if they used massed tanks. As the British Tank Corps were reduced to fewer than one hundred machines after 12th August through casualties and breakdown, the battles of September were not tank battles and thus could not have been decisive.

The crux of Liddell Hart's and Fuller's misconception, as stated by Liddell Hart, is that at Amiens and Cambrai the British had used tanks "in place of any preliminary bombardment." What they failed to perceive is that the development of the techniques of unregistered fire, which allowed the preparation of a surprise bombardment, was entirely unrelated to the use of tanks. As the Germans had shown in March and the British were to repeat in September, it was entirely possible to arrange surprise attacks based on unregistered artillery fire without tanks and for these attacks to break through defensive systems. One can ask in what sense was Amiens the "tank surprise" that both Fuller and Liddell Hart believed it to be. The machines themselves could hardly have been a surprise to the German defenders for they had been fighting them for two years. The tactics of massed tanks could hardly have been a surprise to O.H. for Cambrai had seen massed tanks. The attack at Amiens was a surprise because it was not heralded by a long period of artillery ranging, registration and bombardment before the assault. The
reason these could be dispensed with was that the Royal Artillery were able to locate, range on, and hit their bombardment targets without allowing their preparations to be observed. Rather than the "tank surprise", Amiens should more correctly be termed "the artillery surprise".

There is one further misconception concerning Amiens that is a result of Liddell Harts and Fuller’s interpretation of the battle and one so universally accepted that even the critics did not question it. It is that the low Allied casualties and high German losses in casualties, prisoners and captured material were a product of the battle’s tank tactics. This view is most eloquently put by Cooper in Tank Battles of World War One, one of a number of tank histories of the Great War based closely on Fuller and Liddell Hart. Cooper writes that before the attack at Amiens a great cemetery was dug to receive the bodies of the thousands of British casualties.

"This particular cemetery was one of the finest ever seen. It was also empty, not a single grave. Across it were the tracks made by tanks three days previously when this patch of ground had been the forefront of battle. The relationship between those tracks and the emptiness of the cemetery was very close." 92

This account that the tanks saved the infantry from the fire of German machine-guns, thus saving the attacking force from the huge casualties of the 1916 and 1917 attacks, even convinced Terraine who is, in his general thrust, critical of the arguments of Liddell Hart, Fuller and the tank men. "It had been a sensational day, though not devoid of hazards" wrote Terraine of 8th August.

"By common consent the tanks had done marvels. Against German infantry and machine guns they had proved irresistible and countless infantry lives had been saved by their action. The German artillery, on the other hand, had not suffered the loss of morale that the year’s high casualties had brought in the infantry. They stuck to their guns." 93

The account by the Fourth Army’s medical officer reveals that the reverse was in fact true. The vast majority of British casualties at Amiens came from the fire of German infantry and machine-gunners. Only 27% came from hostile artillery fire. It was the
British artillery who, by improving their methods of counter-battery fire through sound-ranging, calibration and all the complexities of counter-battery, saved the assault troops at Amiens from devastating shell fire. While Terraine points out that German infantry had been surely weakened by losses sustained in the spring offensive it was the German artillery which had suffered not only the effects of the spring attack but also the concentrated counter-battery attack launched by the British in April, which inflicted 13% a month losses on the German artillery force. The casualty figures reveal that while German machine-gunners at Amiens stuck to their guns, inflicting losses on the attacking infantry, the artillery on which they depended had been destroyed by counter-battery fire.

The war on the Western Front did not end after Amiens, as Liddell Hart and Fuller would have us believe; in fact it reached its final climactic battle more than a month after Amiens. In September the British armies closed up to the great Stellungs of the Hindenburg line. The acres of barbed wire had turned a rusty brown in the two winters since the positions had been built and the gun-pits and machine-gun positions had been empty since the German armies had launched themselves out of them in the spring of 1918. But the ferro-concrete bunkers, the deep dugouts, the trenches and communication systems remained.

2 Liddell Hart, History of the First World War, p. 430. Both Liddell Hart and Fuller made these claims repeatedly in their numerous works. I will refer to History of the First World War throughout, as it is the clearest and most definitive of the works stating their view of the war.
3 Ibid. p. 460, and for further claims concerning the crucial nature of Megiddo, the entire chapter of the History, pp. 432-70.
4 Ibid. p. 262.
5 Figures of German re-inforcements from Edmonds, Military Operations France and Belgium 1918, vol. 1, p. 48.
Ibid. p. 52.

Ibid. p. 6.

See Bruchmüller, Introduction, Die Artillerie beim Angriff in Stellungskrieg.


Bruchmüller, Die Artillerie beim Angriff in Stellungskrieg, pp. 95-7.


Ibid.


The development of heavy artillery techniques, Bruchmüller, Die Deutsche Artillerie in den Durchbruchschlachten des Weltkriegs, pp. 1-5. For the disbelief among British artillery expressed at the accuracy of German fire in 1914, see J. Terraine, noting a British officer's diary which ascribed German artillery accuracy as "the amazingly efficient secret service of the enemy." Mons (London: Pan, 1960) p. 73.

Bruchmüller, Die Deutsche Artillerie in den Durchbruchschlachten des Weltkriegs, pp. 1-5.

Figures from Edmonds, Military Operations France and Belgium 1918, vol. I, pp. 52, 102, 103.

This tactical transition, from long, methodical preparation to short, surprise barrages is the main focus of Bruchmüller's Die Deutsche Artillerie in den Durchbruchschlachten des Weltkriegs. Bruchmüller's analysis of the events in which he was the principal author of change, is somewhat baffling to the modern reader because of Bruchmüller's insistence on ascribing all tactical advances to suggestions made by the Kaiser. In fact, Bruchmüller claims the "introduction and quick development of the heavy artillery... [was] ...undoubtedly due to the personal intervention and the resolute attitude of His Majesty Kaiser Wilhelm II. (p. 3). In the development of the tactics used at Riga and those employed in the west in 1918, one can find no other hands but those of Ludendorff and Bruchmüller.

Ibid.

Militar Wochenblatt, quoted in Edmonds, Military Operations France and Belgium 1918, vol. I, p. 262. Both Bruchmüller (Die Artillerie, p. 96) and Ludendorff acknowledge that the original intention of the attack was to break through with the Seventeenth Army.

Ibid. German post-war military analysis concluded this was a profound strategic error.


Ibid.

This agreement and its inadequacies is reviewed in some detail by Edmonds, Military Operations France and Belgium 1918, vol. I, p. 81-6.

Bruchmüller, Die Artillerie beim Angriff in Stellungskrieg, p. 115.


Haig Diary, 10th November 1917, WO 256.


That so many men were found so quickly would seem to support Edmonds' contention that the Government in London was deliberately keeping troops away from the Western Front in the spring of 1918, fearing that Haig would employ them in other offensives. (Military Operations France and Belgium 1918, vol I, p. 51). Edmonds then blames the collapse of the Fifth Army on
lack of reserves and thus the entire defeat of it laid at the door of the Cabinet Committee "not one of whose members was a soldier".

31 Shell output from British factories had been rising steadily since 1915. Total weekly output of completed rounds was in July 1916 ten times greater than the weekly output of July 1915. By December 1916 it was fifteen and a half times and by July 1917, twenty-six times. By mid-1917 shell production finally outstripped demand and stockpiling began. It also allowed shell factories to convert to repairing worn guns. This meant that while only 25% more guns were built in 1918 than in 1917, 50% more guns were available. History of the Ministry of Munitions, vol. II, chap. 1, part 1, pp. 54-5.

35 O.A. 196, 30th June 1918, Notes on counter-battery work, Rawlins, History of the Development of British Artillery in France 1914-1918, MD 1162, p. 201.
37 Ibid., O.A. 196, 30th May 1918, Notes on counter-battery work.
38 The 13% figure is derived from a captured report by Ludendorff dated 1st of August but which does not nominate which month he was referring to. As July saw the major French counter-attack and the climax of the British counter-battery attack, July is almost certainly the month. The report is mentioned by Edmonds (Military Operations France and Belgium 1918, vol. IV, p. 8) and he too concludes that it probably refers to July. If it did in fact relate to April, May or June, German losses would have been even greater than 13% in July.
41 Notes on recent fighting, No. 19, 5th August 1918, issued by General Staff, Final Offensive, 468/2, AWM 26.
42 Fourth Army Artillery instructions. 20th June 1918, Final Offensive, 468/2, AWM 26.
43 Monash highlighted this role for the tanks, in the supply and protection of an advancing attacking force in his Notes on Recent Fighting, No. 19, 5th August 1918, 468/2, AWM 26.
45 Unlike the other aspects of the preparation for Hamel, the meteor telegram just prior to attack was abandoned by the 18th of the month, after Amiens. It was realized that the Germans, overhearing the radio transmission of the weather information might be warned of the attack. After the 18th the reports went out hourly during the morning every day to every division. Thus the Germans would be unable to deduce anything from the messages. Meteorological Section, Fourth Army, No. N/59, 18th August 1918, 468/2, AWM 26.
46 Fourth Army Artillery instructions, 20th June 1918, Final Offensive, 468/2, AWM 26. The preparations of Hamel and the nature of the bombardments is reviewed in some detail by Rawlins, History of the Development of the British Artillery in France 1914-1918, pp. 207-12.
47 Ibid.
48 Notes on recent fighting, No. 19, 5th August 1918, issued by General Staff, Final Offensive, 468/2, AWM 26.
52 Notes on recent fighting, No. 19, 5th August 1918, issued by General Staff, Final Offensive, 468/2, AWM 26.
Tudor Diary, 19th July 1918, MD/1167, Tudor Papers.

54 After the war there was some controversy over who actually suggested the Amiens attack, with competing claims for the credit from, or on behalf of, Foch, Haig, and Rawlinson. What all agree is that in meetings between the three men, shortly after Hamel, the general plan was agreed to. What is of interest to the artillery historian is not who first suggested the Amiens location but that the surprise bombardment tactic of the attack was accepted without discussion by all men for whatever attack was launched. Edmonds examines the meetings and emergent plans in detail promoting Haig’s cause as the battle’s originator, (Military Operations France and Belgium 1918, vol. IV, pp. 1-10), Liddell Hart promotes Rawlinson, because of his "deeper appreciation of the moral element" (History of the First World War, p. 426). Another example of how the crucial improvements in tactics has been overlooked because of the concern with either attacking or defending Haig.

Artillery Resources with corps of Fourth Army on 8th August 1918, undated but presumably 9th August M.G.R.A., Final Offensive, 468/2, AWM 26.

Fourth Army H.Q., G.S. War Diary, 8th August 1918, Final Offensive, 472/2, AWM 26.

Ibid.


Ibid.


Ibid.


Fourth Army Intelligence, Weekly Appreciation for Period 29th June to 5th July 1918. Because of the extensive raiding by the Australian Corps and the prisoners taken at Hamel, combined with the complete air supremacy of the R.F.C. the Fourth Army had not only an accurate picture of the number of German divisions and batteries facing them but of their condition as well. Defence of Amiens, Operations Files, 350/9, AWM26, AWM.

Von der Marwitz made his assessment of his division in a report to O.H.L. on 3rd August. As the Official History records, the Official German Monograph on the disaster of the 8th, drawn up as part of the post-war inquiry into the loss of the war, concluded von der Marwitz was over-stating the Germans’ fighting ability. Edmonds, Military Operations France and Belgium 1918, vol. V, p. 11.

