

2018-04-03

British Doctrine and Canadian Guns: The Evolution of Canadian Artillery Tactics in the First World War

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Torkelson, C. M. (2018). British Doctrine and Canadian Guns: The Evolution of Canadian Artillery Tactics in the First World War (Master's thesis, University of Calgary, Calgary, Canada).

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<http://hdl.handle.net/1880/106476>

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British Doctrine and Canadian Guns: The Evolution of Canadian Artillery Tactics in the First
World War

by

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A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE
DEGREE OF MASTER OF ARTS

GRADUATE PROGRAM IN HISTORY

CALGARY, ALBERTA

APRIL, 2018

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Abstract

During the First World War, artillery was an integral component of military operations on the Western Front. The Canadian Corps, as part of the British Expeditionary Force (BEF), relied heavily on the power of the artillery to support offensive operations. The Canadian Corps has been substantially analyzed by military historians, but the role of the artillery in the success of the Canadian Corps has been insufficiently studied. There is also considerable debate about the extent to which the Canadian Corps possessed a uniquely Canadian way of fighting. This raises the question: to what extent did Canadian artillery differ from prevailing British practice? By using archival documents and secondary sources, this thesis compares the Canadian usage of artillery on the Western Front with the development of artillery tactics and doctrine by the BEF. Through key decisions made before the war and from experience gained during difficult fighting on the Western Front, the BEF led the way in the development of artillery tactics. The Canadian Corps then effectively adapted and employed the tactics pioneered by the BEF during the Corps' own battles, like Mount Sorrel, Vimy Ridge, and the Hundred Days offensives. Analyzing the tactics and doctrine of British and Canadian artillery on the Western Front demonstrates that the employment of the artillery by Canadian gunners did not differ substantially from the tactics and doctrine of the wider BEF.

Preface

This thesis is original and unpublished work by the author Cody Torkelson, under the supervision of Dr. David J. Bercuson, who provided suggestions and feedback about the work.

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List of Abbreviations

BEF: British Expeditionary Force

CB: Counter-battery

CBSO: Counter-battery Staff Officer

CCHA: Commander, Corps Heavy Artillery

CCRA: Commander Corps Royal Artillery

CEF: Canadian Expeditionary Force

CFA: Canadian Field Artillery

CRA: Commander, Royal Artillery

GHQ: General Headquarters

GOCRA: General Officer Commanding, Royal Artillery

HE: High explosive

RCHA: Royal Canadian Horse Artillery

RFA: Royal Field Artillery

RFC: Royal Flying Corps

RGA: Royal Garrison Artillery

RHA: Royal Horse Artillery

Introduction

The First World War was a gunner's war. Despite popular depictions of lines of men slowly advancing into machine gun fire, the machine gun was not the deadliest weapon employed in the war. Instead, modern quick firing artillery scythed down hundreds of thousands of troops. In both the German and British armies, fifty-eight percent of all casualties were caused by the artillery.¹ Shellfire inflicted horrific wounds; disfiguring terribly those lucky enough to survive. Meanwhile, the vast mobilization of industry fed millions of shells into the struggle turning the battlefields of northern France, among other places, into a shattered moonscape. In industrial warfare, the art of gunnery reaped a macabre harvest.

Using thousands of guns and millions of shells effectively required tactical skill. The story of artillery in the First World War is, in large part, the story of the search for a set of tactics which could help defeat trench warfare. Before the war, Britain's artillery establishment had an incoherent and untested tactical doctrine describing the role of the artillery. Yet, by the war's end, the importance of the artillery can hardly be overstated. By the Hundred Days offensives in 1918, 92% of attacks carried out by the British Expeditionary Force's (BEF) Third Army were supported by artillery in some way.² Similarly, new tactics were developed, matured, and then became almost synonymous with the role of the artillery on the battlefield. The best example of this was the creeping barrage. By the Hundred Days offensives, more than three quarters of all attacks supported by the artillery involved some form of a creeping barrage.³

¹ Sir James E. Edmonds, compiler, *Military Operations France and Belgium, 1916: Sir Douglas Haig's Command to the 1st July: Battle of the Somme*, History of the Great War (London: Imperial War Museum, 1932), 282, and Robert Weldon Whalen, *Bitter Wounds: German Victims of the Great War, 1914-1918* (Ithaca, NY: Cornell University Press, 1984), 42.

² Jonathan Boff, "Combined Arms during the Hundred Days Campaign, August-November 1918," *War in History* 17, no. 4 (2010): 463. <https://doi.org/10.1177/0968344510376456>

³ Boff, "Combined Arms," 463.

The First World War was also a major test for the young Canadian nation. While debate continues to rage about the effect the war had on the formation of a Canadian national identity, the war is important for the study of Canadian military history. The Canadian Corps, Canada's main field formation, rated highly among units in the BEF. By the Hundred Days offensives in 1918, the officers and men of the Canadian Corps had, arguably, reached the peak of their fighting capacity. As a result, the Canadians played an important role in pushing the German army out of France. One of the keys to the Canadian Corps' operational effectiveness was the success of the artillery.

While the Canadian Corps was an effective military formation, there is a danger in focusing too closely upon the Canadian experience in the First World War. As Mark Osborne Humphries notes in his discussion of the historiography of the Canadian Corps on the Western Front, "studies of Canadian units are, by definition, nationalistic in approach, as they necessarily emphasize the uniqueness of their subjects, as defined by national boundaries." Thus, as Humphries argues, "perceptions of uniqueness may be a product of the artificial limits imposed by the design of the study itself or the available evidence, rather than any objective differences between imperial and colonial formations."⁴ This is especially apparent in the study of Canadian artillery. Much more than the infantry, the artillery was very closely integrated with the tactical doctrines of the wider British army in France. Many of the most senior officers of the Canadian Corps artillery complement were British officers assigned to serve with the Corps. Most notable was Major Alan Brooke, later Chief of the Imperial General Staff in World War II, who planned many of the Corps' barrages during the pivotal battles of 1917. While Brooke is the most famous of British officers who served with the Canadian artillery, others, such as R. H. Massie,

⁴ Mark Osborne Humphries, "Between Commemoration and History: The Historiography of the Canadian Corps and Military Overseas," *Canadian Historical Review* 95, no. 3 (2014): 391. <https://doi.org/10.3138/chr.95.3.384>

commander of the Corps Heavy Artillery complement until nearly the end of the war, were just as important for the development of an effective Canadian artillery force.⁵ British officers played a key role in the Canadian Corps artillery complement, but the British contribution to the success of the Corps goes much deeper. Indeed, very rarely was a Canadian offensive supported only by the Canadian Corps' integral artillery complement. Artillery was a strategic resource that was massed for the greatest effect at the decisive point. Very often, large numbers of British artillery formations supported "Canadian" offensives. The battle of Vimy Ridge, which itself was part of the larger British Arras offensive, is just one example of this point. At Vimy Ridge, nearly half of all the guns involved, including 417 of the field guns, were provided by British units. Moreover, every gun supporting the advance of the 4th Canadian Division at Vimy was provided by British units.⁶ The support and cooperation available from the rest of the Royal Artillery dramatically increased the firepower of the Canadian Corps, which in turn enabled the Corps to be an effective fighting formation.

The close cooperation between Canadian and British artillery challenges the notion that it is possible to study Canadian artillery in isolation from the wider context of imperial forces in France. Thus, this study compares Canadian artillery tactics with the tactical approach of the wider British army in France. Excepting where terrain played a crucial role in dictating the artillery tactics employed, Canadian gunners employed tactics that were very similar to those used by the rest of the BEF. This is revealed by examining the evolution of artillery tactics throughout the war. Before the war, there was no attempt by the Canadian Corps to develop an

⁵ G. W. L. Nicholson, *The Official History of the Canadian Army in the First World War: Canadian Expeditionary Force 1914-1919* (Ottawa: Queen's Printer and Controller of Stationery, 1962), 539-541. See also Douglas E. Delaney, "Mentoring the Canadian Corps: Imperial Officers and the Canadian Expeditionary Force, 1914-1918," *The Journal of Military History* 77, (2013): 931-953.

⁶ Tim Cook, "The Gunners at Vimy," in *Vimy Ridge: A Canadian Reassessment*, edited by Geoffrey Hays, Andrew Iarocci, and Mike Bechthold (Waterloo, ON: Wilfred Laurier University Press, 2007), 120.

independent approach to the use of the artillery. Instead, theories about the role of the artillery on the battlefield were developed by the British army. Once the war broke out, it took quite some time for the Canadian contingents to be assembled and prepared for operations. It was not until late 1915 that the Canadian Corps was even formed, and not until mid-1916 that the Canadian Corps was undertaking offensive operations. Consequently, the development of artillery tactics during the pivotal early period of the war was left, by necessity, to the British. This is demonstrated by the Canadian Corps approach to retaking Mount Sorrel in mid-1916, an operation which was envisioned within the prevailing British orthodoxy of entirely destroying the enemy's defensive works. Similarly, it is difficult to understand the masterful creeping barrage employed at Vimy Ridge without understanding the influence of British experimentation at the Somme. Finally, the Canadian artillery's tactical approach to Amiens drew very heavily on the success of the British artillery methods pioneered at Cambrai. By examining the long run of the war, it is possible to understand how the Canadian Corps use of artillery evolved in conjunction with wider British practices.

This study examines primary documents relating to the employment of artillery by the Canadian Corps during the war as well as secondary sources that examine British artillery doctrine and tactics. Primary documents were drawn from the archival collection of the Canadian Corps, Royal Artillery documentation held at Library and Archives Canada, particularly in the Record Group 9 collection. The records held there provide an unparalleled view of how the Canadian artillery fought and learned as an organization. Although Canadian Corps documents provide the bulk of the sources consulted, the gunners of the Canadian Corps were privy to, and retained, most of the BEF's hard-won lessons. In the form of training bulletins, doctrinal pamphlets, and circulars on artillery practices, the Canadian Corps learned from British artillery

experiences. Many copies of British doctrinal documents, assembled after the war by the Army Historical Section, are now housed in Record Group 24 at Library and Archives Canada. These documents are useful for analyzing official British military thinking about the role of the artillery. Comparing the primary documents generated by the artillery during the war with official British doctrinal documents provides the opportunity to compare the high-level decisions about doctrine made by the British forces, including army and General Headquarters officers, with the reality of the use of artillery for a smaller unit like the Canadian Corps.

Compared to other national historiographies of the First World War, Canada is relatively unique since it did not produce an official military history until the 1960's. Although the role of official historian was given to Archer Fortescue Duguid in the 1920's, Duguid never finished his official history. In part because Duguid faced a daunting amount of material, 135 tons of documents in fact, and due to a tendency to try and have everything perfectly documented, his one volume *Official History of the Canadian Forces in the Great War 1914-1919* took until 1938 to be published.⁷ This single volume covered from the beginning of the war until formation of the Canadian Corps in September 1915, but in it Duguid barely touched on the role of the artillery. The Second World War broke out a year after the work was published and Duguid shelved the project entirely.⁸ After being interrupted by the Second World War, the project of an official history of the Canadian Expeditionary Force languished. It was not until the 1962 that G.W.L. Nicholson's *Official History of the Canadian Army in the First World War: Canadian Expeditionary Force 1914-1919* filled some of the gaps of an official Canadian military history. The one volume work focused mostly on the operations of the Canadian army, and was to the

⁷ Tim Cook, "Quill and Canon: Writing the Great War in Canada," *American Review of Canadian Studies* 35, no. 3 (2005): 506-7. <https://doi.org/10.1080/02722010509481381>

⁸ Cook, "Quill and Canon," 519-520.

point. Nicholson's work is short compared to other official histories, but it nevertheless had some of the advantage that none of the senior officers were still alive with reputations that needed to be skirted.⁹ While concise and an excellent reference, the work shares criticism common to other official histories, namely that it is somewhat too descriptive and not analytical enough.

Despite a slow start, Canadian military history has flourished in the last few decades. Numerous excellent studies have examined many of the various components of the Canadian Corps. Yet, the study of Canadian artillery has been neglected. The sole comprehensive study of Canadian artillery in the Great War is the first volume of G. W. L. Nicholson's *The Gunners of Canada*. Published not long after his official history, Nicholson's *Gunners of Canada* offers a comprehensive overview of Canadian artillery from its earliest days to the end of the First World War.¹⁰ However, beyond Nicholson's somewhat dated work, there is little else on Canadian artillery. Relatively few regimental histories of Canadian artillery units were published by veteran's groups. Notable is the book *Gunfire* which chronicles the experiences of the 4th Brigade, Canadian Field Artillery, during the war.¹¹ Even in the realm of biography, artillery officers have been neglected. Other than Sir Arthur Currie, who was an artillery officer before the war but who is better known for his command of the Corps, the only Canadian First World War artillery officer to have a published biography was A.G.L. McNaughton. McNaughton has acquired plenty of interest, in part due to his Second World War exploits, although his biography should be treated with care as historian Patrick Brennan called it "as fine as example of

⁹ Cook, "Quill and Canon," 521-522.

¹⁰ G. W. L. Nicholson, *The Gunners of Canada: The History of the Royal Regiment of Canadian Artillery, 1534-1919*, vol. 1 (Toronto: McClellan and Stewart Limited, 1967).

¹¹ J. A. MacDonald, ed., *Gunfire: An Historical Narrative of the 4th Bde. C.F.A. in the Great War (1914-1918)*, compiled by 4th Brigade C.F.A. [Canadian Field Artillery] Association (Toronto: Greenway Press, 1929).

hagiography as one can find in Canadian military historiography.”¹² Otherwise, Canadian artillery has been examined only in a handful of articles, or as a supporting narrative to the central argument of a work.¹³ The relative lack of attention paid to the artillery is likely due to the fact that the artillery played only a supporting role. Often in the historiography, the artillery is mentioned only in passing, or in such a way as to demonstrate the thoroughness of the Canadian operational art. This often makes sense from a narrative and argumentative approach. The artillery was subordinate to the needs of the infantry as the gunners went to great lengths to emphasize during the war. However, the size and importance of the artillery also necessitates study of its own. By the later stages of the war, the Canadian Corps artillery was composed of 350 field and heavy guns and 20,000 gunners making them an integral part of the Canadian Corps warfighting ability.¹⁴ Without the support of the artillery, the infantry could never advance on a First World War battlefield.

Combining the need for comparative studies of the Canadian military during the First World War with the need for further study of Canadian artillery, this study will demonstrate that we should understand the Canadian Corps’ use of artillery within the wider British context. It is not enough to examine the Canadian Corps in isolation. As Humphries notes, “the multinational nature of military operations suggests the necessity of making transnational comparisons,

¹² John Swettenham, *McNaughton: Volume 1 1887-1939* (Toronto: The Ryerson Press, 1968), Patrick Brennan, “Julian Byng and Leadership in the Canadian Corps,” in *Vimy Ridge: A Canadian Reassessment*, edited by Geoffrey Hays, Andrew Iarocci, and Mike Bechthold (Waterloo, ON: Wilfred Laurier University Press, 2007), 103, note 38.

¹³ The role of the artillery appears throughout works like Tim Cook, *At The Sharp End: Canadians Fighting the Great War, 1914-1916* (Toronto: Viking Canada, 2007), Tim Cook, *Shock Troops: Canadians Fighting the Great War, 1917-1918* (Toronto: Viking Canada, 2008), Bill Rawling, *Surviving Trench Warfare: Technology and the Canadian Corps, 1914-1918* (Toronto: University of Toronto Press, 2014), Shane B. Schreiber, *Shock Army of the British Empire: The Canadian Corps in the Last 100 Days of the Great War* (Westport, CT: Praeger, 1997), and in articles like Ian M. Brown, “Not glamorous, but effective: the Canadian Corps and the set-piece attack, 1917-1918,” *The Journal of Military History* 58, no. 3 (1994): 421-444, and Tim Cook, “The Gunners at Vimy,” in *Vimy Ridge: A Canadian Reassessment*, edited by Geoffrey Hays, Andrew Iarocci, and Mike Bechthold (Waterloo, ON: Wilfred Laurier University Press, 2007).

¹⁴ Nicholson, *Official History*, 315.

examining Canadian performance in the light of British, German, French, and American sources.”¹⁵ It is in this spirit that this study has been conducted. Due to space limitations, Canadian sources can only be compared to British sources. However, even this circumscribed study can shed new light on the connections between British and Canadian artillery, which were manifold. Throughout the war, the Canadian gunners borrowed heavily from British experimentation with new artillery tactics, tweaking them to fit the specifics of each battle the Corps faced. As a result, Canadian artillery tactics in the First World War cannot be understood without reference to the tactics and doctrine of the British Expeditionary Force.

¹⁵ Humphries, “Historiography,” 396.

Chapter 1: The British Origins of Canadian Gunnery

Before the outbreak of the First World War, there was a period of major reform to the equipment, organization, and battlefield role of the British Royal Artillery. Shaped by the experience of fighting in the Boer War and radical advances in technology, British decision-makers and theorists attempted to anticipate the role of the artillery on the battlefield of the next war. However, despite being guided by an overall ethos that emphasized offensive operations, there was profound confusion over the role of the artillery in battle. New technological developments, particularly innovations such as new communications technology and quick-firing guns, revolutionized the firepower potential of the artillery. However, organizational changes and the overall lack of a strong doctrine hampered the potential of the Royal Artillery. The chain of command was muddled, field artillery focused on operating in close support of the infantry instead of maximizing firepower, and the role of the heavy artillery was barely developed at all. The threat posed by the enemy's guns was largely ignored and there was the potential for ammunition problems. Moreover, there were fundamental divisions in the Royal Artillery which prevented a consensus on the role of the various branches of the artillery. Importantly, the choices made by the British regarding new technologies and tactics were in large part, also adopted by Canadian gunners. These interlinking factors shaped the way that British and Canadian gunners prepared, both in terms of equipment and doctrine, to fight in the First World War. Therefore, in order to understand the usage of Canadian artillery in the First World War, it is first necessary to examine the conversations that occurred in Britain surrounding the proper usage of artillery prior to the outbreak of the war.