Fourth Army Intelligence summary, 9th August. The Fourth Army reported that "from zero hour onwards shelling in central and southern Corps front was very slight at first, finally dying down altogether. A few shells from H.V. guns [ie. long-range 15- and 18-inch guns] were scattered over the area taken". Final Offensive, Operations Files, 472/2, AWM26.

Ibid.


Taking the entire four years on the Western Front, British casualties were 58.51% from shell fire and 38.98% from rifle and machine-guns. (2.19% bombs or grenades, 0.32% from bayonet). But this averages out the great swings in percentages. There were two periods where rifle/machine-gun casualties were most frequent - 1914-1915, and then again in 1918, as we have seen in Amiens. In the latter part of 1916 and all of Arras and Flanders, casualties from shell fire far outweighed those from rifles and machine-guns. Casualty
70 War Diary, G.S., Fourth Army, 8th August 1918, Final Offensive, 472/2, AWM 26.
74 Deutsche in Weltkrieg, p. 445.
75 This is clear, despite Ludendorff's attempts to disguise his obstinate position in his memoirs. Ludendorff, Mein Kriegserinnerungen (Berlin: Mittler & Sohn, 1936).
76 Fourth Army Intelligence, Summary of Information, 9th August 1918, Final Offensive, 472/2, AWM 26.
78 Ibid.
79 Fourth Army Intelligence, Summary of Information, 11th August 1918, Final Offensive 472/2, AWM 26.
80 Liddell Hart can not bring himself to acknowledge that at this late stage Haig was making some improvements to his tactical thinking. After stating that Foch opposed the closing down of Amiens, and the resumption of the attack with another army, Liddell Hart then claims that Haig should not be applauded for this because "It would be unjust, as many British writers have done, to claim that Haig initiated this strategy, for it is clearly traced in the successive attacks already begun by the French in the South". (History of the First World War, p. 430). But if Foch instigated the "strategy" of successive attacks by different armies, why did he oppose Haig doing exactly that?
82 Ibid. p. 222.
85 Ibid.
86 Ibid.
87 Liddell Hart, History of the First World War, p. 423.
88 Ibid.
89 Ibid.
90 Fuller, quoted in Douglas Orgill, op.cit., p. 84.
92 B. Cooper, Tank Battles of World War One, p. 78.
"I know the War Cabinet would become anxious if we received heavy punishment in attacking the Hindenburg line without success."\textsuperscript{1}

Henry Wilson's "personal" note to Haig. 1st Sept. 1918

"What a wretched lot of weaklings we have in high places at the present time."\textsuperscript{2}

Haig's response.
By 29th August 1918 the German armies facing the British forces on the Western Front had completed the withdrawal precipitated by the attack at Amiens. They had fallen back to a line of old defensive positions and natural obstacles roughly twenty miles in advance of the Hindenburg line, the most important of which were the Drocourt-Queant line facing the First Army, and the Somme river blocking the further advance of the Fourth Army. Here Ludendorff hoped to halt the British armies for the winter, with the security of the Hindenburg positions behind to fall back to in the case of breakdown of the defensive line.3

O.H.L. hopes of making a stand at the end of August and retaining some of the territory won in the Spring advance were rapidly dashed by the continuing advance of the British Fourth, First and Third Armies. Haig continued the policy demonstrated after Amiens of ever widening the battle front, rather than attempting to make a deep decisive penetration at any one point.4 Between 31st August and 2nd September the British armies engaged the German defences along an almost continuous 90-mile frontage and made two crucial advances. On 31st August the Australian Corps took Mount St. Quentin, a fortified hillock of 140 feet on which elements of five German divisions protected the Somme crossings near Peronne. The attack, made without tanks, employed an intensive unregistered bombardment. To overcome the wire entanglements which were more prevalent here than in the advances immediately after Amiens, the attack was supported by five brigades of field guns. At the moment of attack these fired a heavy three-minute bombardment of shrapnel, with all shells fused with the 106 instantaneous fuse. While this did not completely clear the wire, it slashed it enough for the infantry to cut their way through with hand shears. To cover the infantry while they may have been held up at the wire, the entire hillock was shrouded in a smoke bombardment from the moment of attack.5 The attack was launched in the dawn light of 5 am, catching the defenders of the hillock completely by surprise. Within two hours most of the garrison were prisoners, and the Somme crossings were secure.6

Even worse was to come for the German commanders. Two days later the Canadian Corps forced its way through the Drocourt-Queant line of defences. The attack employed a
surprise unregistered barrage, and while the Canadians had the assistance of 80 tanks, the attack was launched in pre-dawn light and under the cover of smoke to ensure that remaining wire could be cut by hand. Again the German defences were unable to repel the Canadian assault and retreated from the prepared positions.\(^7\) By mid-afternoon on 2nd September Ludendorff acknowledged that a complete withdrawal to the old Hindenburg line positions was inevitable. As the attacks were almost continuous along the frontage against the British, and the French First and Tenth Armies were also slowly advancing against him, he could hardly strip the quiet sections of front to reinforce positions where the Canadians and Australians had broken through, as he had done in previous years. There was no substantial quiet section of front that could be further reduced. The tactics employed by both the British and French, of surprise attacks made with limited objectives, one after another in different areas of the front, forced Ludendorff to defend his entire frontage. For the first time on the Western Front the Allies employed a strategy that allowed them to exploit the advantage in sheer manpower and guns that they held over the German armies. The result was that in August and early September the Germans were forced out of the great salients made during the spring offensive, back to their last line of defence, the great Stellungs of the Hindenburg line. The order was issued by Ludendorff just after 2 pm in the afternoon of 2nd September, presumably after the news of the Canadian breakthrough of their Drocourt-Queant position.\(^8\) In the north the German armies fell back over fifteen miles, giving up Messines Ridge and all of the ground won in the Flanders attack in spring. Along the rest of the front the withdrawal was of similar proportions, between twelve to fifteen miles of retreat back to the positions built in the winter of 1916/17. Here the last bitter act of the Western Front’s bloody drama would be played out.

In the ten days after 2nd September there was a pause in the intensity of the fighting, the quiet before the storm, as the German armies fell back, and the Allied troops trudged after them. As they withdrew the Germans smashed the bridges, destroyed the roads and tore up the rail lines, slowing the Allied pursuit. Rearguards of machine-gunners and field guns harassed the advancing troops, but essentially the rival armies drew breath before the
next crucial engagement. During this pause there were considerable soul-searching and
doUBts in the political and military Commands of rival forces on the Western Front. The
strain of events since 8th August was affecting Ludendorff's command, as recalled by
Lossberg, author of Defence in Depth who was, in 1918, serving as Chief of Staff to
Boehn's group of armies, the Army Group facing the British Fourth Army.

On 6th September Ludendorff called the Chiefs of General Staff of the Army Groups
together at O.H.L. Lossberg recalls that Ludendorff looked to be in

"a very nervous state, completely different from his former determined
manner. The troops came in for a good deal of condemnation from his
mouth. He made the troops and their leaders responsible for the events of the
past days without recognizing that his own faulty leading bore the main brunt
for what happened. He gave notice that an O.H.L. order would be issued
reducing infantry battalions from four to three companies as reinforcing of
both officers and men was lacking. The baggage also would be cut down as
Ludendorff demanded sharp measures against shirkers."9

Wetzell, the Chief of the Operations Sections O.H.L. was dismissed, after arguments with
Ludendorff, and Lossberg himself became involved in a disagreement. Lossberg argued
that preparations for a retreat if the Hindenburg line was breached could begin immediately,
along a line from Antwerp to the Meuse, a massive withdrawal of over fifty miles.
Ludendorff dismissed this, and ordered all efforts to be put towards restoring the
Hindenburg reserve lines. He committed his forces to a final stand along this, the greatest
of their defensive constructions. If it fell there could be nothing but complete retreat.

Nerves were also stretched in the British Cabinet as a telegram from Wilson to Haig
demonstrated.

"Just a word of warning in regard to incurring heavy losses in attacks on the
Hindenburg line as opposed to losses in attacks driving the enemy back to that
line. I do not mean to say that you have incurred such losses, but I know the
War Cabinet would become anxious if we received heavy punishment in
attacking the Hindenburg line without success."10
While the War Cabinet may have been anxious, neither Foch nor Haig was exhibiting any signs of nerves. In a note to Haig, Pétain and Pershing on 27th August, Foch outlined the Allied plan.

"At the moment at which we have arrived, the factor of surprise and the wide flung nature of the attacks which we are launching against the enemy, will compel him to take very hurried counter-measures to reinforce his troops holding the line."

Foch, who was as offensively inclined as Haig in his strategic thinking, did not heed the warnings from Paris and London to wait until 1919 for further American reinforcements. He believed that

"If we do not give the enemy time to recover we shall encounter nothing but disorganised and intermixed units, at the very most only improvised measures can be taken to stop us."11

He outlined four great offensives, throwing twelve Allied armies with over six million men at the German line over a period of three days from 26th to 29th September. First, on 26th September the great push would begin with a joint attack by the First American and Fourth French Army. The next day British Third and First Armies would join the fray, attacking the Hindenburg line near Cambrai. On the 28th the newly formed Flanders group of armies, consisting of the Belgian Army and the British Second Army, would launch a final offensive in the north, the last of the many battles of Ypres. Having launched attacks in the south in the Argonne, then the north in Flanders, the last crucial blow would fall on the 29th. The British Fourth and French First Armies would then drive through the centre of the German line, the strongest and most highly developed of the Hindenburg line's sections, the Siegfried Stellung.

The attack by the Fourth Army demands close attention because its task was the most vital and the most difficult conducted as it was along the frontage protected by thirteen of the best remaining German divisions. The Fourth Army's assault also provided an interesting comparison with an assault two years before. The same Army with the same
Army Commander, Rawlinson, had attacked in the centre of the German line and had been repulsed in the catastrophic opening of the Somme campaign. Now, just over two years later and some twenty miles from the old Somme battlefield, the Fourth Army and Rawlinson returned, to again try and drive through the strongest of German defences. The tactical approach, the preparation, and the resulting battle would be vastly different to the effort in 1916.

If the Fourth Army's attack on the Siegfried Stellung reveals how British offensive tactics had changed since 1916, the defences they assaulted demonstrated the changes in German thinking. When the Fourth Army attacked on 1st July 1916 they faced an immensely strong but shallow defensive line, with essentially a front line, a reserve line, and then the artillery positions, spread over three or four miles. In the effort to escape the increasingly destructive fire of Allied barrages, German defences had got deeper and deeper and had incorporated a multitude of outpost lines, main lines, reserves lines, and intermediate positions. The Siegfried Stellung was the deepest and most complex of these defensive positions, with six distinct lines of defence spread over ten miles. The building of the Siegfried Stellung's defences had begun in 1916, prior to the German withdrawal to it in the winter of 1916 and 1917. The position originally followed the line of St. Quentin Canal, incorporating the canalized river as a central anti-tank obstacle. The Germans had built their main line along the canal with the outpost line on the western bank and artillery lines on the eastern bank. By the spring of 1917, however, the Germans had realised the folly of this arrangement. Not only were German defensive tactics emphasizing far greater depth, but by placing the main line along the canal the artillery lines were overlooked by the western bank, held only by the outpost line. During 1917 the outpost line was strengthened to the level of the main line and a new forward defence was built incorporating old British positions. After the spring offensive the British trenches abandoned in the retreat were converted into further forward positions.
On 3rd September, when it had become obvious that the Germans were withdrawing to the Hindenburg line, Haig requested his Army commanders to outline "the enemy dispositions and probable intentions." Rawlinson’s answer was both lengthy and detailed. He reviewed the six lines of the Siegfried Stellung. The first defences that the Fourth Army would encounter in an advance had been abandoned in the March retreat, the British reserve line, main line and outpost line. Each of these had been partially restored by the Germans and constituted a vast forward position of some three miles depth. The strongest of them was the old British main line where the ruined villages of Le Verguiser, Basse, Boulogne and Epehy formed the central focus of defence. After the three old British lines came the three lines of the Siegfried line proper. First was the advance main line. This had originally been the outpost line, but had been upgraded, then the original main line following the canal and behind that, on the eastern side of the canal, the reserve line.

The canal itself formed a remarkable feature in the Siegfried Stellung’s defences. Along most of its length the canal was approximately 35 feet wide and 50 feet deep with reinforced sides at 50 degrees. The Germans had dammed it some time in 1917 producing 10 feet of water along most of its length by the summer of 1918. Wire had been used to cover both sides of the canal and had been deliberately entangled down both banks. Mutually supporting machine-gun positions were on both banks, particularly the eastern side, firing either across the canal or down its length. At one point the canal ran underground in a long tunnel of 13 kilometres from Le Tronquoy to Vendhville. A smaller tunnel, an incomplete offshoot, had its entrance at Bellenglise. Both of these had been converted by the defenders into vast dugouts, holding hundreds of men. In the tunnels, kitchens and field hospitals had been built and barracks for counter-attack troops who would emerge from their protection if any assault threatened the position. Above the 13 kilometres of the tunnel’s length the Germans had constructed five defensive lines with forward field gun positions to drive off any tank attack. Yet despite the concentration of defences over the tunnel, it remained the obvious place for the British to breach the main lines of the
Stellung. Only here could the British employ tanks, which could not cross the 35 feet width of the canal, which also presented an apparently impossible obstacle to the infantry.

Having outlined the nature of the formidable defences, Rawlinson reviewed the offensive options before his Army, and resources at his disposal. One advantage the Fourth Army held was that it was obvious from the fighting in late August that Von Boehn's Army Group was both disorganised and exhausted after its efforts in the spring and then the long retreat after Amiens. Much of the artillery was worn and short of ammunition after several rapid changes of positions and the Germans, of course, had no means of rapid calibration as the British did, nor did they have the abundant supplies of spare parts and shells that the Ministry of Munitions was supplying to the Royal Artillery. As the fighting at Amiens had demonstrated, the Fourth Army's artillery was capable of eliminating the German artillery as a significant factor in the defence. The second advantage the Fourth Army had was that it had unprecedented intelligence concerning the nature and positions of the German defence. This came from two sources - one the product of bitter and bloody labour, the other a stroke of good fortune. In the summer of 1918, the Allied air forces eventually gained a decisive and undisputed superiority in the skies. Having finally caught up with the German technology that allowed forward-firing machine-guns through the propeller blades, and the high-powered rotary engines that allowed Allied planes to match the Germans in speed and manoeuvrability, the R.F.C. inflicted mortal wounds on the Luftwaffe in the spring offensives. By September 1918 the air wings attached to the Fourth Army were free to roam over the German positions almost unmolested, photographing every new trench line dug, and recording the restoration of the old Hindenburg positions.\textsuperscript{14} The second source of Fourth Army intelligence was one that had been won at Amiens. Late in the afternoon of 8th August, as the Australian Corp was overrunning the rear positions of the German defences, a group of soldiers under a Lieut. Rollings had charged and captured a German Corps headquarters taking its Staff entirely by surprise. Among the papers found was a detailed map of the section of the Siegfried Stellung the Corps had held during the summer of 1917, between Bellecourt and St. Quentin.\textsuperscript{15} It was remarkably detailed, showing every
machine-gun nest, communication line, even the latrines. The map also showed aiming points and artillery reference positions for the use of the German artillery in the event of the position being overrun by the British.\textsuperscript{16} It was a remarkable capture. In one stroke it laid bare the nature of the Hindenburg line defences and removed the need for Fourth Army’s artillery to conduct general bombardment. From the map the artillery could develop a highly specific artillery attack on the vital elements of the defence, the communication lines, gun-pits, machine-gun positions and dugouts. In fact, given the overwhelming power of the Royal Artillery in 1918 and the accuracy they had developed since 1916, the capture of the map on 8th August sealed the fate of the Stellung’s defenders.

Having reviewed the obstacles in the Fourth Army’s path, Rawlinson outlined the tactical approach he would take in the assault. If we recall the British attack in 1916, the Fourth Army’s approach had been simplicity itself. They had shelled the entire three lines of the German defence for eight days, and then attempted to launch the infantry through all three lines in one great push. In the event, most of the British infantry had not even made it to the first of the German trenches. In 1918, despite the evident crumbling of the German defence, the bitter lessons of 1916 and 1917 were not forgotten. The attack was to be a series of limited advances, each capturing one of the German positions but none pushing further than the artillery could support. It was, in fact, the sequential advance advocated by Rawlinson in 1916 prior to the Somme but overruled by Haig, and by Plumer in 1917 for Flanders, again ignored by Haig. Rawlinson also pointed out that once the German forward positions were captured the attacks on the advance main line and the old main line would have to employ long bombardments. The tunnels, Rawlinson believed, were the obvious place to breach the old main line as only here could tanks be used and a canal crossing under machine-gun fire avoided. The defences over the tunnels were so strong and the objective of the attack so obvious that a short surprise bombardment would be impossible.

The final sequence of Allied offensives began on 12th September when the American First Army attacked. The next day Haig approved the plans submitted by his Army
Commanders for the final offensive against the Hindenburg line. The Third and First Armies’ review of the defensive positions before them were almost as detailed as Rawlinson’s and, like his, advocated a sequence of limited advances conducted by the three Armies simultaneously. They also agreed with Rawlinson’s contention that it was best to begin the sequence of assaults immediately, denying the Germans time to rehabilitate their old positions. Thus, only five days after Haig approved the plans, the Fourth Army began its attack on the Stellung with what is now known as the battle of Epehy.

Its objective was to overrun the old British trench lines that the Germans had converted to a vast forward defence. While there was much British wire still in the defences, it was positioned to halt an attack from the east, not west. The British had never made much use of ferro-concrete bunkers in their defences and the Germans had not had time to build any since falling back to the positions in the first weeks of September. For these reasons Rawlinson and his Corps Commanders agreed again to use an unregistered barrage and the artillery tactics that had served them so well since Amiens. The Fourth Army had 1,488 guns to use in its bombardment, 978 field guns (18-pdrs. and 4.5-howitzers) and 510 heavies. The bombardment preparation was identical to Amiens’, with careful surveying in of guns, the identification and location of hostile batteries by sound-ranging, flash-spotting and aerial location, and calibration of all guns, even the field guns, before the attack’s launch on the 18th. One major difference however, was the absence of tanks. The Fourth Army Commander, wanting to husband his resources for the assault on the main section of the Siegfried position, allotted only 20 tanks to assist the assault on Epehy. Assaults in early September had revealed that a heavy creeping barrage, using the 106 fuse exclusively, could cut most of a wire barrier away. If the battlefield remained shrouded in smoke it was possible for the infantry to cut their way through the remainder. As at Amiens, the creeping barrage was 10% smoke and also as at Amiens, the great majority of the Fourth Army’s heavy batteries (66%) were to fire an intensive counter-battery attack at the moment of assault, using gas and H.E.
The significance of the Siegfried Stellung’s forward defences was not lost on the German command. Rather than being held by trench divisions which would be sacrificed in any advance, the old British positions were defended by the troops of Alpine Corps, one of the elite German attacking Corps. Despite its illustrious record the Alpine Corps was, by the 9th month of 1918, a badly overworked instrument, particularly with respect to its artillery. After leading the attacks in spring and then acting as a rearguard in the retreat since Amiens, the Alpine Corps artillery had been fought into the ground. After losing heavily to British counter-battery fire and unable to repair or correct for the continuous wear since spring, the Corps’ artillery were entirely unable to protect their comrades in the infantry when the Fourth Army’s assault suddenly descended at 9.30 on the morning of the 18th.\textsuperscript{20}

As a regimental historian from the Alpine Corps recorded, the troops in the advance positions, who lacked the concrete bunkers and deep dugouts that had protected them in the Flanders fighting of 1917, were simply driven out of their positions by the intensive creeping barrage from the Fourth Army’s guns.

"Sections of trench were flattened out in a minute, exits of dug-outs blown in, remnants of walls collapsed, machine guns and trench mortars were covered up by earth, and rubbish and ammunition dumps exploded."\textsuperscript{21}

The Alpine Corps were almost completely overrun and most were captured or driven back by the Australian Corps. On the flanks, the IX. and III. Corps had made less progress but the III. Corps had captured the heavily fortified village of Epéhy. The Australians’ advance was so deep that they had not only passed over the old British positions but had gained a foothold in the advance Hindenburg main line and overlooked the canal itself. The situation was critical for the German Command by midday of the 18th. Within four hours the Fourth Army had not only captured the Siegfried Stellung’s forward defences but were now in a position to range on the main canal defences with the full might of their artillery. Desperate and immediate counter-attacks were ordered with three fresh divisions from the main defences and the remnants of the Alpine Corps flung at the Australian Corps’ advanced
positions. In these afternoon assaults and the major counter-attacks in the days that followed, the superiority of the Fourth Army’s artillery in the counter-battery duel, and the exhausted and worn state of the German artillery were fully exposed.

The Commander of the German Seventeenth Army, Von der Marwitz, deployed his entire reserve of three divisions at 5 pm on the afternoon of the 18th. The attacks failed completely, as Regiment no. 92, who led the assault, recorded "The supporting artillery fire was wholly ineffective. So the attackers advanced little more than a hundred yards." The Seventeenth Army’s artillery were kept under constant counter-battery fire during the aborted counter-attack and their observation obscured by the pall of smoke over the battlefield. Unlike the British, whose sound-ranging allowed them to range onto targets obscured by smoke or gas, German gunners were still entirely dependent on visual observation from the air or ground. While the entire attacking zone was cover by smoke shells and with the R.A.F. dominant in the skies, the German artillery of the Seventeenth Army found itself in much the same position that the Royal Artillery had been in on 1st July 1916, out-gunned, out-ranged, unable to register onto targets, and in the end, unable effectively to intervene in the infantry battle before them. The result was that, as had been the case for the British infantry two years before, the German counter-attacks were cut down by heavy machine-gun fire and the constant strafing of shrapnel shells. When darkness fell the counter-attacks had failed to drive the Australian Corps off the high ground overlooking the Hindenburg line proper, and almost the entire forward position of the Siegfried Stellung was lost. German casualties were heavy, over 15,000, of whom over 7,000 were prisoners. British losses were less than 3,000. On the Fourth Army’s flank the Third Army had also made a small advance, preceded, like the Fourth Army’s attack, by an unregistered barrage according to the Amiens formula. They too had inflicted heavy losses and captured over 2,000 prisoners. Thus, in the space of twelve hours on 18th September the British captured almost 10,000 of the best remaining troops in the German Army, 100 artillery pieces, and 500 machine-guns, inflicted total casualties of over 20,000, destroyed four elite
divisions, and captured jump-off positions for the next major attack, all for a cost less than one fifth of the casualties suffered on 1st July 1916.