Prior to the First World War, Canada had a small cadre of gunners. Aside from regular training during the late nineteenth and early twentieth centuries, Canadian artillery saw only

limited combat in the Northwest Rebellion of 1885 and during the Second Boer War. The Canadian artillery's involvement in the Northwest Rebellion was too temporally distant and too small to have much of an impact on the First World War. However, the Boer War proved to be a major catalyst for change in the British and Canadian artilleries. Militarily, the Canadian artillery's role in the Boer War was slight. Canada only contributed eighteen 12-pounder guns, organized into three batteries. Canadian artillerymen served variously; guarding the supply lines of the British army, in the relief of Mafeking, and at the battle of Leliefontein.¹⁶ For Canada, the war was chiefly notable for the service of several officers who would become important artillery commanders for the Canadian Corps in the Great War, particularly E.W.B Morrison. Morrison commanded a section of guns at Leliefontein, where the gunners were engaged in their most sustained combat of the war.¹⁷ While the involvement of Canadian artillery was minor, the war in South Africa demonstrated serious shortcomings in British artillery tactics. At the time, artillery commentators quite frequently cited the disaster at Colenso where British gunners were slaughtered by long range rifle fire while crewing their guns as emblematic for the need to reform.¹⁸ Fire support was also uneven and grappled with the dispersion of Boer forces, a factor which made concentrations of fire difficult.¹⁹ The recognition of these shortcomings provoked serious reforms in the Royal Artillery after the war. These post-Boer War reforms, when coupled with major improvements in artillery technology during the years between 1902 and 1914, set the stage for how British and Canadian gunners entered the First World War.

¹⁶ G. W. L. Nicholson, *The Gunners of Canada: The History of the Royal Regiment of Canadian Artillery, 1534-1919*, vol. 1 (Toronto: McClellan and Stewart Limited, 1967), 146-160.

¹⁷ Nicholson, 154

¹⁸ H. A. Bethell, *Modern Artillery in the Field: A Description of the Field Army, and the Principles and Methods of its Employment* (London: Macmillan and Co. Limited, 1911), 280.

¹⁹ Sanders Marble, *British Artillery on the Western front in the First World War* (Burlington, VT: Ashgate Publishing Company, 2013), 16-17.

To understand the pre-First World War reforms to the Royal Artillery, it is necessary to first understand the general milieu in which the gunners formulated new approaches to the employment of artillery. As Tim Travers argued in his work *The Killing Grounds*, British officers spent the years before 1914 developing an overall attitude that emphasized the offensive at all costs. This outlook was shaped by circumstances that included rapidly changing technology, fears of modernity, and the need for war to be decisive. Travers argues that this “cult of the offensive” was deeply embedded in the fabric of the British military establishment.²⁰ Also, due to the uncertain nature of future British deployments, which could be overseas in the empire or on the continent, there was an emphasis on flexibility instead of adherence to a set doctrine.²¹ Beyond just the focus on the “cult of the offensive” there were also a specific conception of the role of the artillery on the battlefield. Fundamentally, there was no question among pre-war gunners that the artillery was anything other than a supporting arm for the infantry.²² However, the lack of a clear doctrine meant that there was debate over how to best support the infantry. Keeping in mind these general conceptions of warfare and artillery support, it is necessary to examine the various trends which dominated the discourse surrounding artillery before the First World War.

One of the most important reforms of the period between the end of the Boer War and the beginning of the First World War was the concentration of artillery assets at the divisional level. As part of the wider reforms to the British army, almost all the resources of the Royal Artillery were concentrated into divisional artilleries. Corps and army level artillery formations were, for

²⁰ Tim Travers, *The Killing Ground: The British Army, the Western front & the Emergence of Modern Warfare, 1900-1918* (London: Routledge, 1993), 37-38.

²¹ Shelford Bidwell and Dominick Graham, *Firepower: British Army Weapons and Theories of War 1904-1945* (London: George Allen & Unwin, 1982), 18-19.

²² Marble, *British Artillery*, 12-13.

all intents and purposes, done away with.²³ Batteries remained unchanged as the smallest formation of the artillery, while improvements were made to the structure of the brigade and divisional artillery to make them, in theory, much more effective at controlling the guns.²⁴ Due to the concentration of artillery at the divisional level and the abolition of real corps level artillery assets, the chain of command over the divisional guns became a pressing concern. Even with the possibility that multiple divisions would be fighting together in a corps or army sized formation, pre-war commentators expected the divisional artillery to be the most important level of command.²⁵ The focus on the divisional artillery, when combined with the emphasis of the artillery as a supporting arm in battle, led to an interesting trend in pre-war British artillery theory. Particularly, commentators were convinced that the command of the artillery should be concentrated into one person's hand. As Major C. E. D. Budworth argued in a lecture to the Royal United Services Institute, "combined action demands a central guiding brain — a single commander."²⁶ Although this principle seems logical enough, it was widely expected by pre-war theorists that the divisional commander, not an artillery officer, would ultimately be in command of the guns. Yet, the principle that the divisional commander should be in control of the artillery was complicated by the role of the officer who was nominally in charge of the divisions guns, the Commander, Royal Artillery (CRA). The position of the CRA had been created in 1907. Due to the principle of unified command, the CRA did not actually have executive control over the divisional artillery. If anything, the role of the CRA was merely advisory. Writing in his pre-war artillery manual, Colonel H. A. Bethell noted that "The G.O.C [General Officer Commanding]

²³ Marble, *British Artillery*, 23-24.

²⁴ Marble, 23.

²⁵ Bethell, *Artillery in the Field*, 223.

²⁶ C. E. D. Budworth, "Training and Action Necessary to further Co-Operation between Artillery and Infantry," *Journal of the Royal United Services Institute* 57, no. 419 (1913): 67.

division commands the artillery of the division just as much as he commands the infantry. Any system under which the G.O.C commands merely the infantry, and tells the C.R.A. to act in support, is unsound.”²⁷ In practice, pre-war theorists expected the CRA to advise the divisional commander on how best to employ the artillery, but the divisional commander would be free to issue whatever orders necessary to the division’s guns.²⁸ Bethell did note that the CRA could be given independent command during a “deliberate attack or defence of a position.”²⁹ However, the tiny divisional artillery staff — composed of only a single staff captain and a few other orderlies — was not at all capable of coordinating large numbers of guns.³⁰ Moreover, in order to centrally control the division’s guns, some form of a communications organization was needed.

The only way for one person to effectively exercise command of a large number of guns was through the emerging realm of communications technology. The Royal Artillery was aware of the necessity for some form of communications system in a divisional artillery. Before the First World War, some gunners advocated for an expansion of the role of the telephone for the direction of the artillery in battle. Major Molyneux seemed to have been an early and fervent proponent of using telephones. He argued in 1909 that “a very urgent requirement of our artillery is the provision of a proper telephonic outfit for each battery, and proper organisation for communication.”³¹ Molyneux also argued that “telephonic communication between the infantry and supporting artillery is also essential; if an artillery officer can be spared to accompany the infantry advance, the result of his observation of fire effect will be invaluable to the supporting

²⁷ Bethell, *Artillery in the Field*, 223.

²⁸ Marble, *British Artillery*, 24-25.

²⁹ Bethell, *Artillery in the Field*, 226.

³⁰ Marble, *British Artillery*, 26.

³¹ E. M. Molyneux, “Artillery Support of Infantry,” *Journal of the Royal United Services Institute* 53, no. 381 (1909): 1462.

artillery, if communicated to them by telephone.”³² Yet, despite Molyneux’s arguments, when the war broke out the artillery had little in the way of communications equipment. There were few telephones, even less telephone lines, and, with only three signaling staff at the divisional artillery headquarters, a severe shortage of staff. While there was an appreciation of the possibilities of telephones as a method of coordination and communication, little was done to ensure that there was a robust communications infrastructure.³³ In addition to communications technology, there was also a need for cooperation between the artillery and the infantry during an attack. However, how the artillery should cooperate with the infantry was unclear. In a lecture to the Aldershot Military Society, Major Budworth seemed to be under the impression that the artillery would have to liaise with the infantry commanders to obtain information since he argued that “first of all we must know your plans, &c. Secondly, we must keep constantly in touch with you, and thirdly, we must push guns as much forward as possible.”³⁴ However, as Bidwell and Graham note in their book *Firepower*, there were no actual attempts at figuring out how to conduct liaison between infantry and artillery. Artillery commanders were expected to conform to the infantry’s plans, but there was very little consideration of how this might be done in practice.³⁵ Despite reforms to the command and communication apparatus of British divisional artilleries, the lack of communications equipment and unclear command structure meant that the command of the artillery was only effectively wielded at the battery level.³⁶ Thus, the development of a role for the artillery on the battlefield was hampered by the difficulties of wielding centralized control of the artillery.

³² Molyneux, “Artillery Support of Infantry,” 1465.

³³ Marble, *British Artillery*, 25-26.

³⁴ C. E. D. Budworth, “Artillery in Cooperation with Infantry,” 1910, RG 24 Volume 22007, Library and Archives Canada, 7.

³⁵ Bidwell and Graham, *Firepower*, 20-21.

³⁶ Marble, *British Artillery*, 26.

While there was a general lack of doctrinal development and uncertainty about command and control, there were also deep divisions between the various branches of the Royal Artillery. The Royal Artillery, in Canada and Britain, was divided into different branches. Each branch had its own equipment and expectations of battle which resulted in competing understandings of how to use artillery in support of offensive operations. The three different branches of the Royal Artillery were the Royal Horse Artillery (RHA), the Royal Field Artillery (RFA), and the Royal Garrison Artillery (RGA). The least consequential branch of artillery in the First World War was the RHA. The horse artillery formed specialized batteries of highly mobile light guns that could keep up with advancing cavalry. However, due to the overall weakness of cavalry on First World War battlefields, the RHA played a relatively minor role in the war.³⁷ Canada's own horse artillery formation, the Royal Canadian Horse Artillery (RCHA), only operated in support of the Canadian Corps for a small number of operations. For example, the RCHA only supported their fellow Canadians at Hill 70 and Amiens.³⁸ For most of the war, the RCHA was attached to the British Cavalry Corps. Thus, the RCHA does not play an integral part in the story of Canadian artillery in the First World War.

Much more important for the study of artillery in the First World War was the division of the Royal Artillery between the other two branches, the RFA and the RGA. The RFA focused on mobile quick-firing guns and howitzers that could operate in close support of the infantry. However, the role of the RFA was in flux after the Boer War. Before the start of the First World War, there were significant changes made to the equipment and the structure of the RFA. Old

³⁷ Martin Farndale, *History of the Royal Regiment of Artillery: Western Front, 1914-1918* (London: Royal Artillery Institution, 1986), 342. RHA batteries using the 13-pounder gun fired less than 1 percent as many shells as the RFA did throughout the war.

³⁸ G. W. L. Nicholson, *The Official History of the Canadian Army in the First World War: Canadian Expeditionary Force 1914-1919* (Ottawa: Queen's Printer and Controller of Stationery, 1962), see pages 39, 293, 396, and 404 for information regarding the Royal Canadian Horse Artillery.

style breech loading guns were abandoned for more modern equipment like the 18-pounder field gun and the 4.5-inch field howitzer.³⁹ While there were also major structural changes to the organization of the artillery, it is highly significant that, prior to the outbreak of the First World War, the RFA had little experience with the new equipment. The overall lack of experience, and the advances in artillery technology, led to sustained inquiry into how these new weapons would be employed on the battlefield.

Due to the adoption of radically new weapons between the end of the Boer War and the outbreak of the First World War, there was a great deal of debate over how to functionally employ the new weapons on the battlefield. The design of these new weapons shaped how the Royal Artillery thought the guns would be used in the First World War. Adopted after the Boer War, the 18-pounder field gun was the most numerous RFA piece and it also incorporated several innovative new technologies which made it a formidable modern weapon for its time. The first innovation was that it was a quick-firing gun. First perfected by the French before the turn of the twentieth-century, quick-firing guns relied on recoil springs to return the gun to a resting position after it had been fired, which meant that the gun carriage did not recoil during firing. At a stroke, this revolutionized field artillery. Quick-firing guns negated the need to re-sight and re-lay the gun after each shot and also allowed the gunners to stay right next to the gun as it fired.⁴⁰ Due to the fact that the gun did not need to be re-aimed, the 18-pounder had a very high theoretical rate of fire, perhaps up to twenty rounds per minute “under experimental conditions” as contemporaries noted.⁴¹ Consequently, each 18-pounder gun was many times more effective than the slower firing breach loading guns which had preceded it. The adoption of

³⁹ Marble, *British Artillery*, 19.

⁴⁰ Marble, 19-20.

⁴¹ Budworth, “Artillery in Cooperation with Infantry,” 6.

quick-firing guns is an example of how technology revolutionized firepower before the First World War. It is important to note that the British were not the only army dealing with the new firepower capabilities of the artillery. Starting with the adoption of the French 75mm field gun in 1898, all the major continental powers updated their arsenals with the modern quick firing guns.⁴² However, gunners in Britain and across Europe, needed to determine how the vastly improved firepower of the artillery would influence battlefield operations.

For the Royal Artillery, shells technology was another area of change. One of the most important pre-war decisions made by the gunners in the RFA was to abandon high explosive (HE) shells in favour of shrapnel shells. Due to the lackluster performance of HE shells during the Boer War, the Royal Artillery almost dispensed with them entirely.⁴³ As a consequence of this decision, shrapnel shells were the only shells available for the 18-pounder when war broke out. The choice of the Royal Artillery to focus on shrapnel also drove other technical changes to the guns. The design of the 18-pounder gun carriage only allowed an 18-pounder to fire its shrapnel shell at a relatively low, flat, trajectory. These shells were fused to explode as they approached the target and spread hundreds of shrapnel balls across the targeted area. The resulting hail of shrapnel, if fused to explode at the right moment, had the potential to be extremely deadly against soldiers in the open. However, while shrapnel was optimized for fighting against troop formations in the open, it was not very effective against almost all other targets.⁴⁴ Also important was the fact that shrapnel shells lost effectiveness as they slowed down. Thus, driven by the design of the gun carriages and the decreased killing power of shrapnel at long ranges, the field artillery mostly gave up on long range firing. Despite being theoretically

⁴² J. B. A. Bailey, *Field Artillery and Firepower* (Oxford: The Military Press, 1989), see pages 122-125 for a discussion of British, French, and German gun technology on the eve of war.

⁴³ Marble, *British Artillery*, 20.

⁴⁴ Marble, 19-20.

less effective, proponents of the focus on shrapnel touted the simplified logistics and the increased mobility of the guns which could be made lighter and less complex if they were only firing shrapnel at relatively short ranges. In keeping with the tactical doctrine of the time, it was expected that highly mobile guns would be more effective anyways, so there appeared to be little downside to the abandonment of high explosive shells.⁴⁵ The focus on shrapnel demonstrates how technical decisions could affect battlefield tactics.

While the 18-pounder was the mainstay of the RFA, the adoption of the new quick-firing 4.5-inch field howitzer was also an important step forward. The 4.5-inch howitzer was also a quick-firing gun, sharing many of the characteristics of the 18-pounder. However, instead of firing a shell at a shallow angle, the howitzer fired a shell in a high arching trajectory which could fire over hills or into trenches. In terms of the ammunition it used, the 4.5-inch was mainly armed with shrapnel shells which were supplemented with a few HE shells. Yet, according to Sanders Marble, the RFA's light howitzer HE shell was not designed for maximal explosive effect. Rather, pre-war British theorists expected the gunners to use HE to dial in the range of a target before employing the howitzer's shrapnel shell as the main offensive weapon.⁴⁶ As a result of this change, the RFA was not well equipped to fight infantry that relied on defensive fortifications. Yet, pre-war theorists did not expect this to be a serious shortcoming of the artillery. In a lecture in 1910, Budworth made a fascinating observation when he argued that "artillery fire cannot be trusted to destroy obstacles, such as barbed wire entanglements, &c., even if they can be located."⁴⁷ Therefore, while there was a recognition that the enemy may rely on defensive fortifications, the RFA downplayed the need to destroy entrenched enemy positions

⁴⁵ Marble, *British Artillery*, 20.

⁴⁶ Marble, 21.

⁴⁷ Budworth, "Artillery in Cooperation with Infantry," 6.

because of the expectation that the light field guns and howitzers could maneuver around the enemy and offset the benefit of their fortifications.

Pre-war technical improvements also addressed the problem of the vulnerability of the gun crew to enemy rifle fire. Driven by Boer War experience, a gun shield was added to the 18-pounder and the 4.5-inch howitzer. By adding a vertical steel plate onto the front of the gun carriage, the crew were protected from the enemy's rifle fire. Pre-war theorists, such as Bethell, argued that gun shields on field artillery pieces were the technical development which enabled the guns to get relatively close to the enemy line and provide fire support.⁴⁸ Taken altogether, quick firing guns armed with new shrapnel shells, gun shields, and other technical innovations were not solely decisive for determining how the guns would be used. However, these innovations in weapons technology form part of the interlinking matrix of factors which framed how pre-war British artillery tactics were conceived.

Pre-war technical decisions, like the focus on shrapnel shells and the addition of gun shields, led British artillery theorists to argue that the primary role for the artillery would be to support the infantry near the frontlines. Close support was not a new concept. The field artillery had been supporting the infantry with direct fire for centuries.⁴⁹ Yet, the Royal Artillery's conception of close support contained many interesting features. Commentators expected that the artillery would be physically near the advancing infantry, since their mere presence was expected to lend support to the infantry's morale.⁵⁰ There was some disagreement about how exposed the guns should be when they operated in a close support role. Budworth argued that the morale effect of the "spirit of 'close support'" outweighed the disadvantages of the having the guns

⁴⁸ Bethell, *Artillery in the Field*, 280.

⁴⁹ Bailey, *Field Artillery and Firepower*, 45.