Ludendorff reacted immediately to the disaster, sacking Von der Marwitz, the experienced and respected Commander of the Seventeenth Army, withdrawing the remnants of the Alpine Corps from the Western Front, and then personally organising a major counter-attack to reclaim the high ground.25 This was carried out by the 8th Division which had been resting near Le Cateau and which contained a number of high quality regiments. This new division, with its artillery supplemented by the remaining guns of the Alpine Corps, was in position by the 21st and attacked on the 22nd. These were complete failures, as the immediate counter-attacks on the 18th had been. The re-inforced German artillery still could not suppress the fire of the Fourth Army’s defensive barrages and the inaccuracy of the German fire demonstrated the desperate haste with which it had been prepared and the worn state of the German guns.

One of the counter-attacking regiments was the 153rd, the Ultenburgers. They were fully aware of the crucial nature of the counter-attack,

"Because of the loss of this portion of the line the enemy possessed a good view over our positions up to the canal, while our observation of the enemy position was taken away. It did not surprise us that, with the order to take over the position of the Alpine Corps, also came the order to unconditionally regain both farms."

The two farms referred to were strong points on the high ground, Peit Uriel and Tombois. The Ultenburgers were halted after advancing only 400 meters by heavy defensive barrages from the Fourth Army’s guns and by the short shooting of their own guns.

"Further advances were halted by the too slow forward movement of the creeping barrage... The first company suffered many hits from their own heavy howitzers during which the company and a large number of soldiers were put out of action."
The Ultenburgers, after sustaining heavy losses, were "prevented from advancing by their own and the enemy's fire and went back to their starting points..." The 72nd Regiment, who attacked alongside them suffered the same fate; "because of the too short [German] fire and the strong enemy defence [the 72nd] went back to the starting position."

The German artillery supporting the attack was kept under intensive counter-battery fire all day, with smoke, gas and H.E. As the historian of the 74th field artillery Regiment reveals, the short shooting was the result of the worn German guns, the complete breakdown of artillery communication, and the inability to observe fire in the smoke and gas pall that the British artillery laid over the entire German artillery position.

While the German counter-attacks were driven off on 23rd September, and the Fourth Army consolidated its position overlooking the canal and the main Hindenburg defences, the Commanders-in-Chief of the Allied forces were meeting to fix the dates for the next sequence of attacks.

"Having returned to my headquarters at Bourlon and after the conference with the Commanders-in-Chief, I definitely fixed the time schedule for the general offensive from the Meuse to the North Sea.

September 26th  A Franco-American attack between the Suippe and the Meuse.

September 27th  An attack by the British First and Third Armies in the general direction of Cambrai.

September 28th  An attack by the Flanders group of armies between the sea and the Lys, under the command of the King of the Belgians.

September 29th  An attack by the British Fourth Army, supported by the French First Army in the direction of Busigny."

While the Allied Commanders drew up the grand scheme, the Fourth Army Commander and his Corps Commanders were already developing the details of the attack on the Siegfried Stellung and the canal. Monash, the Australian Corps Commander, put forward his views on the tactics the Army should adopt, now that it faced the well prepared
defences of the Hindenburg line. Monash argued that a canal crossing was too complex and risky to contemplate.

"To cross the canal unaided, he held, would involve great loss of life; he would not have committed the Australian troops to the attempt and did not suggest the task for others."30

Thus, concluded Monash, the long tunnel, despite the density of defences over it, was the only place to attack. Here tanks could be employed and here there was no danger of troops being trapped under machine-gun fire whilst crossing the canal. The logic of the argument would, Monash believed, be as evident to the Germans as themselves and thus the surprise tactics the Fourth Army had been employing in every attack since Amiens would, in this case, be inappropriate. Monash and Rawlinson agreed that a surprise barrage, unregistered and prepared without observation, would probably fail to crush the extensive defenses and would in all likelihood not catch the defenders unprepared. Thus it was decided to return to a long, heavy preliminary bombardment, not as long as the eight-day bombardment of the Somme, but lasting two days from the 27th to the attack's launch on the 29th.31 The Fourth Army had 1,636 guns for the bombardment, 1,044 field guns and 592 heavies, and had a stockpile of half a million shells for the bombardment, and then for the attack itself.32 Included in the stockpile were over 30,000 rounds of mustard gas shells (B.B.'s) which the Ministry of Munitions had been developing since 1917 and now made available for the first time. It was hoped that German gas masks would be unable to keep the mustard gas out and the artillery plan called for the entire German artillery positions to be smothered by B.B. for the duration of the bombardment.33

The infantry plan developed by Monash was complex. Despite having to employ a relatively long bombardment, Monash continued to advocate a strictly limited sequence of infantry advances. This would begin on the 26th under the cover of the bombardment, opening with a short advance to capture the remaining high ground adjacent to the tunnel section of the German line. Once these jump-off positions were taken, field guns and infantry would move forward on the 27th to their attack positions for the assault on the main
Hindenburg line. On the 29th the tunnel section of line would be taken and consolidated. After that attack, there would be another pause while the guns came up for an assault on the artillery lines. Monash requested two fresh divisions to replace the exhausted and depleted 1st and 4th Australian Divisions. He was given the American 27th and 50th Divisions and planned to use them to lead the main thrust on the 29th. In its proportions the bombardment was the same as the long bombardments used by Plumer’s Second Army in Flanders with two thirds of the heavy guns attacking the German gun positions with gas or H.E. while the remaining heavies and field guns attacked the strong points and lines of communication. Rather than repeatedly passing the creeping barrage over the wire barriers, as Plumer had done, Monash allotted particular batteries of 4.5-inch and 6-inch howitzers to cut lanes through. These batteries were exclusively supplied with shrapnel shells fused with the 106 and could concentrate their fire for two full days on smashing particular wire entanglements.

While preparations were being undertaken for bombardment, Rawlinson received another proposal for the assault from General Sir Walter Braithwaite, Commander of IX. Corps. Braithwaite evidently did not believe a canal crossing was impossible, as Monash did, and put forward a plan to storm the canal with one of his divisions, the 46th. While the two-day bombardment of the tunnel section of front would attract all the German attention, Braithwaite’s Corps would prepare a surprise unregistered bombardment and rapid infantry attack a few miles to the south at Bellenglise. Any preliminary wire-cutting or counter-battery fire would be mistaken by the Germans as simply flanking fire for the tunnel attack, the Germans believing, as Monash did, that the tunnel was the only place an attack could succeed. When, on the 29th, the main attack went in over the tunnel and German guns and reserves were fully engaged, the IX. Corps would fire a concentrated unregistered bombardment and creeping barrage along a narrow divisional frontage. This Division, the 46th, would then storm the western bank of the canal, cross the water, and capture the eastern bank. The 32nd Division would then pass through the 46th (leap-frogging the division, the complex procedure developed since the Flanders campaign of 1917) and carry
on the attack. Braithwaite’s plan was an audacious one, resting upon the power of the artillery to fire a concentrated surprise bombardment at the moment of attack, intensive enough to suppress German fire while the canal was crossed, and upon the belief that the German’s defence around Bellenglise, secure behind the canal, could be taken unawares. 

What Braithwaite proposed was the application of the artillery tactics of Cambrai against the most highly developed of German defensive positions manned by the best German divisions but without the assistance of tanks.

The complex plan for the breaching of the Hindenburg line marks the high point of British offensive planning on the Western Front, encapsulating all the tactical lessons learnt in four years of brutal offensives. It was, first and foremost, an assault based on the destructive power of the artillery, particularly the heavy artillery. It was a series of limited attacks, none aiming to pass beyond the protective range of the artillery, and each organised to meet the inevitable counter-attacks that would follow any advance. Its tactical approach was not based on any dogma created in ignorance of the German defence position, but was carefully arranged in the light of a detailed and accurate assessment of the strengths and weaknesses of the defence. To maximise the effectiveness of the assault there were different tactical approaches taken by the different divisions of the Fourth Army. For the Australian/American attack on the tunnel a long, heavy bombardment was used, for here surprise was impossible. For the 46th Division’s assault the supporting guns were silent to enhance the surprise of a canal crossing. But in both of these different artillery formulas the dispositions, preparations and tasks of the various guns was roughly the same. The majority of the heavy guns (66%) were devoted to the crushing of German artillery fire. The infantry were protected in the assault by an intensive and deep creeping barrage. All guns were surveyed in, carefully calibrated and had precise ranging information for their targets and all were primed to react to the infantry’s S.O.S. flares with defensive barrages to stop counter-attack. In 1918 there was no single tactical innovation, no one technological breakthrough, that made the British offensives so much more successful than those of the previous years. It was the gradual and cumulative creation of an effective artillery force
with the tactical experience to apply to a problem the optimum artillery technique. On 29th September Rawlinson was to reap the full reward for his authorization of the IX. Corps’ plan, for the preparations for the Australian/American sequential advance up to the tunnel position encountered a number of problems in the preparatory stages.

Even before the full bombardment of the canal defences was begun the Fourth Army made a series of limited attacks on the 26th which aimed to capture the jump-off positions for the main assault over the tunnel. These were first attempted by the III. Corps. The III. Corps were, however, much weakened by their constant fighting in 1918 and failed to advance the 1,000 yards to the German trench line which the American divisions were to use as the start line for the major assault. Without the assistance of the general bombardment, III. Corps made no headway into the German position. General Butler, himself just returning to active service after a return to England, ordered after the evident strain he suffered in March during the attack on the Fifth Army, seemed completely pessimistic, even at this stage where the Fourth Army seemed poised for a decisive victory. When asked by Rawlinson if he considered fresh divisions re-inforcing III. Corps could successfully take the trenches, Butler answered that III. Corps were done as an attacking force. Rawlinson withdrew the III. Corps divisions from the line. This, however, disrupted Monash’s plan for a sequential advance. The two American divisions would have to be rushed forward, occupy III. Corps positions on the 26th, attack and hold the jump-off line on the 27th, and then spearhead the main assault on the 29th.

The American divisions’ assault on the 27th proved only partially successful with the 30th Division capturing all of its objectives while the 27th were driven back in confusion by stern resistance from the German 153rd Regiment which had just been brought into the defence. The reasons for the failure have received much analysis, particularly by American historians who hotly dispute the account Edmonds gave of the battle. It would seem, however, that the inexperience of the 27th Division’s officers and Staff and their lack of
knowledge of co-operation with tanks, combined with a heavy morning fog, led to the attack breaking down in confusion, almost as soon as it began.38

Only when the afternoon sun began to clear the fog from the battlefield on the 27th, and the R.A.F. could put its spotters in the air, did some sort of overall picture of what had happened emerge. Most of the 27th Division had been driven back to their original trenches, the Germans’ forward strong points were still in German hands and any patrol that approached them was met by machine-gun fire. However, reports continued to arrive claiming that Americans had been seen deep in the German position, but whether these were isolated parties or a large body of men was unknown. (As with the tanks, the Americans were inexperienced in ground-to-air communication and when pilots flew over the Americans the troops failed to use the flares they had been issued with for the purpose). This uncertainty left the American command and Monash in a terrible dilemma. It was clear that the 27th Division would be unable to attack again on the 28th. Its troops were in chaos and it would take a day to reorganize them. This meant there was no chance of the Americans being in their positions for the major attack on the 29th. The artillery were ready, the barrage lines drawn up, but the Americans were now half a mile behind the planned barrage. Two options faced the Allied commanders. They could pull the barrage back so that it would conform to the 27th Division’s present position, or they could proceed as planned and hope the 27th could somehow catch up with their barrage.

To bring the barrage back would seem the only option, as the other invited disaster on an even larger scale than the previous day’s. But American officers argued that groups of Americans had succeeded in passing the German strong points and were still in the German positions. If the barrage on the next morning was brought back these troops would be slaughtered by their own guns. As the Americans weighed up these considerations a spotter pilot reported seeing a large group of Americans deep in the German defences. This final report seems to have swayed the American officers for they decided to go ahead with the barrage as planned and attempt somehow to cover the half mile of German defences up
to that barrage. General O’Ryan, the American Division’s Commander, wrote that to even risk laying a barrage on their own men would have been repulsive to the mass of the officers and men of the division and destructive of morale.39

While it is of only academic interest, a careful search of the German regimental histories shows that no Americans had in fact penetrated as far as the pilot claimed. While a few parties of Americans had made limited advances past the strong points, all were captured or killed by the afternoon of the 28th. The failure of the Americans to use flares may account for the pilot’s confusing reports. When Monash was informed of the American Division’s decision he was, as he put it, "in a state of despair".40 It seemed pointless firing this huge barrage if the Americans were half a mile behind its protective cover. Monash asked Rawlinson to delay the attack for 24 hours to allow the Americans time to launch another attempt to get up to their starting line. Rawlinson refused, arguing that the entire Allied strategy relied on all the armies attacking in sequence and not allowing the Germans time to draw re-inforcements from one part of the line to another. Rawlinson insisted that the plans drawn up on the 18th should not be modified at this late stage. Haig agreed, calling the failure of the Americans "not a serious matter".41 Rather than delay in the attack it was decided to give the Americans more tanks to help them fight their way up to the start line. Both Rawlinson and Haig based their decision on the belief that German morale and fighting strength were rapidly crumbling. The easy victories and advances on the 18th convinced them that the Germans were about to collapse and the many prisoners taken led them to believe that the German troops had given up the fight.

Unlike events just to the north, IX. Corps preparations were proceeding smoothly. As their attack at Bellenglise was where the Australian Corps had made its deepest penetration on the 18th, IX. Corps’ jump-off positions were already in the 46th Division’s hands. From the 27th the Fourth Army’s heavy artillery bombardment and counter-battery groups began their shelling of the Siegfried Stellung’s strong points. The objectives of the 46th Division, the 3,000 yards of canal just before the ruined village of Bellenglise, the
village itself, and the entrance of the Bellenglise tunnel were shelled heavily. The guns of IX. Corps, the field guns and howitzers, and the Corps’ heavy artillery group remained silent, not firing wire-cutting and counter-battery preparation, hoping of course to deceive the German defenders of Bellenglise into believing that the heavy fire they were receiving was merely the flanking preparation for the tunnel attack which the American divisions were so evidently preparing to launch a few miles to the north. This two-day shelling was the longest, most concentrated and destructive that the British had fired since the end of the Flanders campaign.

While the Fourth Army were pounding the Siegfried line, the Third and First Armies were attacking near Cambrai and the Second Army preparing to attack in Flanders. On 28th September over one million shells rained down on German positions facing the British armies, (that is two-thirds of the shells fired in the entire eight-day preliminary bombardment of the Somme), in twenty-four hours. Of course, in the 1916 eight-day bombardment one-third of the shells had been duds and two thirds of the shells had been shrapnel, and those few H.E. shells fired that did go off were unlikely to hit their targets. In the artillery assault of September 1918 over 60% of the shell fired were H.E. and much of the remainder lethal gas, 99% of shells detonated and they were aimed with unprecedented accuracy. This accuracy was a product of cumulative improvements in artillery techniques and organisation that had occurred since the British first realised that artillery, particularly heavy artillery, would be the key to any military success on the Western Front, a realization that first occurred in the summer of 1915. The development of mapping, meteorological services, surveying techniques, of sound-ranging, rapid calibration and air-to-ground communication had meant that in the autumn of 1918 the British artillery had finally arrived at the position they had desired since the Boulogne Conference of 1915. They had the resources, the modern guns and effective shells, the techniques and experience to take the strongest defensive positions the Germans could build and render them untenable. To take but one example, the shelling of the Bellenglise salient, the objective of the 46th Division’s attack; we can see the destructive power of the Royal Artillery of 1918 in part of
the vast bombardment that was devastating the German defences along thirty miles of front, spread over three distinct attacks.

The shelling of the Bellenglise salient by the Fourth Army’s heavy artillery groups was particularly crucial, as the 46th Division’s own guns and those of IX. Corps were to remain silent up to zero hour. There were 216 heavy guns allotted to the 46th Division’s objectives, that is 216 heavy guns along a mere 3,000-yard frontage, more than were used along the 13 miles of frontage of the Somme assault of 1916.42 The Fourth Army’s intelligence on the position was almost complete whereas in 1916 the Army had known little of the nature of the defences they had tackled. While the evidence of raiding parties in 1916 had shown the Fourth Army that the Germans were making use of deep dugouts, their number, position and strength was never ascertained. But, in September 1918, because of the dominance of the Allies in the air, the development of sound-ranging and flash-spotting, and the capture of the map, the Fourth Army’s artillery officers probably knew more of Siegfried position’s defences than their German counter-parts. General Budworth, the Fourth Army’s Commander of Artillery, in his preliminary instructions, outlined the tactics, targets and even map references for the entire Fourth Army artillery assault in great detail.43 In the 46th Division’s sector near Bellenglise he described the unique problems that would face the attack. First there was the Bellenglise tunnel. Budworth noted that the 5.7 kilometers of tunnel ran 20 metres underground for most of its length and was thus immune to even heavy shell fire. Budworth knew from the captured maps that an entire counter-attack battalion, a dressing station, field canteen, ammunition stockpile, and command centre were housed in this offshoot of the main tunnel. Combining information from the map, from captured prisoners and from French locals who had fled in 1914, Budworth provided the exact map co-ordinates for the tunnel’s exit in Bellenglise, close to the Church. Rather than shelling the tunnel’s length, which would have been useless, Budworth ordered a specific attack on the exit, a target only 10 metres by 4 metres. The bombardment was carried out by batteries of 6-inch howitzers, the most accurate heavy weapons at close range, using time-delay fuses and H.E. shells. The result, discovered when the town was
captured, was devastating. A 6-inch shell had passed through the shallow roof of the tunnel a few metres from the exit, the delay fuse detonating the shell in the midst of the field kitchen. The resulting devastation of a large-calibre H.E. shell detonating in a crowded and confined space can be imagined. The tunnel was blocked and its garrison destroyed. The garrison of the Requeval Bridge, and its fate, also demonstrated the accuracy of British fire. Near Bellenglise a bridge over the canal had been kept intact by the Germans to facilitate the passage of supplies and re-inforcements to the forward positions on the western bank. The capture of this bridge would obviously aid the 46th in its canal crossing. From the map Budworth knew the bridge to be mined with explosives, ready to be detonated at the first signs of an attack, but Budworth and the Fourth Army artillery also knew the positions of the dugouts which housed the pioneers of the German 2nd Division who were charged with the destruction of the bridge. The positions were kept under constant shell fire from the 27th and, as captured pioneers related afterwards, "They did not receive food for two days and dared not leave their dug outs owing to the artillery fire." The men of the 75th machine-gun detachment, whose machine-guns guarded the canal, reported that "After suffering casualties from our [British] artillery fire [they] retired to their dug outs and waited for our infantry in order to surrender." Prisoners from the 33rd Regiment, who were ordered up to re-inforce the canal when the bombardment began, were "unable to do so owing to our artillery fire".

Around Usigny dump, a strong point of machine-gun emplacements had been targeted by a concentration of 9.2-howitzers. Over 100 machine-gunners and crews were found dead in the positions after the attack, all killed by shell fire. Special concentrations of fire were maintained on Bellenglise Village and the canal, with devastating results. The remnants of the village and its dugouts, command posts, and machine-gun positions were utterly destroyed. The canal walls were hit repeatedly, scouring away the wire, and banks of débris filled the canal at a number of points. Budworth, who toured the battlefield after the attack to assess the bombardment, described Bellenglise and its canal defences as "mere heaps of débris". The Germans’ artillery was also destroyed, Budworth finding a "good
On the day of attack the German artillery had been rendered almost entirely impotent by the concentrated mustard gas attack on them and British casualties from German shell fire on the 29th were "small".49

As the Fourth Army's heavy guns brought the preliminary bombardment to a crashing conclusion in the dawn light of 29th September, a heavy morning fog thickened by the gas and dust of the bombardment shrouded the entire area. At 5.50 am, the pre-arranged zero hour, the Army's heavy batteries swung from their bombardment duties to their attack fire plan. In the tunnel attack led by the two American divisions, the field guns which had been shelling German strong points and wire barriers drew back their fire to form the creeping barrage. The majority of the heavy guns (two thirds) began the neutralizing barrage of gas and H.E. on German artillery positions while the remainder added their fire to the creeping barrage to give it greater impact and range. The IX. Corps, for the southern attack, whose field guns and re-inforcing batteries had largely remained silent up to the 29th, opened a sudden and intensive attack on the wire and machine-gun positions on the western bank of the canal, and on the canal itself along the 3,000-yard frontage of the 46th Division's attack.

In the main attack over the tunnel, the assault by the two American divisions did not progress as planned. The 30th Division, who on the 27th had successfully captured their jump-off line, advanced into the German positions behind their creeping barrage. While they suffered casualties from isolated machine-gun positions and lost many of their tanks to anti-tank guns, they succeeded in capturing the first two of the tunnel's five defensive lines. The 27th American Division, however, stalled completely. The 27th, who were half a mile behind their jump-off line because of their failure two days previously, began their attack at 4.50 am, one hour before the 30th Division beside them. This was to allow the 27th to get up to the start line. But the Americans had insisted that there was to be no shelling of the intervening half mile on the 28th, nor any creeping barrage to cover the first half mile on
the 29th for fear of hitting troops still out there after the failed attack on the 27th. They attempted to rush the half mile and begin the creeping barrage there. This proved impossible, for in the absence of the creeping barrage the German machine-gunners and riflemen manned their parapets and drove off the American assaults inflicting heavy losses. Even at this very last stage of the war, with German resources drained and their defences under constant attack, assaults without artillery protection failed. The extra tanks allotted to 27th Division could not get the division forward as German anti-tank gunners, unmolested by British artillery fire, picked off one by one all of the 27th Division's tank support.51 But, to the south the 46th Division were making such progress with their canal crossing that the 27th Division's problems would rapidly become irrelevant.

At 5.50 am the 46th Division's guns and its supporting batteries from IX. Corps opened up on the canal and its defences.52 Six brigades of 18-pdr.s and 5 brigades of 4.5-howitzers fired the deep creeping barrage. At each of the major obstacles - the trenches on the western bank, the canal, then the eastern bank - the creeping barrage halted for a time to allow the infantry to catch up or eliminate any troublesome machine-guns. During the pause the 18-pdr.s dropped a standing barrage to protect the infantry while the 4.5-howitzers attacked selected strong points that would be encountered in the next rush. The artillery signalled to the infantry that it was about to resume the creeping barrage by firing one round of smoke from each of the 18-pdr.s. When the infantry saw the smoke bursts in the creeping barrage fire they knew it was time to prepare to move. Specific batteries of 18-pdr.s maintained a heavy smoke shroud over the German positions, particularly the canal itself which was deluged with smoke, H.E. and shrapnel from a variety of guns. Batteries of 4.5-howitzers raked the canal and its banks with H.E. shells and, striking many direct hits, smashed the walls of the canal to form walkways of debris across it.

It was the 137th Brigade of the 46th Division which led the infantry assault on the canal. As the Brigade's Commander, General J.V. Campbell recorded in his report on the assault written on the 30th, it was the combination of the intensive, accurate creeping
barrage and the smoke shelling that allowed the 137th to storm the western defences of the canal and approach the waterway itself.