⁵⁰ Marble, *British Artillery*, 37.

exposed and vulnerable near the infantry in the attack.⁵¹ Other theorists were a bit more cautious about exposing the guns themselves. In an article published in the journal of the Royal United Services Institute, Captain Kearsley noted that, despite the guns being shielded, “attacking artillery should not be exposed to enemy’s rifle fire.”⁵² Major Molyneux argued in 1909 that “the use of the ‘covered position,’ where equally good support can be given by it as can be done by exposing a battery, should be thoroughly inculcated into our artillery, just as much as the use of cover is insisted on for the infantry.”⁵³ However, nearly everyone agreed that, at a certain point in the offensive, it would be necessary to push the guns up right up to the frontline in order to obtain a decisive victory. Kearsley, in the same sentence where he noted that the artillery should avoid rifle fire, also argued that “artillery in the final state of an attack may be advanced to within the decisive ranges and continue its fire upon, and over, the position held by the enemy during the infantry assault.”⁵⁴ However, actual training in close support tactics were relatively minimal. The Royal Artillery did not conduct live fire exercises where infantry and artillery cooperated in a mock battle.⁵⁵ While the RFA had a well-developed notion of close support, it remained to be seen how it would function on the battlefield.

The design of new quick firing guns enabled very high rates of ammunition consumption. Almost all the commentators examining artillery before the war were aware of the problem ammunition consumption posed. It was a matter of simple arithmetic to realize that quick-firing field guns were capable of very high rates of fire. Budworth quite accurately understood the problem of ammunition consumption when he noted: “a battery might expend all the ammunition

⁵¹ Budworth, “Artillery in Cooperation with Infantry,” 8.

⁵² A. H. C. Kearsley, “The Manner in Which the Infantry Attack Can Best Be Supported by Artillery Fire,” *Journal of the Royal United Services Institute* 54, no. 388 (1910): 766.

⁵³ Molyneux, “Artillery Support of Infantry,” 1466.

⁵⁴ Kearsley, “Supported by Artillery Fire,” 766.

⁵⁵ Marble, *British Artillery*, 36-37.

in its wagons and limbers in twenty minutes.” Yet, he also discounted this as “unlikely to occur.”⁵⁶ This highlights a prevailing assumption concerning ammunition. The response of pre-war commentators to the potential for massive ammunition consumption was to argue that expenditure should be limited at every opportunity. Captain Kearsley expressed this sentiment when he wrote that “the indiscriminate use of the new guns would quickly deplete the ammunition columns, and ... ‘rapid fire’ should only be opened when the infantry are in great difficulties.”⁵⁷ The recognition of ammunition constraints also prompted one of the quirks of pre-war British artillery doctrine, namely that there was to be no real preparatory fire before the infantry’s attack commenced. Nearly all commentators were adamant in their view that the artillery would begin to fire only at the commencement of an infantry attack, not before it. Captain Kearsley, quoting the influential Sir Ian Hamilton at length, explained the prevailing expectations of battle as such:

It is mere waste of ammunition, and an encouragement to an entrenched enemy, to fire at him before the commencement of the advance with anything but high angle howitzer fire, and even with howitzers it is no good firing until the imminence of the attack has forced the enemy to man his trenches. Field guns should not open fire until the attacking infantry has got so close to the position that the garrisons of the trenches must hold their heads up to aim and shoot.⁵⁸

Budworth echoed this sentiment in a 1913 lecture given at the Royal United Services Institute.

Budworth argued that for “the infantry advance and artillery action, or duel, to be successful, [they] must form but one, and not separate, phases of the battle.”⁵⁹ The prevailing conception of the artillery’s role in battle relied on the artillery supporting the infantry with fire when they

⁵⁶ Budworth, “Artillery in Cooperation with Infantry,” 6.

⁵⁷ Kearsley, “Supported by Artillery Fire,” 767.

⁵⁸ Kearsley, 772.

⁵⁹ Budworth, “Training and Action,” 76.

began the attack. There was no appreciation of the necessity of firing beforehand, nor the ammunition available, to clear the way for the infantry by weight of fire alone.

Due to the lack of emphasis on preparatory fire, and the overall emphasis on supporting the offensive, there was a focus on mobility in the RFA. The gunners expected that it would be necessary for the guns to operate in relatively close support of the infantry during fluid offensive operations.⁶⁰ The emphasis on close support is highlighted by Budworth's argument that "for artillery, the loss of mobility is the crossing of the Rubicon; it ceases to be available for general purposes."⁶¹ Instead of a rigid system of prepared bombardments, it was considered important that the RFA be able to move the guns to where they could decisively support the infantry. Taken altogether, the technical realities of the RFA's equipment drove a specific set of assumptions about the nature of the artillery's role on the battlefield. The RFA's officers expected the new quick firing guns to support the infantry on a mobile battlefield with shrapnel shells. The gunners would be protected from hostile rifle fire, while ammunition consumption would be limited by only firing while the infantry was attacking. The overall cohesiveness of the RFA's conception of battle stood in stark contrast to the confusion surrounding the role of the heavy guns.

The emphasis on the use of artillery in a close support role had many adherents in the RFA, but there were dissenting voices in the final branch of the artillery, the Royal Garrison Artillery. As a branch of the Royal Artillery, the RGA controlled the heavy guns (known as siege guns in British parlance), coastal defences, and various other odds and ends. Since the heavy guns were less mobile and had longer ranges, they did not fit with the overall orthodoxy of mobile light field guns propounded by the field artillerymen. In general, due to having fewer

⁶⁰ Marble, *British Artillery*, 37.

⁶¹ Budworth, "Artillery in Cooperation with Infantry," 3.

numbers of larger guns, the RGA was more focused on using scientific principles to enable accurate long-range fire.⁶² This attitude was quite often at odds with the views of the field artillerymen. However, the views of the heavy artillery gunners did not often carry the day. The RFA scoffed at suggestions that the gunners incorporate more scientific elements into standard gunnery practice, like accounting for the prevailing meteorological conditions.⁶³ There was also a great deal of confusion over the role of the RGA in general. The confusion surrounding the role of the 60-pounder heavy guns in the divisional artillery is instructive of the confusion surrounding the role of the artillery. The single battery of four 60-pounders were the only RGA units in a divisional artillery. The 60-pounder gun was quite different than the field artillery's weapons. Most importantly, the 60-pounder had a much longer range, up to 10,000 yards. It also had much larger and more powerful HE shells that could have been of great utility to the divisional artillery. However, this capability was mostly wasted since the 60-pounders were primarily armed with shrapnel shells when the war broke out.⁶⁴ Due to their long range and heavy shells, the 60-pounder was not suited for acting in close support. Rather than acting in a close support role, pre-war artillery theorists seem to have vaguely expected the RGA's 60-pounders to fire at targets of opportunity at long ranges. Budworth at least acknowledged the possibility of long range gunnery when he noted that "artillery firing is bound to take place at very distant ranges [in the next war]."⁶⁵ Yet, beyond vague assertions like this, there was no real development of the role the 60-pounder guns should play on the battlefield. The confusion surrounding the role of the 60-pounder was also repeated with the other RGA formations. Pre-

⁶² Bidwell and Graham, *Firepower*, 23-24.

⁶³ Farndale, *History of the Royal Regiment*, 372.

⁶⁴ Marble, *British Artillery*, 21.

⁶⁵ Budworth, "Artillery in Cooperation with Infantry," 4.

war, the RGA possessed several independent batteries of heavy 6-inch and 9.45-inch howitzers.⁶⁶ However, because they were not incorporated in exercises at all, they had even less of an effect on the general ideas about artillery usage. Overall, there was no real development of the practical role of the RGA's large heavy guns in cooperation with the field artillery or the infantry.

Prior to the beginning of the First World War, countering the enemy's artillery featured little in British thought. British guns had struggled to counter Boer guns during the Boer War. However, they faced very few Boer guns and even less harassing fire. Consequently, the Royal Artillery simply concluded that the enemy's guns would not be an issue.⁶⁷ Even if the British ran into significant enemy fire, Marble notes that the Royal Artillery was not expected to counter the enemy's guns directly, but only insofar as it was necessary to support the infantry more generally.⁶⁸ For example, in his Aldershot lecture, Major Budworth makes no mention of counter battery fire at all. Captain Kearsley does mention in passing that "the enemy's heavy guns will...probably become the first objective of the attacking artillery, provided...that their positions can be located and the effects of fire be observed."⁶⁹ However, Kearsley did not elaborate on how to locate the positions of enemy batteries nor the process for determining which to engage first. Major Molyneux perhaps hinted at an important development when he noted that "concentration of fire is as essential as ever; ... control can now be exercised over batteries widely dispersed, and an even greater effect produced by the converging fire of dispersed batteries from several points than could be produced by the same volume of fire from the same firing point."⁷⁰ Nevertheless, conducting this in practice during battle would be

⁶⁶ Marble, *British Artillery*, 22.

⁶⁷ Marble, 29.

⁶⁸ Marble, 35.

⁶⁹ Kearsley, "Supported by Artillery," 765.

⁷⁰ Molyneux, "Artillery Support of Infantry," 1463.

complicated by communication issues and a lack of infrastructure for identifying enemy guns. Consequently, the Royal Artillery's understanding of how to conduct counter-battery fire was underdeveloped prior to the beginning of the war.

Echoing the process of reform underway in the Royal Artillery, there were also significant reforms made to the structure of the Canadian military establishment prior to the First World War. During this period, there were important similarities between British and Canadian artillery, and important differences. Like the British, Canadian gunnery was divided by branch (between Royal Canadian Field Artillery and the Royal Canadian Garrison Artillery). However, in Canada there was also a major division in the artillery between the small permanent force of professionals, and the larger militia artillery force. The permanent force formed the RCHA and a few batteries of coastal defence guns at Esquimalt and Halifax.⁷¹ In contrast, the field artillery was made up mostly of part time militia batteries. Despite these differences, considerable effort was expended to ensure that Canadian artillery adhered to British operational procedure as often as possible. By 1914, Canadian gunners conducted their training using the most up to date British training manual; *Field Artillery Training 1914*.⁷² Following Britain's lead, Canada also rearmed its artillery with modern quick-firing guns, although only a small number of guns were available by the time the First World War began. The Canadian government also secured for itself a small supply of Canadian made ammunition.⁷³ There was a sustained effort to build up an organization that could mobilize enough guns and trained men to support a British style expeditionary force in case of war.⁷⁴ Additionally, there was also an effort to integrate Canadian

⁷¹ Nicholson, *Gunners of Canada*, 164-168.

⁷² Nicholson, 159.

⁷³ Nicholson, 165 and 177-178.

⁷⁴ J. L. Granatstein, *Canada's Army: Waging War and Keeping the Peace* (Toronto: University of Toronto Press, 2002), 48.

staff procedures with British standards. Prior to the First World War, the Canadian military sent officers to British staff colleges, but only twelve officers attended staff college before the war broke out.⁷⁵ In the pre-war period, while the Canadian artillery was heavily influenced by British artillery practices there were also key differences between British and Canadian artillery.

During the pre-war period, changes were made both structurally and technologically within the Canadian artillery establishment. However, the pace of change was not uniformly positive. Historian Jack Granatstein notes that overall budgets were low, training was uneven, and there remained serious divisions between the permanent troops and the militia.⁷⁶ Pre-war artillery organization also differed significantly from the British standard in that the Canadian militia batteries had only four guns each. The hypothetical Canadian expeditionary force, modeled on the British standard, had six-gun batteries. Conforming to the British standard for Canada's expeditionary force necessitated the breaking up of some fifteen militia batteries to produce nine batteries, organized into three British style artillery brigades, when war came.⁷⁷ Furthermore, very few chances for combined training of the infantry and artillery were possible, which hampered readiness. Canadian gunners did have a large new training camp at Petawawa. However, financial constraints meant that no combined arms training occurred at Camp Petawawa between 1907 and 1912.⁷⁸ The lack of combined training led to some interesting departures from British theory. Compared to the British zeal for close support, the Canadian gunners paradoxically complained that they had been better trained in longer range gunnery and had very little experience in close support.⁷⁹ Even within the artillery, training was relatively

⁷⁵ Granatstein, *Canada's Army*, 45.

⁷⁶ Granatstein, 48.

⁷⁷ Nicholson, *Gunners of Canada*, 195-196.

⁷⁸ Nicholson, 172.

⁷⁹ Nicholson, 188-189.

uneven. Some of the batteries were well trained but not all were, as is evidenced by the visit of Sir John French to Canada in 1910. French, who would command the British Expeditionary Force during the first years of the war, assessed the readiness of the Canadian artillery during his visit. French concluded that a third of the artillery batteries were ready to fight, a third could be made ready in a few weeks, and the final third would take months to ready for war.⁸⁰ Training did gradually improve, as is evidenced by reports from various British observers who visited Canada after 1910.⁸¹ However, due to the focus on training and equipping an artillery force, there seems to have been no independent Canadian inquiry into the tactics of employing artillery in battle. Canadian officers did attend British manoeuvres in 1912 and did analyze overall British tactics to an extent.⁸² However, it appears that Canadian gunners adopted British tactics.

Prior to the First World War, theorists in the Royal Artillery engaged in serious discussions about the proper usage of artillery. Due to the prevailing emphasis on the “cult of the offensive,” no single tactical doctrine emerged which governed the usage of artillery on the battlefield. What was left was a notion that the artillery’s role was to support the infantry’s offensive. Organizationally, the concentration of guns at a divisional level was an important development. However, the confusion about who would have control of the guns and the overall lack of communication equipment meant that effective control of the guns would be extremely difficult when the war started. New equipment had the potential to revolutionize the role of firepower on the battlefield. However, because of the desire for the guns to operate in a close support direct fire role, no attempt was made to maximize the potential firepower of the guns. Several technical choices fed into this. The new field artillery equipment was mostly equipped

⁸⁰ Nicholson, *Gunners of Canada*, 190.

⁸¹ Nicholson, 180-182.

⁸² Nicholson, 188-189.

with shrapnel shells, and the emphasis on the protection afforded by gun shields fed into the RFA's mania for close support. Instead of embracing the potential destructiveness of the new equipment, the gunners were trained to conserve ammunition and fire only when an attack was underway. The RGA's focus on longer range and more accurate gunnery was largely ignored by the field artillerymen. In short, new equipment and lack of a clear doctrine characterized the Royal Artillery in the lead up to the First World War. The Canadian gunners adopted most of these reforms. Canada adopted the new equipment, drew up mobilization plans to support an expeditionary force, and focused on training the gunners up to British standards. However, Canada entered the First World War with assumptions about the role of the artillery on the battlefield inherited from the British Royal Artillery. These assumptions would shape the employment of artillery on the battlefield in the first stages of the First World War.

Chapter 2: Mons to Mount Sorrel

When the First World War broke out, Canada began to mobilize an expeditionary force while the British Expeditionary Force faced its baptism of fire on the continent. Even from the first battles of the war, it was readily apparent that it would be a war unlike any other. In response, the gunners of the Royal Artillery attempted to adapt the new reality of warfare resulting in rapid and lasting changes to the artillery system. Most importantly, the pre-war conception of the role of artillery on the battlefield gave way to increasing attempts to destroy the enemy entirely. By examining the changing role of the preliminary bombardment, the development of the barrage system, early experimentation with counter-battery work, and the clarification of the command structure, it is possible to examine the main changes affecting artillery on the battlefield. The experience of battles such as Messines Ridge in late 1914 and Mount Sorrel in June 1916 effectively demonstrates how British and Canadian gunners were forced into addressing the problems presented by trench warfare. Overall, the experience of 1914 demonstrated the inadequacy of the pre-war artillery doctrine, which prompted the search for a new set of tactics. Experimentation with new artillery tactics in 1915 gradually produced a tactical doctrine centred around the destruction of enemy defences, a doctrine which laid the groundwork for the usage of artillery at the Somme.

For Britain and Canada, the war began on 4 August 1914, when Britain declared war on Germany. While the war was met with jubilation on the streets, there was confusion in the Canadian military establishment. Before the war broke out, plans had been drawn up for the mobilization of the militia. Upon the declaration of war, Minister of Militia Sam Hughes

improvised a new mobilization plan which relied upon calling up militia units.⁸³ The artillery was mobilized from militia batteries and reached the main training camp at Valcartier by the end of August. The planned artillery contingent for the Canadian Expeditionary Force (CEF) faced serious problems of organization. Pre-war militia organization had only four guns per battery, but the British standard, which the CEF was to be modelled under, had six-gun batteries. This necessitated the amalgamation of fifteen militia batteries to produce nine 18-pounder batteries, organized into three British style artillery brigades, which accompanied the first contingent.⁸⁴ However, breaking up old militia units to form the new style batteries necessitated a period of adjustment where the gunners needed to learn to work effectively as a team.⁸⁵ The artillery of the first contingent also included a battery of heavy 60-pounder guns to support the divisional artillery but no 4.5-inch guns, of which there were too few in Canada to equip the artillery.⁸⁶ Initial training in August and early September was limited since the camp at Valcartier had no artillery range at all.⁸⁷ Nevertheless, by mid-September the first contingent of Canadian troops began the journey overseas. The Canadian artillery complement, with its divisional guns and 1500 rounds of ammunition per gun, reached England on 24 October 1914.⁸⁸ The first contingent of the Canadian Expeditionary Force camped on Salisbury plain throughout the winter of 1914-1915. While the Canadians were camped out on the Salisbury plain conducting training

⁸³ J. L. Granatstein, *Canada's Army: Waging War and Keeping the Peace* (Toronto: University of Toronto Press, 2002), 53-56.

⁸⁴ G. W. L. Nicholson, *The Gunners of Canada: The History of the Royal Regiment of Canadian Artillery, 1534-1919*, vol. 1 (Toronto: McClellan and Stewart Limited, 1967), 195-196.

⁸⁵ Nicholson, 196-197.

⁸⁶ G. W. L. Nicholson, *The Official History of the Canadian Army in the First World War: Canadian Expeditionary Force 1914-1919* (Ottawa: Queen's Printer and Controller of Stationery, 1962), 22.

⁸⁷ Nicholson, *Gunners of Canada*, 199.

⁸⁸ Nicholson, 200-201.

exercises, the gunners in the British Expeditionary Force (BEF) were coming to terms with the experience of fighting on the continent.