"The barrage put down by our artillery was dense and even, all ranks have testified to the excellence of it. The smoke shell, together with the mist proved useful in allowing our infantry to approach close to the machine gun nests unobserved". He concluded, "The chief tactical lesson was that close following of the barrage lifts saved many casualties and enabled the infantry to surprise garrisons of [the] enemy positions".53

Rapidly overrunning the defences on the western bank, the 137th arrived at the canal itself. The barrage, which had been falling on the canal, lifted and moved on revealing to the 137th the devastation of the canal’s defences. Only the Riqueval Bridge, which the British artillery had avoided, remained intact. The German pioneers, who left their dugouts when the shelling lifted, were unable to make it to the bridge to blow the charges before the 137th crossed it and captured it intact. One German was bayoneted as he actually lit the charge, which was removed still burning.54 Along the rest of the frontage elaborate preparations had been made to get the men across the water. 3,000 life-belts, taken from the channel ferries, had been supplied, together with cork rafts and heaving-lines.55 Most were not needed. In many places the canal’s banks had been so devastated that men crossed on débris without even wetting their feet. Where they did have to swim there were no German machine-gunners left to harass them. The 137th crossed the canal and consolidated themselves on the far bank. The 138th and 139th, who had been following close behind, crossed via the bridge and carried on the attack into Bellenglise Village, and widened the bridgehead to link the attack up with the Australian/American attack to the north. In crossing the canal and breaking the Hindenburg main line the 137th had lost only 150 casualties, all to German machine-gun fire.56

The 138th and 139th then continued the advance after an hour’s pause during which the heavy artillery poured shells into Bellenglise Village. It was during this that the 6-inch shell entered the tunnel which housed the village’s main garrison. When the two battalions stormed the village behind their creeping barrage they discovered the tunnel destroyed, the
village in disarray and the defenders surrendering freely. Survivors of the tunnel explosion were taken prisoner. Counter-attacks were driven off by the artillery who responded to S.O.S. flares sent up by 138th. By three in the afternoon the 46th were ensconced in the main Hindenburg line and the 32nd were advancing through them to continue the advance and drive off any counter-attacks. The 46th had advanced three miles over the strongest defences the Germans had ever built, captured some 4,200 prisoners, 70 artillery pieces and over 500 machine-guns, and themselves lost fewer than 800 casualties.

In his report on the engagement, Braithwaite, the author of the attack and Commander of IX. Corps, while acknowledging the remarkable bravery and persistence of his infantry, gave credit to the R.A. for its preparation and for the creeping barrage they had laid on the canal’s defences.

"The preparatory work of the heavy artillery cannot be too highly praised and it was owing in a great measure to their excellent shooting that the storming of the canal with its concrete defences was made possible. The field artillery, in spite of the fact that the majority of the guns were in silent positions up to zero hour and unable to register, put down one of the finest barrages that the troops have ever advanced under."

By nightfall on the 29th the American 30th Division had partially completed its advance over the long tunnel and despite fierce resistance had occupied two of the five lines of defence. The American 27th Division were still in their original trenches, having attempted in the afternoon to gain the jump-off positions but again refusing the assistance of the creeping barrage and again failing with heavy losses. The Australian divisions who were supposedly to leap-frog through the American divisions to exploit their advance were now entangled with the American troops. On IX. Corps front, however, success was clear cut. The 32nd Division had completed the capture of the Hindenburg main line along 3,000 yards, overrun much of the German artillery position and driven off two counter-attacks. The German regiments, driven back by IX. Corps, had lost much of their artillery because of the rapidity of the advance and the devastation of the counter-battery fire. The 153rd, for example, were withdrawn from the Hindenburg main line and fell back to the reserve line at 1 am.
"The night passed quietly and we could vacate the position in accordance with orders undisturbed at 1 am, taking with us all machine guns and mortars, ...to the reserve line, the guns of the accompanying batteries could not be saved."

The author of the 153rd history notes that this marked the end of the regiment as a fighting force, as it could no longer defend itself nor launch counter-attacks for it and indeed the entire division, was "largely without artillery support...".60

Clearly the breaching of the main line and the near destruction of the German regiments holding the Bellenglise position required an immediate and substantial counter-attack by the German Second Army, along the lines of that which had been launched at the Cambrai break-in of 1917. This, however, was beyond the powers of the German Army in September 1918, for the Fourth Army’s attack was not an isolated assault as Cambrai, but the culmination of a great sequence of attacks that had committed O.H.L. strategic reserves to far-flung battlefields from the sea to the Meuse. On the 26th the Americans and French had attacked in the Argonne, drawing O.H.L.’s entire southern strategic reserves into the engagement. The next day, when the Fourth Army’s bombardment of the Siegfried line began, the First and Third Armies had launched a surprise attack on the German defences near Cambrai and crossed the canal Nord. The Canadian Corps, who breached the canal, had employed artillery tactics almost identical to those of IX. Corps. An intensive surprise bombardment, unregistered and prepared by the surveymen and sound-rangers, fired on a narrow 3,000-yard frontage in order to concentrate the fire of many batteries. This partial breach of the defence line had attracted most of the reserve divisions available in the armies opposed to the British. When, on the 28th, the Flanders group of armies attacked in the north the remaining reserves were committed to halt that advance. Thus, on the 29th when the final and heaviest blow fell in the centre on the Siegfried Stellung, there were simply no divisions O.H.L. could send to the Second Army to redeem its situation. In the afternoon of the 30th, as the Fourth Army made a series of small advances under heavy artillery cover
to link up the two assaults, Von Boehn received an answer from Ludendorff to his desperate pleas for fresh divisions to recapture the main line.

Because of the success of Allied attacks, the "supply of O.H.L. reserves can no longer be reckoned with. Nevertheless, an enemy break-through must be prevented at all costs." However, Ludendorff also informed Von Boehn that if his troops were to be pushed out of their remaining positions, they were to fall back to the Hermann Stellung. As the Hermann Stellung had not yet been built, Ludendorff instructed Von Boehn that it "must be constructed with all possible speed for holding as a permanent position". Ludendorff did not make it clear how the Second Army, which had lost a great deal of its artillery, had lost thousands of men killed or captured and had clung only to the very last section of the defensive system, could avoid being overrun by the British Fourth Army.

Nothing could have illustrated more clearly Ludendorff's increasing distance from the realities of the war. The Second Army attempted to fulfil its impossible orders. Units were scraped together from cooks, orderlies and artillery-men who had lost their guns and formed into defensive units to hold the remaining strong-holds. Some units were detailed to work on the Hermann position. The 65th Regiment, which had just completed their roll call having lost 213 of their men and most of their officers, were hoping for a rest from the "unprecedented and unendurable fatigue" when they received orders to "go to fatigue work on the new Hermann Stellung".

Not surprisingly, when the British resumed their attacks on 1st October, the remaining defenders were unable to hold their positions. Fighting on a united front the Australian and IX. Corps attacked the remaining strong-holds of the old main line and cleared the last Germans from the deep dugouts and machine-gun positions. The remaining German units fell back to the reserve line some half a mile behind the canal, and prepared for another Fourth Army assault.
All that remained in German hands of the Siegfried Stellung was the reserve line, called by the British the Beaurevoir line. It consisted of two trench lines dotted with concrete machine-gun posts protected by wire. The Germans manned it as best they could with the remnants of the units pushed out of the main defences. The defenders had little artillery and only small amounts of shell for their guns. They did retain, however, their machine-guns and small arms and these proved enough to drive off a British cavalry assault on the afternoon of the 2nd. It is remarkable that a commander of Rawlinson’s stature, and one who was clearly able to organize successful attacks, still believed that there was a role for cavalry on the Western Front. Throughout the war British commanders had attempted to "exploit" an advance with cavalry, ignoring the fact that no matter what the state of the German defenders, they were always able to stop British cavalry with machine-guns.

On 2nd October Rawlinson tried again, believing that now, finally, the Germans were so disorganized and demoralized that a quick cavalry charge would push them out of the reserve line. Yet again he was proved wrong for horsemen are an easy target for a traversing machine-gun and a single weapon was enough to stop an entire squadron of cavalry. It was only on 3rd October when the British artillery had been brought forward that the real attack on the reserve line began. After a heavy barrage, units of the Australian and IX. Corps pushed through the last of the trench lines taking further prisoners and inflicting heavy casualties on the already weakened German units. During the night the reserve line was abandoned by the Germans and the battered regiments began the retreat to an almost non-existent Hermann Stellung. The Fourth Army troops gazed on the green fields of the land behind the Hindenburg line, untouched by war, its villages still intact. They had broken through at last. There were no more Stellungen to be overcome, no more deep German defences out of which the defenders had to be hammered, only open rolling fields all the way to the German frontier. It was, after the years of bitter losses, the sight of victory. That day the German government forwarded a telegram to Washington.

"The German Government requests the President of the United States of America to take steps for the restoration of peace, to notify all belligerents of
this request, and to invite them to delegate plenipotentiaries for the purpose of taking up negotiations. In order to avoid further bloodshed, the German Government requests the President to bring about the immediate conclusion of a general armistice on land, on water and in the air. 664

With the breaching of the Siegfried Stellung the bitter and bloody battle of the Western Front was over. While the fighting continued for a further six weeks there could be, after 30th September, no doubt as to the inevitability of German defeat. The German armies in the west were in full retreat, abandoning the great defensive positions and most of their artillery as they fell back towards the German frontier. At each of the great rivers that blocked the Allies advance, such as the Sambre and the Selle, German rear-guards attempted to slow the Allied advance, but lacking any artillery support or protective defences these proved to be mere pauses in a relentless Allied pursuit. Attempts to halt the attacks simply demonstrated the completeness of the German Army’s collapse and the rapidity with which the Royal Artillery were able to change to the tactics of open warfare. In the retreat up to the Selle, 12,000 prisoners were captured by the British. From 17th October the British armies launched a great attack across the Selle, and within the week 24 British divisions from the three central armies were over the river, advancing six miles and capturing 20,000 prisoners. On the 18th, Ludendorff resigned. The artillery tactics employed by the British in these dying days of the war reveal the flexibility and adaptability the British had learnt in the bitter years on the Western Front. In the major attack on Selle they had employed a two-day bombardment like that used on the Siegfried line. But by 23rd October when the river was crossed and the absence of deep defences was noted, the long bombardments were abandoned. By the 4th of November the German armies were along the Sambre River, the last great obstacle before the Meuse and the German front line. A great attack was launched on the Sambre line along 30 miles of frontage. It was preceded by a surprise unregistered barrage and swept across the river; by the afternoon the British had penetrated two miles and the German armies were in headlong retreat again. During the crossing Wilfred Owen was killed, only seven days before peace, for the battle for the Meuse never eventuated. On 11th November news of the armistice arrived at the front line. That very morning the British, in their pursuit up to the Meuse, had recaptured Mons, in German hands since 1914 and the point at which, five years before, the British Expeditionary Force had first
encountered the Imperial German Army. Thus the war came full circle, beginning and ending for the British Army at Mons. On the 11th hour of the 11th month, after five years of monstrous anger, the guns of the Western Front finally fell silent.