While the Canadian military establishment was hurriedly outfitting the first contingent, the BEF had already engaged in heavy fighting on the continent. The first encounters at Mons and Le Cateau had been defensive battles fought to stop the advance of the assaulting German forces. From the fighting in August and September 1914, it was immediately apparent that the war was not conforming to pre-war expectations. Little concern had been given to using artillery in defensive operations and it was immediately apparent how serious a threat the enemy artillery posed. Many British guns were silenced at Le Cateau by effective German counter battery fire, clearly upending pre-war expectations of the threat posed by enemy guns.⁸⁹ Furthermore, the expectations of the role of gunners on the battlefield did not conform to pre-war plans. Some batteries did operate in close support of the infantry during the early battles, conforming broadly to pre-war expectations. However, by the time of the First Battle of Ypres in the autumn of 1914, many batteries were also kept well in the rear and used in an indirect fire support role, linked to the front only via telephone lines. The withdrawal of batteries to the rear and the increasing reliance on indirect fire was hampered by the serious lack of communication equipment. There was simply not enough telephones or telephone wire to link forward observers with the guns.⁹⁰ Gradually, the whole front began to congeal into two opposing trench systems after the failure of either side to turn the enemy's flank during the "Race to the Sea."

The development of trench warfare fundamentally altered how artillery was wielded for the rest of the war. As the front began to stagnate into opposing trench lines, the gunners of the

⁸⁹ Sanders Marble, *British Artillery on the Western front in the First World War* (Burlington, VT: Ashgate Publishing Company, 2013), 44-46.

⁹⁰ Marble, 53-54.

Royal Artillery were faced with an interlinking set of problems. Strategically, because the German army now occupied a large part of northern France, it was incumbent on the British and French forces on the Western Front to push them out of their defensive positions. To do so, it was necessary for the gunners to support the infantry in breaking the stalemate. However, serious problems beset the Royal Artillery. Logistically, the number of shells available to the guns was inadequate even a month into the war. British shell production simply could not sustain offensive operations. As early as a month into the war, ammunition was critically short for all weapons.⁹¹ The entire British monthly production of 18-pounder shrapnel shells was only 10,000 shells per month, enough for about one shell per gun per day.⁹² The shell shortage, as it became known, was not solvable by the gunners alone. It took time for Britain's industrial base to be mobilized to substantially increase shell production. In the meantime, the gunners were forced to make do with what they had available.

While British industry mobilized to support the Royal Artillery, the gunners were forced to immediately confront the new and disorienting obstacles posed by trench warfare. The most obvious obstacles presented by trench warfare were the physical obstacles. Although primitive at first, German defensive emplacements rapidly grew in complexity and depth. The combination of barbed wire entanglements, machine gun emplacements, and trenches proved to be a formidable set of obstacles. Additionally, although the German artillery was short of ammunition, the British gunners needed to come up with a framework for dealing with the enemy's artillery.⁹³ The Royal Artillery's communications infrastructure needed to be upgraded for the artillery to be able to support offensive operations. Determining the best method to

⁹¹ Marble, *British Artillery*, 48.

⁹² Shelford Bidwell and Dominick Graham, *Firepower: British Army Weapons and Theories of War 1904-1945* (London: George Allen & Unwin, 1982), 96.

⁹³ Marble, *British Artillery*, 59.

effectively support the infantry also required overhauling the decentralized command structure which had defined the pre-war Royal Artillery. While each of the problems posed by trench warfare were solved, it took precious time and experimentation to create a framework for dealing with the onset of trench warfare.

Although there is no single date for when trench warfare began, by late 1914 the first set piece attacks involving the coordinated action of infantry and artillery were taking place. The attack on Messines Ridge in December of 1914 provides a case study of the pre-war offensive artillery tactics being put to the test. To support French offensives scheduled for late 1914, the BEF launched a series of attacks along their portion of the front at Messines Ridge from 14-20 December 1914.⁹⁴ In terms of the artillery plan, it is interesting to note how closely it followed the general principles of the pre-war doctrine. The various divisional commanders planned their own bombardments with little concern for a combined plan while the corps level artillery officers did not attempt to coordinate the offensive action. Following pre-war doctrine there was no preliminary bombardment, nor any plan to cut the barbed wire which was already springing up in front of the trench lines.⁹⁵ Even if the gunners had intended to carry out a preliminary bombardment to destroy the German barbed wire, the shortages in ammunition posed a serious problem. The Indian Corps only had 40 rounds of 18-pounder ammunition per gun to support its entire attack on 17 December.⁹⁶ Fire support, where it existed, took the form of the individual batteries firing on targets of opportunity as the infantry began their attack. Predictably, the slap dash artillery arrangements were inadequate. The decentralization of command, lack of cooperation, lack of ammunition, and lack of specialized shells for wire-cutting, all led to the

⁹⁴ Sir James E. Edmonds and G. C. Wynne, *Military Operations France and Belgium, 1915: Winter 1914-1915: Battle of Neuve Chapelle: Battle of Ypres*, History of the Great War (London: Imperial War Museum, 1927), 17-20.

⁹⁵ Marble, *British Artillery*, 56-58.

⁹⁶ Edmonds and Wynne, *Winter 1914-1915*, 19.

attacks failing.⁹⁷ In practice, pre-war tactics were insufficient to support the infantry in trench warfare.

As the fighting gradually died down in late 1914, the senior officers in the BEF and Royal Artillery attempted to digest the lessons from the fighting in 1914. Most dramatically, the experience of fighting in 1914 seemed to demonstrate that the existence of trenches and barbed wire was what prevented the infantry from breaking the deadlock of trench warfare. While pre-war doctrine focused on neutralizing the enemy's troops, the gunners of the Royal Artillery began to emphasize that success would be made possible by destroying the German positions. As early as the attacks at Messines Ridge, senior British officers were primarily concerned with destroying the trenches which sheltered the German infantry.⁹⁸ It is quite remarkable how quickly, and as historian Sanders Marble notes how, with very little deliberation, the conversation among gunners surrounding the use of artillery switched from the pre-war conception of close support towards the tactic of completely destroying the enemy's positions. The focus on destruction changed the whole nature of British artillery support for several years of fighting as it quickly became the dominant way in which the role of artillery was perceived. When faced with the problems presented by the onset of trench warfare in late 1914, it seemed to the gunners that the best way to support the infantry was to destroy the obstacles to the infantry's advance.⁹⁹ Other problems were also being addressed. Artillery that operated in the open, protected only by gun shields, was completely inadequate in 1914. German counter-battery fire killed crews and destroyed guns positioned in the open with frightening ease. As close support, particularly direct fire, roles became increasingly ineffective due to hostile artillery fire

⁹⁷ Marble, *British Artillery*, 56-58.

⁹⁸ Marble, 57.

⁹⁹ Marble, 59-60.

supported by aerial observers, it became necessary to hide the artillery from view.¹⁰⁰ It also became clear from the defensive battles of 1914 that, while shrapnel shells were extremely effective against infantry in the open, they were of limited effectiveness when used to try and destroy fortifications. Moreover, excessive shell consumption and dangerously low stockpiles of shells meant that the gunners had limited ability to use the guns effectively.¹⁰¹ By 1915, it was very clear that both these issues needed addressing for the artillery to be effective in future battles.

In these early days of the war, much of the innovation in artillery tactics was carried out at the divisional level. For example, in late 1914 the first operations orders (documents laying out the fire support role of the artillery in a single attack) were being issued by the CRA of the British 3rd Division. Overall, 3rd Division's template for operations orders would eventually be followed throughout the war.¹⁰² However, the pace of change was uneven and varied per the competence of the various CRAs. Despite individual efforts at solving the problem posed by trench warfare, it took some time to reverse the pre-war decentralization of artillery command. At this early point in the war, the role of artillery officers at the army and corps level remained purely advisory with no authority over the divisional CRAs. Cooperation between divisional artilleries, where it existed, was based purely on the working relationships of the various CRAs.¹⁰³ Compounding the existing issue in the command structure was the need for improved communications equipment. Communications problems manifested throughout the war, but by the end of 1914 the British army realized the severity of the problem. Finally, there was a

¹⁰⁰ Martin Farndale, *History of the Royal Regiment of Artillery: Western Front, 1914-1918* (London: Royal Artillery Institution, 1986), 332-333 and Marble, *British Artillery*, 59-60.

¹⁰¹ Marble, *British Artillery*, 59.

¹⁰² Farndale, *History of the Royal Regiment*, 83-85.

¹⁰³ Marble, *British Artillery*, 61-63.

recognition that for any offensive to succeed the enemy's guns needed to be destroyed. The need for effective counter-battery fire, which was first realized in 1914, remained an area of concentration throughout the war.¹⁰⁴ Combat experience in the first months of the war had exposed the faults of pre-war artillery tactics. In 1915, the gunners attempted to address these issues.

While the first Canadian contingent spent the entire winter of 1914-1915 training on the Salisbury plain, chances for training were relatively limited due to inclement weather and overcrowding on the plain.¹⁰⁵ Moreover, once the Canadian gunners got into action in France, they were unable to gain much combat experience due to the extreme ammunition shortages. One 18-pounder battery in Flanders received only four 18-pounder shells per day!¹⁰⁶ While the lack of shells hobbled the striking power of the guns, progress was made on adapting the artillery to its role in trench warfare. To demonstrate the major changes to British artillery tactics in 1915, it is helpful to examine a few different battles which represent transitional points for the use of artillery. In March 1915, the British attacked near Neuve Chapelle using artillery tactics that, in some ways, reflected the pre-war expectations of battle modified by the experience of combat in 1914. The battles of Aubers Ridge and Festubert, in May 1915, marked a major transition in the usage of the preliminary bombardment, while the offensive at Loos, in September 1915, cemented the general set of tactics that dominated the thinking of the gunners until the battle of the Somme in 1916.

The offensive at Neuve Chapelle in the spring of 1915 demonstrates a shift in British artillery tactics away from the inadequacies of 1914. The attack at Neuve Chapelle was

¹⁰⁴ Farndale, *History of the Royal Regiment*, 332-333.

¹⁰⁵ Nicholson, *Gunners of Canada*, 203-204.

¹⁰⁶ Nicholson, 214.

envisioned as the first step in a series of offensives designed to take the strategically important Aubers Ridge, which overlooked the Ypres salient.¹⁰⁷ The artillery plan developed to support the attack on Neuve Chapelle started to codify some of the standard operating procedures for artillery planning that would dominate the rest of the war. To begin with, First Army commander Sir Douglas Haig, had a guiding hand in laying down his expectations for the artillery supporting the Neuve Chapelle offensive. For Haig, the primary tasks of the artillery were the destruction of the enemy frontline trenches, the use of artillery fire to protect the infantry's flanks from counterattack, the neutralization of the enemy's frontline trenches, and the destruction of enemy machine gun nests and artillery. However, this was still a transitional period. No single officer was solely in command of the artillery. While Haig created the guidelines, it was the divisional CRAs who planned the use of the guns on the battlefield.¹⁰⁸ Another novel feature of the usage of artillery at Neuve Chapelle was the high concentration of guns in a relatively small area. Bailey notes that there were 354 guns tasked to provide support to the infantry. All the firepower from these guns was concentrated along a front of only 1200 yards.¹⁰⁹ Moreover, despite the problems of ammunition supply, the BEF managed to stockpile enough ammunition to provide approximately 300-400 rounds per gun.¹¹⁰ This stockpile enabled the destructive fire planned along the front.

While the plan for the bombardment called for only 35 minutes of preparatory fire before the infantry attacked, the duration necessary to ensure the wire was cut and that the enemy's defences were destroyed was unknown. Due to the lack of experience attacking fortified positions, it was not known to Haig and the artillery staff just how much fire was needed to pave

¹⁰⁷ Edmonds and Wynne, *Winter 1914-1915*, 75.

¹⁰⁸ Farndale, *History of the Royal Regiment*, 86.

¹⁰⁹ J. B. A. Bailey, *Field Artillery and Firepower* (Oxford: The Military Press, 1989), 131.

¹¹⁰ Bailey, *Field Artillery and Firepower*, 131.

the way for the infantry. There was considerable disagreement, but ammunition constraints and the small number of heavy guns available meant that 35 minutes of preliminary fire was all the artillery could provide.¹¹¹ Preparations before the battle, including registering the guns and carrying out practice wire-cutting, were conducted gradually to not raise suspicion.¹¹² An important first for Neuve Chapelle was the formation of specific counter-battery units. Much of the heavy artillery then in France was concentrated into the Heavy Artillery Reserve which was attached to First Army and tasked to suppress the enemy's guns.¹¹³ In terms of planning, the first artillery timetable of targets was distributed to each battery prior to zero hour, while the gunners worked extensively with the fledgling Royal Flying Corps (RFC), which observed the artillery fire and provided reconnaissance information.¹¹⁴ With the preparations complete, at 7:30am on 15 March, 1915, the bombardment began. The destructive fire of IV and Indian Corps' guns turned out to be mostly successful. Most of the wire in the targeted areas was quickly cut by the shrapnel shells from the 18-pounders while the rest of the howitzers and guns focused on the German frontline trenches.¹¹⁵ Ten minutes into the bombardment, the heavy artillery's counter-battery program began. Meanwhile, twenty batteries of field guns began to lay down a standing barrage 400 yards behind the front to prevent the movements of Germans away from or towards the front. This barrage, intended to deny the enemy the use of the area behind the frontlines, was the first of the war.¹¹⁶ As Marble notes, all subsequent development of the barrage system would evolve from the humble standing barrage employed at Neuve Chapelle.¹¹⁷ The sudden large-scale bombardment caught the enemy completely by surprise. Most of the frontline trenches

¹¹¹ Marble, *British Artillery*, 73-74.

¹¹² Edmonds and Wynne, *Winter 1914-1915*, 77.

¹¹³ Edmonds and Wynne, 77-78.

¹¹⁴ Edmonds and Wynne, 85-86.

¹¹⁵ Edmonds and Wynne, 91.

¹¹⁶ Edmonds and Wynne, 92-93.

¹¹⁷ Marble, *British Artillery*, 75.

targeted by the artillery plan were nearly obliterated by the time the bombardment lifted at 8:05am.¹¹⁸ The British infantry surged into the breach opened by the guns, but tragically the offensive stalled due to a lack of communications infrastructure and an overly centralized command structure which could not react to the sudden success.¹¹⁹ Although the battle was not a success, the usage of artillery at Neuve Chapelle had a lasting impact on British artillery tactics.

The artillery support at Neuve Chapelle had been relatively successful. However, the lessons learnt by the British high command were not always positive. Instead of drawing on the lesson that the short but fierce bombardment had mostly neutralized the German defences and gained the element of surprise, the high command was convinced the attack failed because of the defences not being destroyed.¹²⁰ At Neuve Chapelle, the wire-cutting operation had been relatively successful against the simple wire defences of the day. However, the rapid increase in the complexity of the German defences soon made it much more difficult to cut the enemy's wire. Meanwhile, the bombardment of German trenches had failed to destroy several large portions of the line. The consequence of the failure of the destructive portion of the bombardment was more attention was given to destroying the German trenches.¹²¹ In addition to being a catalyst for change in the role of artillery, Neuve Chapelle is notable for another reason. Namely, the battle marked the first involvement of Canadian troops in an offensive action, even though all the untested Canadians did was occupy a flank and provide diversionary fire on the front opposite them.¹²² The Canadians faced more sustained combat in April 1915, when the enemy attacked their positions in the Ypres salient. The Second Battle of Ypres is most

¹¹⁸ Edmonds and Wynne, *Winter 1914-1915*, 92-93.

¹¹⁹ Nicholson, *Gunners of Canada*, 213.

¹²⁰ Bailey, *Field Artillery and Firepower*, 131.

¹²¹ Marble, *British Artillery*, 74.

¹²² Tim Cook, *At The Sharp End: Canadians Fighting the Great War, 1914-1916* (Toronto: Viking Canada, 2007), 106-107.

remembered for the introduction of gas warfare to the Western Front. However, it was also the main baptism of fire for the guns of the 1st Canadian Division. In the desperate defence of the salient, the Canadian gunners fired thousands of rounds to stem the German attacks. Despite the overall shell shortage that gripped the Allies during 1915, the 2nd Canadian Field Artillery Brigade fired 12,000 rounds of ammunition in just two days of fighting.¹²³ The efforts of the gunners helped stop the advance of the German offensive. However, despite the ferocity of the fighting, due to the defensive nature of the fighting at 2nd Ypres the Canadians did not have a chance to experiment with new tactics.

After Neuve Chapelle and 2nd Ypres, the gunners of the Royal Artillery continued to change their methods in response to the tactical situation. Aubers Ridge had been the target of British offensive planning since Neuve Chapelle earlier in the year, and the BEF was ready to try to take the ridge by May 1915. The artillery preparations for the attack on Aubers Ridge were modelled after the offensive at Neuve Chapelle. On 9 May 1915, a sharp, but short, bombardment of 40 minutes presaged the British infantry's attack on Aubers Ridge. The short bombardment was not new, but it is interesting to note several innovations. The artillery plan for the capture of the ridge provided for batteries of field artillery which would form up near the frontline prior to the battle and be ready to follow the infantry forward and provide close support gun fire. The provision for field artillery batteries operating in close support was instituted as a response to the failure of the gunners to react quickly to trouble spots at Neuve Chapelle.¹²⁴ Cooperation with the RFC was also expanded to include continuous observation from planes sporting wireless communication sets.¹²⁵ Aubers Ridge also marks the first time an aircraft was

¹²³ Cook, *At the Sharp End*, 164.

¹²⁴ Sir James E. Edmonds, *Military Operations France and Belgium, 1915: Battles of Aubers Ridge, Festubert, Loos*, History of the Great War (London: Imperial War Museum, 1927), 8-9.

¹²⁵ Edmonds, *1915: Battles of Aubers Ridge, Festubert, Loos*, 10.

assigned to aid the gunners in counter battery work.¹²⁶ However, the short bombardment failed to provide enough suppressing fire to keep the Germans in their trenches as the infantry advanced. While the infantry began to advance during the last ten minutes of the preliminary bombardment, the artillery barrage shifted 600 yards off the frontline before the infantry could reach the German trenches. Moreover, the preliminary bombardment had failed to cut the wire adequately. Predictably then, the unsupported infantry were shredded by machine gun fire.¹²⁷ The offensive turned out disastrously, producing 11,000 casualties for no gain.¹²⁸

Many factors led the failure of the Aubers Ridge offensive. Many of the guns available to the Royal Artillery were old 15-pounder guns which were not as effective as the modern 18-pounders. Moreover, even where modern guns and howitzers were available, their accuracy suffered from months of continuous fighting with little maintenance.¹²⁹ The 18-pounder HE shell, employed at Aubers Ridge for the first time, was a useful addition to the British arsenal. Under limited tests in April 1915, the HE shell was determined to be effective against German parapets.¹³⁰ While it may have been useful in test conditions, at Aubers Ridge the shell was simply not powerful enough to be a substitute for large amounts of fire from heavy howitzers.¹³¹ Most importantly, the failure at Aubers Ridge proved to be the final major attack that employed a short preliminary bombardment until Cambrai in 1917!¹³² In the place of the short bombardment, the gunners employed increasingly longer and heavier bombardments that were intended to crush the enemy defences completely. Interestingly, GHQ justified dropping short bombardments in

¹²⁶ Marble, *British Artillery*, 82.

¹²⁷ Edmonds, *1915: Battles of Aubers Ridge, Festubert, Loos*, 19-22.

¹²⁸ Nicholson, *Gunners of Canada*, 232.

¹²⁹ Farndale, *History of the Royal Regiment*, 103-104.

¹³⁰ "Second Army Report: Trials of The 18-pounder HE Shell," 21-22 April 1915, RG9-III-C-3 Volume 4006 Folder 1 File 8, Library and Archives Canada, 1.

¹³¹ Marble, *British Artillery*, 82.

¹³² Farndale, *History of the Royal Regiment*, 107.

order to economize the usage of shells. The argument was that hasty bombardments led to inefficient allocation of resources in the rush to achieve the objective of the attack.¹³³ In the quest to destroy the enemy's defences, Aubers Ridge seemed to prove that a short bombardment could not offer sufficient levels of destruction. In response, new tactics were sought.

Despite the failure of the attack at Aubers Ridge, the BEF quickly launched another offensive towards Festubert in May 1915. The usage of artillery at Festubert very clearly demonstrates the changing nature of the role of the artillery. The artillery plan for the bombardment in support of the attack at Festubert ditched the short bombardments that had so far characterized British artillery tactics. Instead, the artillery preparations were spread out over two and a half days. An impressive 433 guns and howitzers were tasked with destroying 5,000 yards of German defences. However, the artillery was hobbled by shell shortages since only 150 rounds per gun was allotted for the entire bombardment period.¹³⁴ The guns, particularly the 18-pounders, were devoted to wire cutting which was satisfactorily accomplished after extra time was allotted to complete the task. The howitzers focused on the destruction of trenches in support of the infantry. However, while the bombardment was effective in some areas, the lack of effective counter battery fire doomed the offensive. Although the BEF allotted No. 1 Heavy Artillery Group, including the Canadian Heavy Batteries, to counter-battery work, they failed to silence a single German battery.¹³⁵ As zero hour approached on 15 May, German guns opened a strong bombardment of the Allied frontline trenches, wreaking havoc on the infantry with impunity.¹³⁶ The disruption caused by the counter-bombardment doomed any chance of success during the initial attack. The British offensive continued for a few more days with little results.

¹³³ Marble, *British Artillery*, 83.

¹³⁴ Farndale, *History of the Royal Regiment*, 108.

¹³⁵ Edmonds, *1915: Battles of Aubers Ridge, Festubert, Loos*, 54.

¹³⁶ Nicholson, *Gunnery of Canada*, 232.

Despite the failures in May 1915, the abandonment of the short artillery bombardment was a decisive change in British artillery tactics. The longer artillery preparation at Festubert allowed the gunners to adequately destroy the enemy's defences, but the battle proved more than ever that counter-battery fire was an important, but unsolved, problem.

The battle of Loos in September and October 1915 demonstrates the overall set tactics which emerged from the experimentation of 1915. Particularly, the preparations for the Loos offensive demonstrates what lessons were absorbed, and what lessons were ignored from the fighting in spring 1915. The battle of Loos was the British contribution to the wider French offensive in Artois aiming at Vimy Ridge and the Douai Plain, which coupled with a simultaneous offensive in Champagne, was intended to expel the Germans from France.¹³⁷ Sir Douglas Haig's First Army planned for an offensive involving six divisions attacking along a four-mile-long front from the La Basse Canal to the village of Loos.¹³⁸ The preparations for the preliminary bombardment demonstrate how much artillery planning had evolved since the beginning of the war. In total, the artillery plan for Loos called for a 96-hour bombardment.¹³⁹ On the first day of the preliminary bombardment the gunners began with harassing fire and registration, and in subsequent days the intensity of fire grew as the task of cutting the German wire was undertaken.¹⁴⁰ The artillery plan for the offensive at Loos is also interesting because of the recognized inadequacy of the artillery to carry out all the tasks allotted to it. Due to the lack of ammunition and heavy guns, there was no expectation that the preliminary bombardment would be enough. Instead, the use of gas was intended to aid in the preparations. The limited amount of fire from heavy guns was diluted widely across the frontage, while the field artillery

¹³⁷ Edmonds, *1915: Battles of Aubers Ridge, Festubert, Loos*, 111-113.

¹³⁸ Edmonds, 148-150.

¹³⁹ Farndale, *History of the Royal Regiment*, 121.

¹⁴⁰ Farndale, 122.

concentrated on cutting the wire in front of the German first line. No attempt was made to cut the wire in front of the German second line defences.¹⁴¹ Counter-battery fire failed to adequately silence the German artillery, which simply stopped firing when they came under fire, and so appeared to have been destroyed. However, the German gunners simply waited for the offensive to begin to recommence their own fire. Nowhere was the artillery fire adequate to destroy the enemy's obstacles. Wire cutting was difficult, true counter-battery fire was not achieved, and the heavy artillery wasted its fire on too many targets.¹⁴²

Despite the failure of the artillery to accomplish its role under the plan, the Loos offensive was still launched. On the morning of 25 September, forty minutes prior to zero hour, the artillery bombardment intensified, and at zero hour the artillery program shifted to a lifting barrage, jumping from one German trench line to the next.¹⁴³ The development of the lifting barrage had its origins perhaps as far back as summer of 1915. Marble speculates that VI Corps or 6th Division were possibly the first to carry out a lifting barrage during a small attack near Hooge.¹⁴⁴ In any case, the lifting barrage was a further evolution of the concept of a defensive barrage that would cover the advance of the infantry. The lifting barrage was carried out on a timetable whereby the artillery would lift their fire from one objective to the next based on a preplanned schedule.¹⁴⁵ The development of the lifting barrage was an important innovation, but it was not a substitute for a proper preliminary bombardment. Despite the gunner's preparations, the amount of artillery allotted to the attack was simply not enough. First Army tried to compensate with the substitution of gas, but the plan of attack became overly reliant on the gas

¹⁴¹ Edmonds, *1915: Battles of Aubers Ridge, Festubert, Loos*, 164.

¹⁴² Edmonds, 167.

¹⁴³ Edmonds, 172-173.

¹⁴⁴ Marble, *British Artillery*, 88-89.

¹⁴⁵ Marble, 90-91.

attack to cover the advance of the infantry. When the gas failed to be the panacea the planners hoped, the artillery was not able to provide enough cover to support the infantry.¹⁴⁶ The battle of Loos dragged on for another month after the initial attack with little overall success in breaking the stalemated Western Front.

As major offensives ceased after the battle of Loos, the gunners reacted to what had worked and what had not worked with the artillery in the 1915 battles. The lessons learnt during 1915 were distilled into a series of doctrinal documents published by the General Staff at General Headquarters (GHQ) in early 1916. The “Artillery Notes” series of pamphlets dealt with several different themes like the use of artillery in offensive operations, counter-battery work, and close support. Most important was S.S. 98/4 “Artillery Notes No. 4 — Artillery In Offensive Operations.” The first few pages of “Artillery Notes No. 4” details the general steps to be taken when planning for the use of artillery in an offensive. The artillery commander needed to first understand the frontage where the attack will take place, an estimate of the number of guns and their capabilities, and have thorough reconnaissance of the ground to be bombarded. When it comes to the actual plan itself, the “allotment of tasks,” the pamphlet presents a fascinating example of the priorities the senior gunners had in early 1916. First, the author notes that the field guns’ primary task is to cut the enemy’s wire. Secondly, the field howitzers and medium howitzers, like the new 26-cwt. 6-inch howitzers, were supposed to destroy the enemy’s frontline defences. The heavy howitzers were supposed to be used to destroy the second line defences and any strong points in the frontline. Super heavy howitzers, like 12-inch and 15-inch howitzers, were used for special targets like villages or deep dugouts. Finally, medium guns like the 60-pounder were to be used for counter battery work, but they could also be used in the destructive

¹⁴⁶ Farndale, *History of the Royal Regiment*, 126.

bombardment.¹⁴⁷ The document also explains that the “preliminary bombardment is designed to achieve a certain purpose, namely, to enable the infantry to enter and penetrate the enemy’s positions: for his works and the obstacles protecting them must be adequately destroyed, and his morale shaken.”¹⁴⁸ Artillery preparation also depended on constant, particularly nighttime, harassing fire. The purpose of this was twofold, “to shake his morale” and to prevent the enemy “from repairing the damage done to his trenches and wire.”¹⁴⁹ Long bombardments also seemed to be preferred because of the “effect on the enemy’s morale as the protracted strain of some days’ exposure to constant shell fire.”¹⁵⁰ However, most telling was the lack of emphasis on the neutralization of the enemy during the attack. The firepower potential of the German defenders was barely acknowledged. For example, the pamphlet notes that machine guns need to be suppressed during the attack, but how this should be systematically accomplished is lacking detail. The section on barrages only considers the use of standing barrages and cautions that “to attempt to keep up intense fire for any great length of time may only lead to the guns being short of ammunition at the moment when the attack actually comes.”¹⁵¹ Overall, “Artillery Notes No. 4” encapsulates the evolution of British artillery tactics during 1915. The focus of the artillery was on the destruction of trenches and barbed wire, to the detriment of any possibility of stopping German machine guns from slaughtering the British infantry when they attacked.

In addition to the overall codification of the planning and employment of artillery, the principles of accurate long-range gunnery were being realized in the BEF. In January of 1916, GHQ also published the pamphlet “Artillery Notes No. 1 — Close Shooting in the Field.”

¹⁴⁷ “S.S. 98/4 ‘Artillery Notes No. 4 — Artillery In Offensive Operations,’” April 1916, RG 24 Volume 21998, Library and Archives Canada, 1-6.

¹⁴⁸ “S.S. 98/4,” 10.

¹⁴⁹ “S.S. 98/4,” 11.

¹⁵⁰ “S.S. 98/4,” 12.

¹⁵¹ “S.S. 98/4,” 13-14.

Mostly the document explains in technical terms how to achieve accuracy in the field. While not strictly operating in a direct fire role, the guns were nevertheless being used to support friendly infantry that were operating in very close proximity to the areas being bombarded. Thus, accuracy was of paramount importance to lessen the chance of friendly fire. The recognition of the effect of weather, wear on the guns, the ammunition to be used, and the role of registering the guns all demonstrates how much the science of gunnery had changed in 1914 and 1915.¹⁵² Also published in January 1916 was “Artillery Notes No. 3 — Counter-Battery Work.” The changing role of the artillery is encapsulated in the very first line of the pamphlet which read “counter-battery work is in many ways the most important...of the tasks of the artillery.”¹⁵³ The pamphlet details the rapid changes which were occurring regarding the collection of information about enemy gun positions, particularly the use of aerial reconnaissance, flash spotting, and ground observation. Additionally, there were details about typical enemy gun positions, the role of counter-battery work in all manner of operations, and the general principles of counter-battery fire. Interestingly, the writer notes that the enemy’s batteries “cannot be *permanently* silenced except by the destruction of its guns...but the object in view may be better attained by its *temporary* silencing or neutralization.”¹⁵⁴ Additional technical developments also aided British counter-battery work. Sound ranging, the process of determining the location of guns by using the “sound waves generated by their firing,” was pioneered by Third Army as early as 1916. However, early sound ranging methods were complex and only functioned when a few guns were active, lest the system be overwhelmed.¹⁵⁵ Also notable was the increasing cooperation of

¹⁵² “Artillery Notes No. 1 — Close Shooting in the Field,” January 1916, RG 24 Volume 21998, Library and Archives Canada, 1-7.

¹⁵³ “Artillery Notes No. 3 — Counter-Battery Work,” January 1916, RG 24 Box 21998, Library and Archives Canada, 1.

¹⁵⁴ “Artillery Notes No. 3,” 3. Emphasis in original.

¹⁵⁵ Marble, *British Artillery*, 119.

aircraft with counter-battery fire, as early as mid-1915 Second Army was fully integrating the RFC into its counter-battery program.¹⁵⁶ Counter-battery fire remained in its infancy, as demonstrated by the consistent failure of British counter-battery fire to permanently silence German guns. However, increasing experience with accurate fire, the codification of doctrine, and the integration of new technical improvements were the first steps towards the creation of an integrated counter-battery system.

Command and control arrangements, which had been unclearly laid out prior to the war, were also an important area for improvement in 1915. Particularly, there was a realization of the need for control above divisional level. The battle of Loos marked an important milestone since it was the first offensive action where the artillery was controlled at the corps level. The amalgamation of several divisional artilleries into one command that could operate across a relatively large area was an important step forward in the coordination of artillery. The coordination of the corps' artillery fell to the newly created position of Commander Corps Royal Artillery (CCRA).¹⁵⁷ Despite the constant search for a set of tactics that could reliably defeat the enemy defences, there was a serious problem in that German defences adapted to each innovation in Allied artillery fire, rendering the new artillery tactics less useful.¹⁵⁸ Taken together, the tactics pioneered in 1915 and codified into doctrine in early 1916 were the basis for the usage of artillery in 1916.

Despite the general lack of offensive action before the Somme, the involvement of the Canadian Corps at the battle of Mount Sorrel in June 1916 demonstrates the tactics which grew out of the experience of fighting in 1915. The Battle of Mount Sorrel began as a German

¹⁵⁶ Marble, *British Artillery*, 120.

¹⁵⁷ Farndale, *History of the Royal Regiment*, 118.

¹⁵⁸ Marble, *British Artillery*, 110.

offensive against the 3rd Canadian Division's positions on Mount Sorrel, which guarded part of the Ypres salient. On 2 June 1916, a large German artillery bombardment was laid down on the frontlines of the 3rd Canadian Division as German infantry swept forward and attacked. Taken by surprise, the Canadians were pushed back 600-700 yards from their former frontline.

Unfortunately, the commanding officer of the 3rd Division, Major-General Mercer, also happened to be visiting the front at the moment of the attack and was killed during the fighting. Canadian infantry on the flanks rushed to close the breach in the line, and by the next day the front had stabilized. The German attackers had advanced 600-700 yards on a front approximately 600 yards wide. In the process, they seized some of the best defensive positions on Mount Sorrel.¹⁵⁹ Despite the setback suffered by the Canadian Corps, the British High Command ordered the Canadians to retake Mount Sorrel since it provided a commanding position over the Ypres Salient.¹⁶⁰ The responsibility for retaking Mount Sorrel fell primarily on the shoulders of the Canadian Corps.

The planned bombardment of Mount Sorrel, which prepared the way for the infantry attack, followed very much in the British style. The bombardment, the plan for which was laid out in Canadian Corps Royal Artillery Operation Order 11, was intended to “entirely destroy the enemy’s defences, kill his personnel, and prepare for our infantry assault.”¹⁶¹ The bombardment itself was split into three phases. Phase one was a ten-hour long bombardment carried out between 7:00am and 7:00pm on 12 June, with two one hour pauses to ensure the guns were registered on their targets. The goal of the artillery fire in phase one was to employ the heavy guns to destroy the enemy trenches. Operations Order 11 was clear that “trenches must be

¹⁵⁹ Nicholson, *Official History*, 147-151.

¹⁶⁰ Nicholson, 151.

¹⁶¹ “Canadian Corps R.A., Operation Order No. 11,” 11 June 1916, RG9-III-C-3 Volume 4011 File 16 Folder 3, Library and Archives Canada, 1.

obliterated.”¹⁶² The second phase was an intense half-hour long bombardment involving all guns under the command of the Canadian Corps, including the heavy guns and the 18-pounders, slated for 8:00pm on 12 June. The order called for the bombardment to be carried out with the guns “firing at greatest speed consistent with accuracy.” Phase three immediately preceded the infantry attack, taking the form of a 45-minute bombardment conducted in the same manner as phase two. Meanwhile, the bombardment transitioned to a lifting barrage as the infantry assault began.¹⁶³ In addition to the destructive fire, the importance of counter battery fire was well recognized. Operation Order 11 assigned the medium guns to counter battery work, and even went so far as to state that “it is of vital importance to check the hostile artillery fire after the attack is launched.”¹⁶⁴ The artillery preparations proved to be very successful. In the *Official History of the Canadian Army in the First World War*, Nicholson notes that the German defenders were completely surprised and unable to halt the advance of the four Canadian infantry battalions as they advanced up the slopes of Mount Sorrel.¹⁶⁵ However, it should be noted it was not solely a Canadian effort. In addition to the two Canadian Divisional Artilleries and the Canadian Corps heavy guns, two British Corps, V and IX, the 3rd British Divisional Artillery, and numerous other batteries of heavy guns contributed their guns to aid the attack.¹⁶⁶ The usage of artillery at Mount Sorrel represents the culmination of the trends in the usage of artillery up until the middle of 1916. The role of the artillery at Mount Sorrel was clear, to destroy the enemy’s defences and pave the way for the infantry.

¹⁶² “Operation Order No. 11,” 1.

¹⁶³ “Operation Order No. 11,” 1.

¹⁶⁴ “Operation Order No. 11,” 2.

¹⁶⁵ Nicholson, *Official History*, 153.

¹⁶⁶ Farndale, *History of the Royal Regiment*, 140.