2 Haig, quoted in J. Terraine, To Win a War, p. 138.
3 Die Kriegführung an der Westfront in Jahre 1918, Der Weltkrieg, p. 640.
4 That this was the conscious policy of the Allied armies is clear from Foch’s letter to Haig on 11th August, Foch, op.cit., pp. 382-3. The letter, however, was a mere formalization of agreements reached at meetings between the two men. Foch, and the anti-Haig writers, such as Liddell Hart, insist the idea was Foch’s. Haig supporters, such as Dewar and Boraston and Edmonds, claim it was Haig’s. See: Liddell Hart, History of the First World War, p. 430; and Edmonds, Military Operations France and Belgium 1918, vol. IV, p. 134.
5 Fourth Army Artillery Instructions, 31st August 1918, Final Offensive, 474/3, AWM 26.
6 Fourth Army Weekly Intelligence Summary for week ending 1st September, Final Offensive, 474/3, AWM 26.
7 This attack on the D-Q position and the Canal Nord, which was in reality almost as complex as the St. Quentin Canal and Siegfried line crossing by the Fourth Army with which this chapter concerns itself is reviewed in detail by Edmonds, Military Operations France and Belgium 1918, vol. IV, pp. 396-426.
8 Ibid., p. 413.
10 Ibid. p. 383.
12 Ibid. vol. IV, p. 458.
13 Army Commanders’ report, 10th September 1918, Fourth Army General Staff, 474/1, AWM 26.
15 Bean, op.cit., vol. VI, p. 578.
16 Budworth, Report on St. Quentin Canal, part II (Date illegible but presumably issued with the Fourth Army artillery instructions on 22nd September 1918), 474/2, AWM 26. In Budworth’s report he explains how the detailed aiming instructions he issued were derived from the map.
17 Haig Diary, 13th September.
18 J. Monash, op.cit., p. 224.
19 Fourth Army Artillery Instructions, 15th September 1918, 473/1, AWM 26.
20 Die Kriegführung an der Westfront in Jahre 1918, Der Weltkrieg, p. 640.
22 Ibid.
23 Die Kriegführung an der Westfront in Jahre 1918, Der Weltkrieg, p. 640.
25 Ludendorff, Mein Kriegserinnerungen, p. 199.
Das Königlich Infanterie-Regiment in Weltkrieg (No. 71) (Berlin: Gerhard Stalling, 1927) p. 378.

Feldartillerie Regiment No. 74 (Berlin: Stalling, 1928) pp. 281-2.

Foch, op.cit., p. 408.

Bean, op.cit., vol. VI, p. 945.


G.O.C.R.A. Fourth Army, Fourth Army Artillery in the Attack on the Hindenburg Line, 29th September 1918, 474/2, AWM 26. This was the report on the Fourth Army’s artillery written by Budworth in the week after 29th September. The figures quoted by Edmonds in the Official History for this engagement are slightly incorrect.

Bombardment with B.B. gas shell on night of 26th/27th September on Fourth Army front. This is an intelligence report drawn up by Fourth Army intelligence section on the results of the B.B. shelling. The effects were not as dramatic as hoped for but prisoners affected by mustard gas were taken on a wide stretch of front. Artillery men seem to have been inconvenienced by the gas. The report also noted that a large number of German Regiments were suffering epidemics of influenza. 474/2, AWM 26.

Monash, op.cit., p. 236.


Account of the part taken by the 46th Division in the battle of Bellenglise on the 29th September 1918. A divisional intelligence report written on 7th October. This report reviews the leadup to the 46th Division’s attack and the course of the fighting, 484/9, AWM 26.


J. Pershing, My Experiences in the World War (London: Hodder and Stoughton, 1931). Pershing, and other Americans, blame the distance 27th Division had to travel rather than inexperience, as Edmonds and Bean do.


Bean, op.cit., p. 420.

Bean, op.cit., vol. VI, p. 57.


Report on the St. Quentin Canal, undated but evidently in the period of Fourth Army artillery preparation, 22nd September to 26th September 1918. This report was prepared by Budworth, 474/2, AWM 26.


Ibid.

Ibid.

Ibid.

Ibid.

Ibid.

Ibid.

The failure of the Americans and the confused fighting that followed when the Australian Division, who were supposed to "leap-frog" through, became entangled with the Americans is reviewed in detail in Bean, op.cit., vol. VI, pp. 958-69.

This account of the 46th artillery work is derived from an account of the part taken by the 46th Division in the battle of Bellenglise on 29th September 1918, 484/9, AWM 26.

Report on the operations of the 137th Infantry Brigade for the days 28th and 29th September 1918, dated 1st October and signed by J.V. Campbell, Brigade Commander, 484/9, AWM 26.

Ibid.

137th Infantry Brigade Instructions, No. 2, 27th September 1918, 484/9, AWM 26.
Report on the operations of the 137th Infantry Brigade, 484/9, AWM 26.


Ibid.

Account of the part taken by the 46th Division in the battle of Bellenglise on 29th September 1918, 484/9, AWM 26.

Das Ultenburger Regiment, p. 72.

Bean, op.cit., vol. VI, p. 1012.

Ibid. p. 1013.


Third Army Artillery Instructions, 18th October 1918, 471/10, AWM 26.
The story of the Royal Artillery in the great war has two distinct, though intertwined, strands. The first is the development of the artillery’s offensive tactics, particularly for heavy artillery, a subject that had barely been examined prior to 1914. The second strand is the development and manufacture of the artillery force that could put heavy artillery strategy into effect. From the outbreak of war to the end of 1916, the British artillery experimented tactically, re-organizing its command structure and gun groupings. These improvements resulted in no more than partial success on the battlefield as the British simply lacked the artillery power required to put any strategy based on heavy artillery into effect. During 1917, with an artillery force that could now contend with its German rivals, the tactical experimentation continued with some complete successes like Messines, some partial successes like Cambrai and some complete failures like Pilckem Ridge. Then, in August 1918, when the British returned to the offensive, they used the tactical formulas that had emerged during the 1917 battles and employed an artillery force that was numerically superior, more technologically advanced, and better equipped than the German artillery. None of the major British attacks in 1918 were less than a partial success and the two major offensives, Amiens and September’s attack on the Canal Nord and the Siegfried line, were utterly devastating to the German prosecution of the war. While this progress was both gradual and cumulative, and minor improvements in manufacture and refinements of barrages and administration continued until November 1918, there are a
number of crucial turning points in both the production of the artillery force and the tactical development of the heavy artillery war that can be isolated.

The first of these significant moments was May 9th 1915 and the complete failure of the attack on Aubers Ridge. It was this failure that convinced the British Army Command that pre-war artillery tactics and the force they had built to apply those tactics were inappropriate for attacking the field defences that the Germans were ensconced in. The day after the Aubers Ridge fiasco, Haig concluded that the preparatory bombardments before attacks needed to be conducted with heavy artillery pieces, not the small-calibre rapid-fire field guns with which the artillery were almost exclusively armed. He also concluded that these preparatory bombardments would need to be "accurate and so fairly long", the advantages of a short surprise bombardment being out-weighed by additional destruction wrought by a long, accurate shelling. Exactly one month after the Aubers Ridge attack the full ramifications of this point were brought home to the British government and military Command at the Boulogne Munitions Conference. Here Haig stated that the British Army would be unable to attack successfully without an artillery force of over 1,000 heavy guns and a large stockpile of reliable H.E. shells.

On reviewing their resources in 1915, the British artillery found that it had one effective large-calibre artillery piece, the experimental 9.2-howitzer. Other than that they had a small number of 60-pdrs. and a motley collection of antique pieces and cut-down naval guns. There were no existing designs for heavy guns other than the 9.2, no manufacturers with experience in mass-producing heavy guns, nor any contingency plans for creating such a manufacturing capacity. In regard to gun ammunition, the British found they had no large-scale manufacturing capacity in T.N.T. and what production did occur was dependent on German chemical factories. As with the guns,
there were no existing plans for larger H.E. shells or fuses or for a T.N.T. substitute, nor any contingency planning for a sharp increase in production. Shortly after the Conference, the Ministry of Munitions began its daunting task, to design and build a great heavy artillery force, to design and build a new H.E. shell, and to design and build fuses that would detonate the new shells. This, of course, could not occur overnight and indeed, it was not until 1917 that the British artillery had over 1,000 modern heavy guns, an effective H.E. explosive, and the fuses to detonate them. Thus, through 1916, the British Army struggled to launch successful attacks, hamstrung by the poverty of their artillery resources and the teething problems of the new munitions they were receiving.

While the great Somme offensive of 1916 failed to achieve the desired breakthrough, a number of crucial disputes over artillery doctrine occurred and many important lessons were learnt. The most important was the debate between Rawlinson and Birch on the one hand, and Haig on the other, concerning the nature and objectives of an attack that was preceded by a long bombardment - between limited and unlimited objectives. Rawlinson and Birch argued that, even given the greater artillery and ammunition resources available in 1916, the attack should still proceed slowly and cautiously. The bombardment should be concentrated on only the forward part of the German defence and the infantry should advance only a mile or so, still under the protection of the artillery's fire. Haig believed that the entire German defensive system should be shelled and the infantry should drive right through the trench lines and out into the green fields beyond where artillery cover would not be necessary. The dispute over limited objectives as opposed to the breakthrough strategy was the central debate within the senior command of the British Army until 1918 and caused a falling-out between Haig and his two most senior Army Commanders, Rawlinson and Plumer, and with his own artillery adviser, Birch and the Head of Operations, Davidson at G.H.Q.
After the failure of July the 1st, there were a number of developments in the British artillery’s offensive tactics. The most important of these was the creeping barrage, which allowed the quick-fire but relatively short-range field guns to be utilized. The first simple creeping barrages could be discerned in some of the divisional artillery fire on 1st July, and by the end of the campaign the practice had been refined and incorporated in all attack plans. The creeping fire required great organisational discipline, for guns from numerous batteries were required to fire in unison along pre-arranged lines and advance their fire at the same rate. This led to the other crucial development of 1916, the emergence of a centralized artillery command and centralized planning.

When the war began, the most senior artillery commanders were the divisional C.R.A.s. Above that level there were only artillery advisers to Corps and Army Head Quarters. As the administrative demands on the artillery grew and the need to co-ordinate and organise the fire of many batteries became more evident, a centralized superstructure of artillery command emerged. The catalyst for this change was the appointment of Birch as artillery adviser to G.H.Q. in June 1916. It was Birch who forced through the changes that enabled Corps and Army artillery advisers and commanders simply to override the squabbling of their divisional C.R.A.’s. It was the Corps and Army artillery commanders who created the administrative structure of co-ordinated artillery work, fire-plans, barrage tables, and army directed bombardment plans.

The development of a superstructure of artillery command was a recognition that the artillery, particularly the heavy artillery, were fighting battles that were, for much of the time, independent of the infantry divisions they were attached to. In the
bombardments that preceded the many attacks of the Somme campaign the Fourth Army's artillery were engaged in an almost continuous search for and bombardment of the German positions and in a protracted and escalating duel with the German artillery batteries opposed to them. It grew increasingly unworkable to direct this artillery battle from divisional or Corps headquarters, which couldn't provide the administrative and technical support the artillery required. Thus, in 1916 the H.A.R. emerged, the Heavy Artillery Reserve, where the majority of heavy guns were grouped together administratively and placed under an artillery officer charged with conducting the artillery attack. Specialist positions were created in this administration to conduct various aspects of the artillery battle, the most important of which were the C.B.S.O. who conducted the counter-battery attack on the enemy's guns, and the Signals Officers charged with building and maintaining the vast communication system which the artillery required to co-ordinate their fire and pass ranging instructions to each other. Units which could provide technical assistance were also created in 1916. The survey companies provided maps, surveyed positions, and attempted to provide information for ranging the guns in the flash-spotting and sound-ranging sections. The artillery Meteorological Service, to assist the heavy guns firing at long range, was begun at G.H.Q. and independent artillery schools were established in France and Britain. Observer squadrons were formed in the R.F.C. and aerial observation was organised by the Artillery Command rather than through the haphazard and varied arrangements that had previously existed between squadrons and individual C.R.A.'s of divisions.