From the first artillery duels at Mons and Le Cateau up until the prepared bombardment at Mount Sorrel in June 1916, the employment of artillery by the BEF changed rapidly and decisively. The initial contacts in 1914 demonstrated the inadequacy of pre-war expectations of the usage of artillery. Guns operating in close support of the infantry were simply too vulnerable, so the artillery was withdrawn behind the lines. During the winter of 1914/1915, the BEF moved away from suppressing the enemy and towards attempting to destroy the enemy's defences. When operating in support of the infantry attacks at Neuve Chappelle and Aubers Ridge in 1915, the gunners decided that short bombardments were unable to adequately destroy prepared defences. More changes followed, from increasing realization of the need for counter-battery fire, to more centralized command and control arrangements. At Loos and into early 1916, the gunners attempted to bludgeon the German defenders with increasingly longer and fiercer bombardments. The codification of doctrine and tactics during the winter of 1915/1916 pulled together many of the disparate trends in the development of artillery, trends which culminated in the minor Canadian success at Mount Sorrel. However, while Mount Sorrel was successful, the application of the same set of tactics at the Somme produced a miserable failure. The experience of a few battles in 1915 cemented a system of artillery which would dominate the early tactics used in the fighting at the Somme. The experience gained at the Somme rapidly improved many areas of British artillery support which were lacking in sophistication.

Chapter 3: The Somme and Vimy Ridge

Due to the inadequacy of the Royal Artillery's pre-war artillery doctrine, the BEF spent the year of 1915 attempting to find a role for the artillery on the battlefield. From the experimentation with new methods in 1915, senior British commanders drew the lesson that the purpose of artillery support was to destroy the German defensive positions. The BEF entered the battle of the Somme in the summer of 1916 with this expectation. However, the failure of the artillery to adequately destroy the German defensive works before the attack on 1 July demonstrated the problems inherent in this doctrine. Thus, artillery tactics changed rapidly during the Somme campaign to compensate for the failings of British doctrine. Four elements of the use of artillery which were improved at the Somme require analysis, namely the system of command and control, improved preliminary bombardments, the development of the creeping barrage, and the rationalization of counter-battery methods. The actions of the Canadian Corps at the battles of the Somme and Vimy Ridge illustrate the changes in British artillery. During the planning for the attack on Vimy Ridge, the Canadian Corps borrowed heavily from the set of artillery tactics that were pioneered at the Somme and then codified in British doctrine in early 1917. Canadian artillery tactics at Vimy Ridge were not new nor innovative, but instead relied on the accumulated experience of the BEF.

The Somme campaign was a period of very rapid innovation in the development of artillery tactics which, when coupled with many other improvements throughout the army, led to a series of successful battles in 1917. The evolution of command and control arrangements in the BEF was an important legacy of the Somme. However, this was not a straightforward process. Due to the vast nature of the resources required to carry out an attack, the duration and scope of any bombardment preceding a major attack was a strategic issue and not a tactical one. Thus,

senior commanders at GHQ set the duration of the bombardment. Once GHQ had decided on the nature and duration of an attack, the army (or armies) involved in the offensive were responsible for assigning counter-battery and heavy artillery resources to the corps. Each corps then drew up a plan to capture its objective and deal with targets in its sector. Additionally, the corps was responsible for coordinating counter-battery fire with the Royal Flying Corps.¹⁶⁷ Corps level artillery officers had a very important role in planning for any offensive action. However, during the Somme, the entire system of artillery command at the corps level was thrown into confusion by an administrative change. Throughout the war, artillery command had slowly been centralized. By mid-1916, the General Officer Commanding, Royal Artillery (GOCRA) was in command of the Corps artillery complement. However, the creation of the position of Commander, Corps Heavy Artillery (CCHA) in mid-1916 eroded the executive authority of the GOCRA. The CCHA took responsibility for the corps heavy artillery complement, and tended to circumvent the authority of the GOCRA. As a result, the GOCRA largely reverted to a more advisory role and British corps tended to lack centralized control of the artillery.¹⁶⁸ Interestingly, this process did not occur in the Canadian Corps. The GOCRA of the Canadian Corps retained the prestige of the executive commanding officer position during the Somme.¹⁶⁹ As a result, there was more stability in command and control arrangements in the Canadian Corps during the Somme campaign.

One of the defining features of the Somme campaign was the failure of the British attack on 1 July. Part of this failure was the inability of the artillery's preliminary bombardment to

¹⁶⁷ Sanders Marble, *British Artillery on the Western front in the First World War* (Burlington, VT: Ashgate Publishing Company, 2013), 124.

¹⁶⁸ G. W. L. Nicholson, *The Gunners of Canada: The History of the Royal Regiment of Canadian Artillery, 1534-1919*, vol. 1 (Toronto: McClellan and Stewart Limited, 1967), 242.

¹⁶⁹ Nicholson, 242-243.

destroy the German defences. Part of the reason the artillery was unable to destroy the German defences was that the role of the artillery on the battlefield was poorly understood by senior commanders. Field Marshal Sir Douglas Haig seemed to envision the artillery's role in the offensive as paving the way for the breakthrough which would end trench warfare and restore mobility to the battlefield. Meanwhile, First Army commander Sir Henry Rawlinson seemed to imagine the offensive as a series of sequential steps, which historian Tim Travers calls the "bite and hold" approach whereby the artillery would enable the infantry to take one trench line, consolidate, and then support an attack to take the next limited objective.¹⁷⁰ The confusion surrounding the purpose of the main offensive push on 1 July did not help with artillery preparations. Nor had carrying out adequate destructive fire gotten any less difficult since Loos in 1915. Cutting the enemy's wire remained an unsolved problem, especially since the German defences now incorporated multiple defensive lines each with their own barbed wire entanglements. The bombardment also failed to effectively deal with the enemy's deep dugouts which sheltered the German troops during the six-day preliminary bombardment.¹⁷¹ The bombardment was ostensibly planned from the army level, but each corps had significant latitude over the bombardment in its sector. This resulted in significant variation in the artillery preparations.¹⁷² Some British corps concentrated only on the first line of German defences, totally eschewing any chance for a decisive breakthrough in favour of limited objectives, with good results.¹⁷³ The confusion surrounding the purpose of the bombardment, and what tactics

¹⁷⁰ Tim Travers, *The Killing Ground: The British Army, the Western front & the Emergence of Modern Warfare, 1900-1918* (London: Routledge, 1993), 130-134.

¹⁷¹ Nicholson, *Gunners of Canada*, 258.

¹⁷² Martin Farndale, *History of the Royal Regiment of Artillery: Western Front, 1914-1918* (London: Royal Artillery Institution, 1986), 332-333 and Marble, *British Artillery*, 142.

¹⁷³ Marble, *British Artillery*, 135.

were best able to deliver results, was one of the factors which led to the failure of the attack on 1 July.

Despite the problems with planning for the offensive, the scale of the preparations for the attack on 1 July were massive. By mid-1916 the BEF was finally overcoming the persistent shell shortages of 1915. Shell production increased dramatically in 1916, but the rapid expansion of the armaments industry led to poor quality control. As a result, a quarter of all shells were duds which limited the effectiveness of the artillery. In addition to more shells, new and better guns and howitzers were also arriving. During the Somme campaign alone, there was a net increase of 2,200 guns and howitzers in the BEF. More importantly, the number of medium and heavy howitzers quadrupled from 143 to 758 during 1916.¹⁷⁴¹⁷⁵ Technical changes helped with artillery preparations. For example, the deployment of new fuzes, primarily the No. 106 instantaneous fuze, and new heavy trench mortars helped with the wire cutting operations. However, neither was available in large enough numbers during the Somme campaign to make much of a difference.¹⁷⁶ While increases in the number of guns and amount of ammunition available helped, the artillery would have been useless without extensive logistical preparations. At the Somme, seven trains per day were solely detailed to transporting artillery ammunition. Meanwhile, engineers laid 50,000 miles of telephone cable — 7,000 miles of it deeply buried to immunize it from enemy artillery fire — to ensure communications for the artillery.¹⁷⁷ However, due to the uncertainty of the purpose of the bombardment and the difficulty of destroying the German defences, the artillery preparations were not complete when the infantry went ahead with the main attack on 1 July 1916. Predictably, they suffered terribly due to uncut wire and

¹⁷⁴ Marble, *British Artillery*, 127.

¹⁷⁵ Marble, 126.

¹⁷⁶ Marble, 133.

¹⁷⁷ Farndale, *History of the Royal Regiment*, 142-143.

unsuppressed enemy machine guns. After 1 July, Haig's hopes of a breakthrough were dashed and the campaign settled down into a series of smaller actions directed at taking limited objectives.¹⁷⁸ It was during this period that some of the most important changes in the usage of artillery occurred.

During the remainder of the Somme campaign, preliminary bombardments improved only incrementally. Part of the reason for this is that other aspects of the artillery's work, like barrages and counter-battery work, grew in importance and resource allocation.¹⁷⁹ Thus, the artillery tended to be concentrated more narrowly after 1 July to obtain good destructive results.¹⁸⁰ For example, during the Flers-Courcelette operation in September 1916, the Canadian Corps employed a three-day preliminary bombardment which crushed the German defences. However, the Canadians were aided by the large number of guns and a relatively limited frontage. Indeed, the Canadians deployed 64 heavy and 234 field guns on a frontage of only 2,200 yards.¹⁸¹ The historian of the 4th Brigade, Canadian Field Artillery (CFA), notes the mass of guns assembled in preparation for Flers-Courcelette by describing that "covering the floors of the valleys, were row after row of 18 pounders, 4.5 howitzers, 60 pounders and 9.2's. All was in readiness for the 'Big Push'"¹⁸² As Flers-Courcelette seemed to demonstrate, thorough preliminary bombardments could pave the way for the infantry if properly supported. However, preliminary bombardments never achieved consistent success in destroying the German defences. In October 1916, the Canadian Corps persistently failed to capture a section of the German defences dubbed Regina Trench. During successive attacks on Regina Trench, the

¹⁷⁸ Travers, *The Killing Ground*, 153-154.

¹⁷⁹ Marble, *British Artillery*, 137.

¹⁸⁰ Marble, 135.

¹⁸¹ Nicholson, *The Gunners of Canada*, 262-265.

¹⁸² J. A. MacDonald, ed., *Gunfire: An Historical Narrative of the 4th Bde. C.F.A. in the Great War (1914-1918)*, compiled by 4th Brigade C.F.A. [Canadian Field Artillery] Association (Toronto: Greenway Press, 1929), 55.

Corps' preliminary bombardments targeted the trench with very large amounts of shrapnel and high-explosive ammunition. Indeed, Canadian Corps Artillery Instructions No. 42, issued on 10 October 1916, explained that there was to be "no limit to the number of rounds fired on each spot, except that each section of trench must be completely obliterated."¹⁸³ Despite essentially unlimited ammunition, the trench survived substantially intact through several attempts at destroying it. Only after a month of trying did the trench fall to the Canadians on 11 November 1916.¹⁸⁴ The struggle for Regina Trench is only one example of where a preliminary bombardment could not be relied upon to completely destroy the German defences. Instead, actions like Regina Trench demonstrated that the expectation of complete destruction in British doctrine prior to the Somme was misplaced. Instead of trying to bludgeon the enemy, the gunners placed new emphasis on neutralizing the defenders during the infantry attack by using a creeping barrage.

One of the main innovations of fighting at the Somme was the evolution of the lifting barrage into the creeping barrage. In the literature, the origin of the creeping barrage is unclear. Paddy Griffith credits the 15th British Division at Loos with the first practical creeping barrage but whether this was a true creeping barrage is unclear.¹⁸⁵ While most of the attacks on 1 July featured various types of lifting barrages which drew heavily upon the type conducted at Loos in September 1915, some units began experimenting with moving barrages.¹⁸⁶ Moreover, after 14 July, creeping barrages became very common in prepared attacks.¹⁸⁷ In general, a creeping

¹⁸³ "Canadian Corps Artillery Instructions No. 42," 10 October 1916, *War Diary 18/04/1916-30/04/1917*, *General Officer Commanding, Royal Artillery, Canadian Corps*, Library and Archives Canada. http://collections.canada.gc.ca/pam_archives/index.php?fuseaction=genitem.displayItem&rec_nbr=2004735&lang=eng&rec_nbr_list=2004735,2004734,2004736,1883285,3224483,4288101,3948145,3948144,3948042,3948024

¹⁸⁴ Nicholson, *The Gunners of Canada*, 266-270.

¹⁸⁵ Paddy Griffith, *Battle Tactics on the Western front: The British Army's Art of Attack, 1916-1918* (New Haven, CT: Yale University Press, 1994), 142.

¹⁸⁶ Marble, *British Artillery*, 137-139.

¹⁸⁷ Marble, 140-141.

barrage was a moving wall of explosions which was intended to shield the infantry and neutralize the enemy. The barrage would move on a timetable, generally a certain number of minutes would elapse before the gunners would shift their fire forward 50 or 100 yards. The infantry followed closely behind this moving line of explosives. When the creeping barrage passed over the enemy's frontline, the infantry would only be a few yards away from the defenders and able to close the distance before the defenders had a chance to stop them. More guns would conduct destructive fire, searching up and down the line for enemy positions, while yet more guns would lay down a standing barrage on enemy positions before the creeping barrage passed over them. Once the infantry reached their objectives, the barrage would halt and provide a protective wall of fire for the infantry to consolidate their positions.¹⁸⁸ There were of course problems with the development of the creeping barrage. Most significantly, the barrages were planned based on rigid timetables. Changing local circumstances on the ground, for example an unexpected enemy strongpoint, had the potential to derail the entire barrage since everything depended on the barrage going according to plan. The experimentation process was also hampered by the complexity of organizing a creeping barrage. It was only at the corps level that staff officers had the resources and authority to coordinate a creeping barrage. Yet, corps level command and control was weak at the Somme.¹⁸⁹ Furthermore, friendly fire was also an ever-present danger. The infantry was required to stay very near the creeping barrage, close enough that they would likely take casualties from their own shells. However, this was a necessary risk as if the infantry were too far back, they would not be able to close the distance to the enemy positions when the barrage lifted. The distance of the infantry to the barrage varied

¹⁸⁸ Griffith, *Battle Tactics*, 142-143.

¹⁸⁹ Marble, *British Artillery*, 142-144. Marble notes that experimentation is not really the correct term, since British officers had "no spirit of experimentation with men's lives on the line." (143)

between battles but they were typically very close to the barrage front, generally within 30-70 yards. Although a somewhat later example, Tim Cook notes that infantry “hug[ged] their barrage” to within 60 yards of the barrage front at Vimy Ridge.¹⁹⁰ Nevertheless, the refinement of the creeping barrage was a vitally important tactic which was pioneered at the Somme.

Knowledge of the creeping barrage was quickly disseminated throughout the BEF. As early as 15 August 1916, Arthur Currie, then commanding the 1st Canadian Division, circulated a document detailing the lessons learnt by the BEF at the Somme. Several of his points dealt with new artillery methods. Currie started by detailing the tactics of destruction developed in 1915 and early 1916 when he noted that “formerly when we wanted to take an enemy position we first endeavoured to destroy it by heavy artillery fire, and the cessation of that fire was the signal for the Infantry to advance and occupy the position.”¹⁹¹ However, Currie was now beginning to appreciate that purely trying to destroy the enemy was inadequate. The evolution of new tactics was highlighted when he stated:

Now the beginning of the Artillery fire marks the beginning of the Infantry advance. At the time set for the Infantry advance to occupy the position we now concentrate as much 18-pdr. shrapnel fire as it is possible to do, that shrapnel fire being kept up only for as long as it takes the attacking Infantry to go from their attacking position to the edge of the barrage. Then, the fire is lifted and the infantry are into the hostile trench before the enemy has time to man the parapet or bring a machine gun into action.¹⁹²

From this excerpt, it is unclear whether Currie describes the evolution of the creeping barrage or merely the practice of a lifting barrage. The words “creeping barrage” never appear in the document but the next section of it concludes with an interesting passage: “The infantry should be taught to follow the artillery barrage as closely as a horse will follow a nosebag filled with

¹⁹⁰ Tim Cook, *Shock Troops: Canadians Fighting the Great War, 1917-1918* (Toronto: Viking Canada, 2008), 99.

¹⁹¹ A. W. Currie, “The Experiences Gained in the Somme Fighting,” 15 August 1916, RG9-III-C-3 Volume 4011 Folder 17 File 1, Library and Archives Canada, 1.

¹⁹² Currie, 1.

corn. It is far better to lose a few of our own men from our own artillery fire than to sacrifice [sic] hundreds by hostile machine gun fire.”¹⁹³ This excerpt highlights that senior Canadian commanders were aware of some of the benefits and drawbacks of the creeping barrage. The creeping barrage could be used to guide the infantry onto their objectives before the Germans could mount a defence. When Currie’s memorandum was written, the Canadian Corps was still a month away from seeing action on the Somme. However, senior officers in the Canadian Corps were already absorbing the lessons learnt by the wider BEF during the fighting that had already taken place.

One of the most important lessons from the Somme was of the absolute necessity of a comprehensive counter-battery program. The creeping barrage could suppress the enemy’s frontline defences and machine guns but a method was also needed to neutralize the enemy’s artillery. The application of effective counter-battery fire involved several different tactics. The gunners needed to locate the enemy guns, direct accurate fire onto them, and neutralize the enemy artillery crews during the infantry attack. Before the Somme, counter-battery work was carried out inconsistently and without much urgency. During the preparations for the attack on 1 July, counter-battery work was low on the list of priorities. However, as the Somme offensive progressed, the German defenders grew to rely more and more on their defensive artillery fire. In response, British counter-battery work needed to be expanded.¹⁹⁴ Throughout the Somme, pinpointing the location of German batteries, especially since they moved frequently, was difficult. However, administrative changes at the army level moved to correct this somewhat. Reserve Army headquarters instituted a series of daily reports tracking the activity of all known German batteries. Through the coordination of information gathered from aircraft, sound

¹⁹³ Currie, “The Experiences Gained in the Somme Fighting,” 1.

¹⁹⁴ Marble, *British Artillery*, 145-146.

ranging, flash spotting, and ground observers more German batteries were being identified. However, because the counter-battery staff was drawn up and changed on an ad-hoc basis in each corps and even in different subordinate heavy artillery formations, it was difficult to efficiently coordinate counter-battery work as the sources of intelligence steadily increased.¹⁹⁵ What was needed was a more permanent staff arrangement to coordinate counter-battery work. At the Somme, new tactics were also integrated. Tear gas shells, an area denial weapon, was used to neutralize or at least hinder the German gunners. The emphasis of counter-battery fire also shifted. During the preliminary bombardment, counter-battery fire was directed at destroying the German guns. Then, during the infantry assault counter-battery work shifted to neutralize the surviving enemy gunners.¹⁹⁶ Farndale mentions that a major lesson of 1916 was the need for improved flash-spotting and sound-ranging equipment that could be used to find the enemy's batteries. He also stresses that the Royal Artillery discovered that it needed further centralization of command and information processing. For counter-battery work, this required the creation of the Counter Battery Staff Officer at the corps level to coordinate expanded counter-battery work.¹⁹⁷ Due to the complexity of the task, counter-battery work was not mastered at the Somme. However, the realization counter-battery fire needed to destroy the enemy guns before the battle and then neutralize the surviving German gunners during the actual assault was a critical one.

During the winter of 1916/1917, the new fighting methods pioneered at the Somme were recorded and disseminated throughout the BEF. In early 1917, GHQ reissued doctrinal pamphlets which incorporated the lessons learnt at the Somme. The changes to S.S. 139/4

¹⁹⁵ Marble, *British Artillery*, 148.

¹⁹⁶ Marble, 147.

¹⁹⁷ Farndale, *History of the Royal Regiment*, 334.

“Artillery in Offensive Operations” were quite dramatic.¹⁹⁸ Whereas the 1916 issue of “Artillery in Offensive Operations” was vague about the command and control arrangements for offensive operations, the February 1917 reissue immediately makes apparent the clarification of the command structure. Most interestingly, the new issue of the pamphlet demonstrates how the general expectations for the “role of the artillery” in battle were changing. Although the authors kept a focus on destroying the “obstacles to the infantry’s advance” they also included the duty to support “a rapid and combined advance of all arms acting in close co-operation.”¹⁹⁹ In terms of preliminary bombardments, there was now less emphasis on outright destruction and more emphasis on disrupting the enemy. Special targets like “communications, places of assembly, bivouacs, billets, dumps, railway stations, [and] headquarters” were all considered important targets to disrupt the enemy’s morale and ability to operate.²⁰⁰ Moreover, the authors note that “to attempt the complete destruction of the enemy’s trenches is impracticable...and it is unnecessary.”²⁰¹ The inclusion of this sentence represents a dramatic shift from the earlier use of artillery. The Somme campaign demonstrated that fully destroying the enemy’s trenches was not even desirable since the attacking infantry were left with no cover once they took an objective. Rather, the emphasis was on destroying the barbed wire, communications system, dug-outs, machine gun nests, and trench junctions to paralyze the enemy defenders.²⁰² The folly of concentrating solely on the frontline trenches is also recognized, since an entire section of the document is concerned with disrupting and destroying the enemy’s rear staging areas.²⁰³ The changes to the preliminary bombardment also necessitated the modification of the role of the

¹⁹⁸ S.S. 98/4 “Artillery in Offensive Operations” was renumbered to S.S. 139/4 in early 1917.

¹⁹⁹ “S.S. 139/4 ‘Artillery Notes. No. 4 — Artillery In Offensive Operations,’” February 1917, RG 24 Volume 21998, Library and Archives Canada, 5.

²⁰⁰ “S.S. 139/4,” 15.

²⁰¹ “S.S. 139/4,” 17.

²⁰² “S.S. 139/4,” 16-18.

²⁰³ “S.S. 139/4,” 20.

guns and howitzers on the battlefield. The 18-pounders were now primarily used in barrages and harassing fire. The author of S.S. 139/4 notes that they should only be used to destroy the enemy's "breastworks and barriers" because of their small high-explosive shells. The medium guns, like the 60-pounders, were almost entirely allotted to counter-battery work. It is also notable to consider the depth to which the artillery fight was being extended. The increase in the number of heavy guns meant that more shells could be fired deeply into the enemy's rear areas. As a result of increased striking distance, heavy guns were to be used for targets "beyond the range of other artillery."²⁰⁴ The field and medium howitzers had the most varied roles since they were useful for essentially all tasks. Heavy howitzers were to be tasked primarily with counter-battery work.²⁰⁵ Increasingly, the principles of accurate gunnery were being stressed. The pamphlet notes that "accuracy of fire is a matter of the utmost importance" and included suggestions to account for the calibration of the gun, meteorological conditions, and carrying out proper registration to obtain better results.²⁰⁶ Overall, one of the lessons the BEF drew from the Somme fighting was that destructive artillery fire needed to be combined with more varied artillery preparation.

Reflecting the development of the creeping barrage, the section on barrages in the February 1917 issue of "Artillery in Offensive Operations" was much longer and more detailed. The new guidelines for preparing barrages were quite detailed, but several points stand out. Three types of barrages were listed in the pamphlet, standing, creeping, and back barrages. Standing and creeping barrages followed from the general experience of fighting at the Somme. Meanwhile, a back barrage "searches and sweeps all the ground in the rear of the objective when

²⁰⁴ "S.S. 139/4," 7-8.

²⁰⁵ "S.S. 139/4," 8.

²⁰⁶ "S.S. 139/4," 13.

rifle or machine gun fire might be directed against the advancing infantry.”²⁰⁷ The experience of fighting at the Somme led to several general expectations. One of these was that one 18-pounder field gun per 15 yards “should provide adequate barrages of all natures.”²⁰⁸ Another expectation was that the pace of any barrage depended on local conditions, but it was generally agreed that 100-yard lifts were ideal for creeping barrages.²⁰⁹ Also issued in February 1917 was a pamphlet on counter-battery work. Immediately, the authors echo the experience of the Somme by noting the importance of counter-battery work. The authors note that “the struggle against hostile artillery must therefore be the constant consideration of Commanders.”²¹⁰ A fair amount of detail is given about command and control arrangements. Although the GOCRA was the senior artillery officer who dealt with the coordination of all the artillery, the executive authority for counter-battery work lay with the CCHA.²¹¹ However, this command arrangement was supposed to be flexible enough to maintain concentrated and coordinated counter-battery fire. The authors place an emphasis on flexibility, since the corps counter-battery forces should be able to operate outside of their designated zone when needed.²¹² The position of “Staff Officer for Counter Battery Work” is mentioned, but considered more in the light of an officer whose role it was to collect and coordinate information gathering about hostile batteries.²¹³ For the use of counter-battery fire on the battlefield, the pamphlet mentions two different approaches to counter-battery work. The first was the “destruction of hostile batteries” which was intended to be a “daily task.” However, the authors understood that destroying the German guns was a difficult proposition,

²⁰⁷ “S.S. 139/4,” 22.

²⁰⁸ “S.S. 139/4,” 23, 27.

²⁰⁹ “S.S. 139/4,” 26.

²¹⁰ General Headquarters, “S.S. 139/3 ‘Artillery Notes. No. 3 — Counter-Battery Work,’” February 1917, RG 24 Volume 21998, Library and Archives Canada, 3.

²¹¹ “S.S. 139/3,” 3-4.

²¹² “S.S. 139/3,” 5.

²¹³ “S.S. 139/3,” 4.

especially due to inherent time constraints when preparing for a major battle. In addition to routine destructive fire, special counter-battery procedures were needed to support offensive operations. Thus, the writer of the pamphlet notes that “occasions will arise in all active operations when the infantry must be further protected against the enemy’s guns by fire for neutralization.”²¹⁴ Neutralizing counter-battery work was intended to “paralyse and blind” the enemy’s remaining guns to protect the infantry from a German barrage.²¹⁵ Thus in early 1917, the lessons of combat that had been learned at the Somme regarding preliminary bombardments, creeping barrages, and counter-battery work were distilled down into a new set of tactics which was widely disseminated throughout the BEF.

In early 1917, the BEF set its sights on Vimy Ridge. The origins for the offensive lay in the joint Allied conference at Chantilly in November 1916. Haig and the French commander, Joseph Joffre, agreed to launch a coordinated major attack in early 1917. The British role in the offensive was to launch a diversionary attack to support of the larger French offensive on the Chemin des Dames. The Canadian Corps was given the dubious honour of taking one of the toughest objectives allotted to the British attack, Vimy Ridge itself. Vimy Ridge already had a formidable reputation due to the French army’s three failed offensives in 1914 and 1915.²¹⁶ The extent of the bombardment deemed necessary to prepare for the offensive was staggering because the German defenders had turned Vimy Ridge into a veritable maze of trenches and barbed wire during 1916. The British First Army estimated that the Canadian Corps needed to destroy up to 57,500 yards of enemy trenches for the attack to be successful. The general rule of thumb the planners adopted was that three rounds of howitzer ammunition per yard of trench was

²¹⁴ “S.S. 139/3,” 8.

²¹⁵ “S.S. 139/3,” 11.

²¹⁶ Tim Cook, *Shock Troops*, 74-77.

needed to ensure success. This meant that 172,500 rounds of howitzer ammunition were needed just for trench destruction!²¹⁷ During the winter of 1917, the Canadian Corps occupied the trenches in front of Vimy Ridge. The gunners honed their tactics by firing in support of raids. In February 1917, the artillery supported no less than five raids, and carried out a five-day period of pre-arranged night firing on the “enemys [*sic*] roads and rear communications.”²¹⁸ The preparations for taking the ridge interrupted what had been a relatively quiet front filled by units recuperating from the Somme in 1916. As Canadian artillery activity increased, the historian of the 4th Brigade, CFA, notes that the German defenders hung signs in front of their trenches reading “CUT OUT YOUR DAMNED ARTILLERY. WE, TOO, ARE FROM THE SOMME.” In response, the gunners of 4th Brigade lobbed even more shells.²¹⁹ With Vimy Ridge set as the objective of the Canadian Corps, it was up to the artillery to pave the way for the infantry.

The preparations for the capture of Vimy Ridge allow the opportunity to examine the planning of a major artillery offensive. While GHQ set the general direction for the offensive, planning for the capture of the ridge originated with the BEF’s First Army in February 1917. The First Army plan was based around a set of guiding principles. In broad strokes, the plan called for three to four weeks of slowly building preparatory fire and a 48-hour main preliminary bombardment which ended at zero hour (zero hour referring to the scheduled start of the offensive). Moreover, in contrast with the preliminary bombardments at the Somme, First Army never envisioned destroying the entirety of the extensive German defensive lines. Rather, the focus of destructive fire was to be directed at “important points such as trench junctions, m.g.

²¹⁷ Canadian Corps Royal Artillery Headquarters, “S.430/4-6 ‘Artillery Appreciation,’” 20 February 1917, RG9-III-C-1 Volume 3903 Folder 20 File 3, Library and Archives Canada, 1.

²¹⁸ “War Diary of R.A. Canadian Corps from 1st February 1917 to 28th February 1917,” *War Diary 18/04/1916-30/04/1917, General Officer Commanding, Royal Artillery, Canadian Corps*, Library and Archives Canada. http://collectionscanada.gc.ca/pam_archives/index.php?fuseaction=genitem.displayItem&rec_nbr=2004735&lang=eng&rec_nbr_list=2004735,2004734,2004736,1883285,3224483,4288101,3948145,3948144,3948042,3948024

²¹⁹ MacDonald, *Gunfire*, 73.

emplacements, &c.”²²⁰ Due to the difficulty of ground observation — the Canadians were overlooked by the Germans on Vimy Ridge and had a difficult time accurately observing fire — aerial observation was very important to the success of the plan. The First Army plan noted the “very great importance that GOCRA of [the Canadian] Corps should communicate their plans as early as possible to O.C. [Officer Commanding], 1st Wing RFC, to enable him to make his arrangements: constant touch between these two is essential.”²²¹ The contrast with the preliminary artillery bombardments at the Somme is striking. Rather than attempting to destroy the enemy’s trenches, the First Army planners envisioned a more precise approach to the artillery preparations for taking Vimy Ridge.

Another area of concentration in the First Army plan was counter-battery work. The First Army plan ordered that several batteries of howitzers from each counter-battery group were exclusively available for destructive counter-battery fire. In addition, First Army’s plan also made provision for howitzers being removed from destructive work against the enemy’s trench system to bolster the counter-battery program if needed.²²² These two elements of the plan highlight the emphasis placed on the need for uninterrupted counter-battery fire. In general, counter-battery work was to be divided into two phases. Phase one was comprised of ten days of fire prior to the scheduled start of the offensive and was focused on destroying the enemy’s guns and their “telephone exchanges.” Phase two began at zero hour when the counter-battery program shifted to focus on the neutralization of the enemy’s gun positions. One of the lessons from the Somme, that concentrated fire was more effective than dispersed fire, is clearly acknowledged when the author states that “it is better to bring a heavy fire from 2 guns or

²²⁰ First Army, “Artillery Plan for the Capture of Vimy Ridge,” 7 February 1917, RG9-III-C-1 Volume 3903 Folder 20 File 4, Library and Archives Canada, 4.

²²¹ First Army, “Artillery Plan,” 7.

²²² First Army, “Artillery Plan,” 2.

howitzers on one battery position than to attempt to neutralize two batteries with a single gun each.”²²³ One area of First Army’s plan which was left relatively undefined were the details of the creeping barrage. The planners acknowledged the need for one, but noted that the specific form of the barrage depended greatly on the condition on the ground at zero hour. The First Army planners did however specify that the creeping barrage should be paired with standing barrages further behind the line which would prevent the enemy from occupying defensive positions behind the front.²²⁴ These general guidelines provided the outline for the Canadian Corps’ attack on Vimy Ridge.

Within the framework set out by First Army, the Canadian Corps drafted its own artillery plan for the capture of Vimy Ridge. It broadly followed the instructions laid down by First Army. The Canadian Corps artillery plan was composed of three phases. Phase one ran from Z-20 (zero hour minus twenty days) to Z-7. Phase two ran from Z-6 to Zero Hour. Phase two represents a significant deviation from the First Army plan, since the preliminary bombardment was lengthened from 48-hours to a full week. Meanwhile, phase three was the barrage in support of the infantry assault which commenced at zero hour. Phase one was characterized by a limited bombardment of the enemy’s lines. The Canadian Corps’ plan specified that no more than half of the artillery was to be used during phase one, and all destructive fire was supposed to be observed to ensure good effect.²²⁵ During phase one, the artillery carried out trench destruction, wire cutting, and counter-battery work. No respite was to be given to the German defenders since the gunners harassed them with artillery fire day and night. Interestingly, the enemy’s telephone exchanges, mentioned by the First Army plan, were not to be targeted in phase one. Phase two

²²³ First Army, “Artillery Plan,” 2-3.

²²⁴ First Army, “Artillery Plan,” 6.

²²⁵ “S.156/31/2. Canadian Corps Artillery Instructions for the Capture of Vimy Ridge,” 28 March 1917, RG9-III-C-1 Volume 3922 Folder 8 File 3, Library and Archives Canada, Section I, Section 2.

was the main preliminary bombardment. In the Canadian Corps plan, the main bombardment was longer than First Army's two days. From Z-6 until zero-hour, fire was intensified and all batteries were brought into action. Several targets were given special attention, particularly the German barbed wire behind the frontline, targeted by the new No. 106 fuse, and villages like Thelus, which were believed to be potential German strong points. Phase two also included a feint barrage which allowed the gunners to practice the creeping barrage in its entirety before the attack.²²⁶

Phase three of the Canadian Corps plan consisted of the creeping barrage which supported the infantry attack. This involved two separate barrages, the creeping barrage and a series of standing barrages. The Canadian Corps' creeping barrage was composed of "a rolling barrage preceding the infantry in average lifts of 100 yards...established by 18 pr. [pounder] guns." This barrage was to be maintained by each gun firing roughly three rounds per minute.²²⁷ While three rounds per minute was well below the maximum possible rate of fire for the 18-pounder gun, rates of fire of two to four rounds per minute were often used to preserve the life of the guns. Sustained rapid fire quickly shot out the guns, wore rifling, and warped barrels to the point where accuracy was seriously impaired.²²⁸ In addition to the creeping barrage, several standing barrages were to be placed at key points of the line to deny the enemy space to move or to keep their heads down. As was the case in the First Army plan, at zero hour the counter-battery program shifted from destructive fire to neutralization fire.²²⁹ Interestingly, something which the Canadian Corps planned for, but which was not mentioned in the First Army plan,

²²⁶ "S.156/31/2," Section 3.

²²⁷ "S.156/31/2," Section 4.

²²⁸ GHQ issued an artillery circular in May 1918 formalizing what had already been standard rates of fire for the guns. For the 18-pounder "Intense" fire was four rounds per minute, "Rapid" three, "Normal" two, and "Slow" one. "G.H.Q Artillery Circular No. 10, Horse-Field-Heavy and Siege Artillery," May 1918, RG9-III-C-3 Volume 4144 Folder 1 File 4, Library and Archives Canada.

²²⁹ "S.156/31/2," "Canadian Corps Artillery Instructions," Section 4.

were provisions for the advance of artillery batteries if the offensive was successful.²³⁰ However, general guidelines for advancing the artillery during an offensive operation had been laid out in S.S. 139/4 in February 1917.²³¹ It is likely that the Canadian Corps planners were drawing upon British doctrinal documents when considering how to stage the advance of the artillery. The Canadian Corps plan concluded with various sundry instructions, including that during one half-hour period each day the bombardment would cease so that aerial photographs could be taken of the battlefield.²³² Between First Army's and the Canadian Corps' plans, the artillery had a blueprint for taking the ridge.