During 1917 the great national effort that had begun at the Boulogne Conference two years before began to bear fruit. The Artillery's heavy artillery grew to over 1,000 modern heavy guns and during the year all the older, worn or compromise weapons were discarded. The gunners had reliable H.E. shells in large variety as Amatol with smoke and a new generation of fuses appeared in the shell stockpiles.
During the course of the year smoke and gas shells became available in large numbers. An effective ground-to-air radio system was developed and the clapper brake allowed a number of spotter planes to operate at once. In the artillery's specialist support services great strides were made. The survey techniques developed in the survey battalions allowed guns and their targets to be accurately fixed on maps and the guns to get accurate bearings to the target. The sound-rangers found a mechanism for accurately locating the most troublesome of targets, German gun-pits. They also introduced rapid and accurate calibration of guns.

Disputes over how this increasingly powerful artillery force was to be used continued. The failure of the Arras attacks caused the limited versus breakthrough argument to emerge again, this time even more violently than it had in 1916. Plumer's plans for the Flanders campaign distinctly followed the cautious step-by-step approach with each of the many advances only 1,500 yards in depth, the effective range of the field guns. Rawlinson supported Plumer in his dispute with Haig, which resulted in Rawlinson's being dropped from the Flanders attack entirely and Plumer relegated to a minor preparatory attack. The main attack was conducted by Gough, more amenable to Haig's tactical thinking. Plumer's preparatory attack was a complete success, an advance of 1,500 yards into strong German defences which inflicted heavy casualties and suffered comparatively few losses. German counter-attacks which had turned the initial success of Arras into a bitter stalemate were driven off by the artillery. The main attack by Gough failed with heavy losses. The bombardment was spread over such a vast area, three lines of defence spread over five miles depth - that in some places the attackers were prevented even from reaching the Germans' lightly held front line. In other places they advanced into the defences only to be driven back by counter-attack. Plumer then assumed command of the main offensive and conducted a sequence of successful limited advances, but as the rains set in, the attacks became
increasingly feeble as the effectiveness of the artillery was hampered by the quagmire which the battlefield had become. Haig ordered the attacks to continue, despite the fact that his army was pursuing an attacking formula that rested almost entirely on the destructive power of his artillery's H.E., in conditions where the effect of H.E. was rapidly diminishing because of the soft ground. After the termination of the Flanders offensive a most novel attack was launched at Cambrai. This demonstrated that the R.A. was now so powerful and accurate that it could provide a bombardment that was both short and precise. The surprise attack also demonstrated that even this new method of assault required a limited objective and a pre-arranged plan to deal with counter-attack, for the Germans' response to the deep advance was devastatingly effective.

The British used their experience of 1917 in preparing their approach to the Stellung of the Germans' prepared positions in 1918. All of the attacks on the Hindenburg line were limited assaults driving a mile and a half or two miles into the defence and then halting to repel counter-attacks with the artillery's assistance. The Fourth Army first fought the battle of Ephy, then breached the main line, then the reserve. The fighting of 1917, particularly Plumer's attack, had demonstrated that the heavy artillery's main task was the suppression of the German artillery. Plumer had devoted two-thirds of his heavy guns to counter-battery and in all of the British attacks on the Hindenburg line, two-thirds of the heavies fired counter-battery. Rather than unleashing a general bombardment at the German trenches the remaining guns concentrated on specific strong points. To assist the infantry with the German wire and machine-guns, Plumer strengthened the creeping barrage with the fire from some heavy batteries and made it deeper and more destructive by using over 50% H.E. shells and adding howitzers and machine-guns' fire into the creeping fire. All of these features are to be found in the attack plans of September 1918. Cambrai had demonstrated the
value of surprise, the accuracy of un-registered fire, and the use of smoke to shroud a battlefield not softened up by a long barrage. It showed that the long barrage policy followed since mid-1915 was not the only method by which success could be achieved. In September 1918 the British Armies employed the tactics that best applied to the situations confronting them. The Third Army, going over the Canal Nord, used a surprise barrage, the Fourth Army over the tunnel in the St. Quentin canal used a long one, but even within the Fourth Army there was variation as the 46th Division conducted a surprise barrage of its own Corps guns in its Canal crossing. In all of these attacks smoke was used extensively to cover and disguise the British attacking forces, and gas was used to neutralize the German gunners.

The tactical flexibility demonstrated by the Royal Artillery in 1918 was a product, not just of the accumulation of experience on the battlefield, but also of the triumph of the Ministry of Munitions. When the Royal Artillery had entered the war in 1914 the regiment had taken 1,962 guns to war. Of those only 147 were modern, heavy artillery pieces - the 144 60-pdr.s., two 9.2-inch guns, and one 9.2-howitzer. By November 1918 the gun strength had grown to 6,437 weapons of which 2,067 were heavy guns or howitzers. The growth in shell production was equally great. In 1914 the Royal Artillery had a shell stockpile of 1,739,760 shells, thought to be enough to see the regiment through any conflict. In one day in 1918, 28th September, the regiment fired off almost a million shells in 24 hours. Over the duration of the Western Front the Royal Artillery expended over one hundred and seventy million shells. Not only the rate of consumption but the variety of shells had also changed. In 1914, prepared for a mobile field war of rapid manoeuvre, the Artillery had been supplied almost exclusively with shrapnel. By 1918, 50% of shells used were H.E. and the bombardments made use of the gas, smoke and star shells that the Ministry had developed. Even amongst the millions of H.E. shells there was diversity and
specialization, with graze fuses for wire cutting, delay fuses for deep dugouts and impact fuses for general destruction. Perhaps it is in gun production, however, that the Ministry's most significant and remarkable contribution is to be found.

<table>
<thead>
<tr>
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<th>Gun Production</th>
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<tbody>
<tr>
<td>1914</td>
<td>91</td>
</tr>
<tr>
<td>1915</td>
<td>3,226</td>
</tr>
<tr>
<td>1916</td>
<td>4,551</td>
</tr>
<tr>
<td>1917</td>
<td>6,483</td>
</tr>
<tr>
<td>1918</td>
<td>10,680</td>
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By 1918 the Ministry's factories were producing over 200 guns per week, more than twice the annual production in 1914. It was from this out-pouring of guns that the Royal Artillery were able to replenish their stocks after the German offensive of 1918, and to impose artillery superiority in August 1918, a superiority they held until the Hindenburg line broke and the war ended. To man the vast artillery force of 1918 the regiment had grown from less than 100,000 men (4,083 officers, 88,837 OR) to just under half a million (29,990 officers, 518,790 OR). During the war just under 50,000 (48,849) Royal Artillery men were killed in action.

I have concentrated almost exclusively on the artillery aspects of British offensive tactics on the Western Front. This is not to deny that in the end it was the infantry-man who had to clamber out of his trench and actually advance across the waste-land to fight his German rivals for possession of the trenches. But the role of the infantry-man has been examined in minute detail since the war ended, most comprehensively by the Official History. The gunners' war, the changes in
bombardment tactics, the new technologies, the innovations in science and chemistry that made up the artillery battle have been ignored.

In the end the Western Front was a vast artillery battle in which the Germans began with a huge advantage, a head start that was slowly and painfully overhauled by the Allies. In 1918 the engine of destruction was the Royal Artillery, greater in size than the German artillery, possessing more heavy guns than their rivals, better gunnery techniques, more advanced and complex munitions, and a flexible and highly developed tactical range. The evidence of that artillery war still lies in the fields of France and Flanders, millions of tons of metal, thousands of still unexploded shells, and a landscape that, even 75 years on, bears the faint scars of the fury of the great gunnery battle that raged there. Noel Birch, the unsung hero of Britain's war on the Western Front, wrote to Edmonds in 1930, outlining in general terms changes in artillery tactics.

"We copied French tactics, which were childish, and swallowed the German idea that if you pushed and pushed men at defences you would eventually get there and win... In truth the problems of semi-siege and the large concentrations of guns necessary for the work had never been studied by the General Staff in peace, nor by any of the leading gunners or gunnery schools, so we had to learn our lesson in the pitiless school of war."

The End
GLOSSARY

It appears to the untrained reader that artillery work on the Western Front had a language of its own. This brief Glossary of terms and abbreviations used throughout the work gives definitions appropriate to the Western Front 1914-1918.

Barrage - A curtain of shell bursts produced by rapid and continuous fire from a number of guns. This barrage can be fired on a fixed position, or move forward or back, as with a Creeping Barrage.

Barrel life - The number of rounds that could be fired through a barrel before its rifling became so worn that accuracy became impaired.

C.B. - Counter-Battery: The fire of weapons, usually heavy weapons, to impede or destroy enemy gun batteries.

Dial Sight - An aiming device that came into increasing use throughout the Royal Artillery’s campaign on the Western Front. The sight, which could be swung around 360 degrees was used in conjunction with the bearing picket (q.v.) to give a reading of the gun’s angle in relation to a fixed aiming point.

Dud - A dud, or blind shell, was one that failed to detonate on striking the target.

Enfilade - To fire from the flanks of an enemy position and thus up and down the length of the trenches.

Fire Plan - A detailed list of targets and their position, and a firing timetable of how the targets were to be engaged, provided to a battery before a major bombardment.

Gun - A weapon firing a shell at high velocity and flat trajectory (ie. less than 20 degrees). The term is also used as a generic name for guns and howitzers (q.v.)

H.E. - High explosive.

Heavy Gun/Howitzer - The term "heavy artillery" meant different things in different armies as each had their own division and groupings of various guns. Throughout this thesis I have taken heavy to mean all weapons above 6 inches in calibre, but have included the German 5.9-inch in this category.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Howitzer</td>
<td>Howitzers fired shells of greater weight and thus destructive power than guns of the same calibre. The shells therefore travelled at less velocity and had to be flung at higher angles (ie. above 20 degrees). This meant howitzers packed more power but at less range.</td>
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<tr>
<td>Meteor</td>
<td>The meteorological service of G.H.Q. After 1916 it came to refer to the artillery telegram the service issued to the artillery.</td>
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<tr>
<td>Predicted fire</td>
<td>The firing of a gun onto a target which did not use previous firings, observed from a forward position to adjust the fall of shot. (Also called shooting by the map, or silent registration).</td>
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<tr>
<td>Premature</td>
<td>The premature detonation of a shell either in the barrel or shortly after leaving the gun.</td>
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<tr>
<td>Q.F.</td>
<td>Quick firing. Referring to guns and howitzers that used a standard charge shell and a quick release breech that allowed the gun crews to achieve high rates of fire. The most notable was the 18-pdr. Q.F.</td>
</tr>
<tr>
<td>R.F.A.</td>
<td>Royal Field Artillery</td>
</tr>
<tr>
<td>R.G.A.</td>
<td>Royal Garrison Artillery</td>
</tr>
<tr>
<td>R.H.A.</td>
<td>Royal Horse Artillery</td>
</tr>
<tr>
<td>Registration</td>
<td>The fixing of a target’s range and direction such that a gun’s sights could be set to drop shells on the target. This could be done by ranging or registration rounds being fired at the target and an observer correcting the fire until it was on target, or silently predicted (q.v.).</td>
</tr>
</tbody>
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