On 20 March 1917, the first phase of the Canadian Corps preliminary artillery bombardment began. The term preliminary bombardment does not do justice to the scale of the preparatory fire. Despite only half the Corps' available guns firing, still 200,000 rounds of 18-pounder ammunition and 143,000 large calibre shells were expended during the thirteen days of constant fire.²³³ After enduring phase one, the German defenders were then subject to the full fury of the Canadian Corps' artillery complement beginning on 2 April. The corps expended 2,500 tonnes of ammunition per day during phase two as the German defensive points on the ridge were systematically blasted away.²³⁴ Due to the unrelenting ferocity of the bombardment, the seven-day long period of the main bombardment was known among the German defenders as the "week of suffering."²³⁵ During the preliminary bombardment, over 42,000 yards of trenches and 8,000 yards of barbed wire were destroyed. The village of Thelus was deluged with 24,000

²³⁰ "S.156/31/2," Section 5.

²³¹ "S.S. 139/4," 30-31.

²³² "Notes on the Artillery Preparation and Support of the Attack on Vimy Ridge," RG9-III-C-1 Volume 3922 Folder 8 File 3, Library and Archives Canada, Appendix E.

²³³ Cook, *Shock Troops*, 84.

²³⁴ Cook, 85.

²³⁵ Tim Cook, "The Gunners at Vimy," in *Vimy Ridge: A Canadian Reassessment*, edited by Geoffrey Hays, Andrew Iarocci, and Mike Bechthold (Waterloo, ON: Wilfred Laurier University Press, 2007), 114.

rounds of heavy and medium howitzer ammunition, and was completely destroyed.²³⁶ While the Canadian barrage was thorough and unrelenting, the German artillery put up a stout resistance. During the first week of April 1917, German gunners were regularly firing more than 20,000 shells per day at the Canadian Corps.²³⁷ The counter-battery struggle raged as the static defences were pounded into dust. Cooperation with the RFC was judged to be a vitally important part of the artillery bombardment. Accurate aerial observation was considered so important that all guns ceased firing for a half hour each day to allow for accurate aerial photography of the German positions.²³⁸ Satisfactory results in counter-battery work relied on the work of the aerial observers. McNaughton reported after the battle that “fully 75% of the Counter-Battery Work has to be carried out by Aeroplane Observation.”²³⁹ For a week, the artillery pounded the ridge continuously until a few moments before zero hour when all the guns fell silent.

At 5:30 a.m. on 9 April 1917, nearly a thousand guns and howitzers burst forth signaling the beginning of the offensive.²⁴⁰ Counter-battery fire pounded the German gun positions, standing barrages laid down fire on key points, and a ferocious creeping barrage rolled methodically across the battlefield to cover the advance of the infantry. In all, the artillery preparations were very successful. In many places, the preliminary bombardment had scoured the German defences off the face of the ridge. The 3rd Canadian Division’s narrative report of the battle noted that “the destruction of the enemy’s works was so complete that he was unable to offer any serious resistance to our assault.”²⁴¹ Similarly, the counter-battery program was both

²³⁶ “Notes on the Artillery Preparation,” 2-3.

²³⁷ Tim Cook, *Vimy: The Battle and the Legend* (Toronto, ON: Allen Lane, 2017), 64-65.

²³⁸ “Canadian Corps Artillery Instructions,” Appendix E.

²³⁹ “Counter Battery Office CB 20/8,” 25 June 1917, RG9-III-C-1 Volume 3897 Folder 9 File 1, Library and Archives Canada, 2.

²⁴⁰ Cook, *Shock Troops*, 99.

²⁴¹ 3rd Canadian Division, “Narrative of Operations in connection with the Attack and Capture of Vimy Ridge – From April 9th to 14th., 1917,” RG9-III-C-3 Volume 4089 Folder 21 File 2, Library and Archives Canada, 1.

effective and comprehensive. At zero hour, the Corps' neutralizing counter-battery fire silenced forty-seven German batteries. Results were so good in fact that the counter-battery report notes that "the number of H.B's [hostile battery's] neutralized during the attack – 47 – represented practically the limit in number which could be satisfactorily engaged with neutralizing fire with the guns at our disposal."²⁴² The result of this effective counter battery fire was that the 4th Brigade, CFA, suffered only a single wounded man due to enemy artillery fire on 9 April.²⁴³ The complicated creeping barrage was good, but not perfect. Cook notes that the pace of the barrage slowed down the infantry of 2nd Canadian Division, who faced very little resistance. Meanwhile, the assaulting infantry of 4th Canadian Division struggled against undestroyed German positions and a section of trenches not covered by the barrage.²⁴⁴ It is interesting to note the flexibility in the creeping barrage across the Canadian Corps front as the situation on the ground dictated. The plan followed the general suggestion in S.S. 139/4 that one third of the 18-pounders be used for standing barrages and the remaining two thirds for the creeping barrage. However, the plan also allowed for flexibility when dealing with the different terrain across the battlefield. Barrages fired on open ground employed more guns in the standing barrage; in heavily defended country more guns were used to thicken up the creeping barrage.²⁴⁵ Additionally, the report also notes the use of field artillery which had been positioned forward but kept silent up until zero hour. When they opened fire to aid in the creeping barrage, the forward positioned batteries increased the depth of the barrage so that the infantry could reach its distant objectives.²⁴⁶ However, the extent of the destruction was also a hindrance to the gunners tasked with establishing forward positions

²⁴² "Notes on Counter-Battery Work in Connection with the Capture of the Vimy Ridge by the Canadian Corps on April 9th 1917," RG9-III-C-1 Volume 3922 Folder 8 File 4, Library and Archives Canada, Section F, 3.

²⁴³ MacDonald, *Gunfire*, 86.

²⁴⁴ Cook, "The Gunners at Vimy," 118.

²⁴⁵ "Notes on the Artillery Preparation," 6.

²⁴⁶ "Notes on the Artillery Preparation," 5.

on 9 April. The ridge itself was so completely pockmarked with craters that advancing and then supplying the forward gun positions was extremely difficult.²⁴⁷ Despite the difficulty, the fact that the artillery could be moved forward over heavily shelled ground during combat operations was an important lesson. Notwithstanding some small difficulties, nearly all objectives were taken quickly on the morning of 9 April and by 12 April the 4th Canadian Division had captured the last portions of the ridge.²⁴⁸ The battle of Vimy Ridge was over, and the Canadian Corps was victorious.

The success of the Canadian and British artillery at Vimy Ridge was formidable. Nearly all the Corps' objectives were taken quickly and according to the plan. However, it is important to note that the employment of the artillery in the capture of Vimy Ridge was not fundamentally revolutionary. Rather, the success of the Canadian Corps at Vimy Ridge should be seen as the culmination of a learning process which began at the Somme. The refinements in the art of the preliminary bombardment, particularly the fact that the artillery no longer attempted to completely level the German defences, were a consequence of mixed results at the Somme. The Counter Battery Staff Office achieved an impressive level of success at Vimy, but only due to the realization of the importance of effective counter-battery fire at the Somme. The creeping barrage used at Vimy was more complex than the early examples practiced at the Somme, but the concept of the creeping barrage was already very well established by April 1917. Planning for the offensive to take the ridge was thorough, but ultimately followed in the mould set out by the BEF's doctrinal documents. Nor should it be forgotten the extent of British aid to the Canadian Corps. About 25% all targets engaged by the artillery were engaged by the two British

²⁴⁷ Johnathan Bailey, "British Artillery in the Great War," in *British Fighting Methods in the Great War*, edited by Paddy Griffith (Portland, OR: Frank Cass & Co. Ltd., 1996), 35.

²⁴⁸ Cook, "The Gunners at Vimy," 119-120.

corps on either flank of the Canadian Corps.²⁴⁹ Nevertheless, the fact that the Canadians had taken one of the most heavily defended positions on the Western Front was a significant achievement in and of itself. Moreover, the success at Vimy demonstrated conclusively that the BEF possessed a set of tactics that could defeat the enemy's defensive system.

²⁴⁹ "Notes on the Artillery Preparation," 2-3.

Chapter 4: Cambrai and the Hundred Days Offensive

The battle of Vimy Ridge was a masterfully planned offensive which employed very heavy artillery support to enable the infantry to achieve victory. However, to win the war, British and Canadian forces needed to fight through the deep German defensive works and push the German army out of France. To achieve this goal, British and Canadian gunners experimented with new artillery tactics. While the Canadian Corps conducted artillery operations in the mud of Flanders, in late 1917 British artillery officers planned a new kind of combined arms offensive at Cambrai. The battle of Cambrai introduced a set of technologies and tactics which helped enable the British Expeditionary Force to defeat the German army. By dispensing with the long preliminary bombardments that had characterized British artillery tactics since 1915, the gunners were able to focus on achieving the element of surprise. Due to a series of technical innovations, like screen calibrating the guns, and through tactical changes, like the lack of wire-cutting or destructive counter-battery fire, the first British attack at Cambrai provided a template for the further evolution of British artillery tactics. While the battle of Cambrai itself was a failure, it heavily influenced the artillery tactics of 1918. During the Hundred Days campaign, the Canadian Corps combined new mobile warfare techniques with the precise application of mature tactics, such as the creeping barrage, to enable the artillery to solve the problem of trench warfare and help the Allies push the German army out of France.

The battle of Arras demonstrated that the Royal Artillery finally had a set of artillery tactics which could overcome German defences on the Western Front. Better counter-battery methods and the development of the creeping barrage meant that British and Canadian artillery had the firepower to effectively crush static defenses. This was amply proven after Vimy Ridge, as the BEF won a string of victories in the summer of 1917. In June 1917, the British attacked

and took the strongly fortified German positions on Messines Ridge in a single day. The preliminary artillery bombardment wore down the German defenders so much that fresh troops were rotated into the frontline, only for them to be almost completely wiped out by the explosion of several huge mines on Z-Day.²⁵⁰ Meanwhile, the Canadian Corps fought a set piece engagement against the German defenders on Hill 70, near the French city of Lens, in August 1917. Initially, the Canadian artillery crushed the German defences and then, once the infantry had captured their objectives on Z-Day, the gunners broke up twenty-one German counter-attacks.²⁵¹ The Canadians quickly took the high ground on Hill 70, but then committed a tactical blunder by throwing successive poorly prepared attacks against dug-in German defenders in the city of Lens.²⁵² Nevertheless, compared to the stalemated bloodletting on the Somme, the relative ease with which the BEF won set-piece battles during the first half of 1917 seemed to demonstrate the effectiveness of the new artillery tactics.

Buoyed by a string of seemingly easy successes, Sir Douglas Haig, commander in chief of the BEF, chose to launch the next great attack in Flanders. However, the disadvantageous position occupied by the BEF in the salient necessitated extensive preparations that entirely negated the element of surprise. Surrounded on three sides by German defenders who occupied the high ground, the British troops were terribly exposed to the German artillery.²⁵³ To overcome their natural disadvantages, Haig poured enormous numbers of men, guns, and shells into the struggle. Despite the relatively narrow sector of the front, GHQ concentrated over 3,000 guns

²⁵⁰ Sanders Marble, *British Artillery on the Western front in the First World War* (Burlington, VT: Ashgate Publishing Company, 2013), 186.

²⁵¹ Martin Farndale, *History of the Royal Regiment of Artillery: Western Front, 1914-1918* (London: Royal Artillery Institution, 1986), 204-205, and G. W. L. Nicholson, *The Gunners of Canada: The History of the Royal Regiment of Canadian Artillery, 1534-1919*, vol. 1 (Toronto: McClelland and Stewart Limited, 1967), 292-299.

²⁵² Tim Cook, *Shock Troops: Canadians Fighting the Great War, 1917-1918* (Toronto: Viking Canada, 2008), 297-304.

²⁵³ Marble, *British Artillery*, 188.

and howitzers and supplied three million shells for the preliminary bombardment alone.²⁵⁴ Yet, the enormous number of guns involved meant that it was very difficult to coordinate the fire of hundreds of batteries of guns with only telephone sets, visual signalling, and the most rudimentary radio systems.²⁵⁵ While the massive preliminary bombardment pulverized the terrain, the counter-battery struggle was one of the fiercest of the war. Aided by excellent observation on the high ground, German gunners had an enormous advantage over the Royal Artillery. Indiscriminate German interdiction fire made life miserable for the British forces, but the German gunners made a key mistake by diluting their fire widely across the salient.²⁵⁶ As a result, superior British counter-battery tactics achieved some measure of superiority over the German guns after a drawn-out struggle.²⁵⁷ Despite all the difficulties, the preliminary bombardment was effective in destroying much of the defensive works. Trenches, never very deep in Flanders due to the high prevailing water table, were easy to destroy and most of the German wire was effectively destroyed. The BEF's first attack on 31 July 1917 proved promising. Despite bad weather which hampered counter-battery work, the destruction of the German wire and effective creeping barrages meant that several limited objectives fell into British hands.²⁵⁸ However, soon after the first attack the weather turned bad. Heavy, unrelenting rains turned the shattered battlefield into one giant quagmire. In the face of stiff German resistance and terrible conditions, a string of British attacks failed to push through the stalemate during the rest of August, September, and much of October.²⁵⁹ With the offensive mired in the mud, Haig brought in the Canadian Corps to take the village of Passchendaele.

²⁵⁴ Farndale, *History of the Royal Regiment*, 195.

²⁵⁵ Farndale, 198.

²⁵⁶ Marble, *British Artillery*, 188.

²⁵⁷ Marble, 190.

²⁵⁸ Farndale, *History of the Royal Regiment*, 202-203.

²⁵⁹ Farndale, 204-211.

Tasked with taking Passchendaele, Arthur Currie's Canadian Corps faced a daunting task.²⁶⁰ The terrain alone was enough to stall most military offensives. Having marched to battery positions under the cover of darkness, Canadian gunner Donald Macpherson, fighting with the 9th Battery, CFA, noted his first views of the Passchendaele battlefield in his diary entry for 20 October 1917. In it he wrote:

The coming of dawn disclosed a most desolate scene. The entire expanse of country in all directions is one unbroken waste, unspeakably dreary and barren. Shell-hole merged into shell-hole, all water-filled and well nigh impassable at any point.²⁶¹

In addition to the terrible conditions, exhaustion also took its toll. Due to the drawn-out nature of the struggle, the gunners of the 4th Brigade, CFA, stayed at their battery positions in the salient for an extraordinary twenty-eight days under constant German harassing fire before being relieved.²⁶² While exhaustion and the terrain presented extreme difficulties, the Canadians were also faced with the problem that their artillery tactics were now less effective due to changes to German defensive arrangements. Whereas previously trench lines had been the consistent target of the artillery, in Flanders the trench systems had mostly been destroyed by concentrated artillery bombardment before the Canadians even entered the salient. Now, as the Canadian Corps' "Artillery Report on Passchendaele" noted, the "hostile defences consisted of detached strong posts, 'Concrete Pill Boxes', organized shell holes, and a certain amount of wire distributed mostly along hedges."²⁶³ The Canadians could not overcome this new system of defence by merely applying old tactics.

²⁶⁰ Currie was promoted to commander of the Canadian Corps in June 1917.

²⁶¹ Donald Stuart Macpherson, *A Soldier's Diary: The WWI Diaries of Donald Macpherson* (St. Catharines, ON: Vanwell Publishing Limited, 2001), 87.

²⁶² J. A. MacDonald, ed., *Gunfire: An Historical Narrative of the 4th Bde. C.F.A. in the Great War (1914-1918)*, compiled by 4th Brigade C.F.A. [Canadian Field Artillery] Association (Toronto: Greenway Press, 1929), 111-112.

²⁶³ "Canadian Corps Artillery Report on Passchendaele: Oct.17th to Nov.18th 1917," RG9-III-C-1 Volume 4148 Folder 12 File 1, Library and Archives Canada, 5-6.

Of all the new German defensive positions, concrete pillboxes were one of the consistent obstacles to the infantry's advance. The Canadian gunners deluged the pillboxes with high-explosive from heavy and medium howitzers by day and with 18-pounder shells by night to try and destroy the pillboxes but "this procedure was not advisable, as it increased the difficulties of attacking these defences by rendering the ground surrounding them even more impassable."²⁶⁴ The Canadian infantry also struggled to keep up with the creeping barrage when faced with heavily defended pillboxes. The Canadian Corps' report notes that, "some method is required allowing rather more scope to assist the individual enterprises required for the capture of each 'pill box' as a separate strong point."²⁶⁵ Interestingly, Herbert Uniacke, GOCRA of Fifth Army, determined in early October that a special combination of barrages was effective against German pill-boxes. In Uniacke's system, the main creeping barrage was composed of a mixed shrapnel and smoke shell barrage with atypically short lifts of 50 yards. Then, areas of special concentration around the pill-boxes were continuously shelled for a period of two lifts as the barrage passed over the position. In Uniacke's words, this method "allowed the Infantry detailed for the capture of the strong point to get close up to it in front, whilst the advancing waves of Infantry on either side could, in case of necessity, attack it from the rear."²⁶⁶ As this report is held within the Canadian Corps textual records, at least some officers in the Canadian artillery were aware of the existence of this tactic. However, there is no mention in the Canadian Corps report on Passchendaele of the Canadian artillery employing a tactic like this. This represents a missed opportunity to incorporate the lessons learnt elsewhere in the BEF into Canadian Corps tactics.

²⁶⁴ "Report on Passchendaele," 5-6.

²⁶⁵ "Report on Passchendaele," 10.

²⁶⁶ H. Uniacke, "Special Form of Creeping Barrages used against Concreted Buildings and Shelters," 2 October 1917, RG9-III-C-1 Volume 3908 Folder 28 File 4, Library and Archives Canada, 1.

The customary creeping barrages, which the Canadian Corps had employed so successfully earlier in the year, were noticeably slower at Passchendaele. The mud-bogged infantry advanced so slowly that the creeping barrages lifted at an unprecedentedly low rate of one hundred yards every eight minutes.²⁶⁷ However, the fighting at Passchendaele allowed the Canadian gunners to perfect the employment of the creeping barrage through continual practice. One of the ways the gunners practiced the creeping barrage was through preparatory barrages. Preparatory barrages generally took the form of mock barrages, intended to mimic the real barrage that would be laid down during the infantry assault.²⁶⁸ The advantages to this system were twofold. Firstly, the gunners got practical experience carrying out the entire barrage. Secondly, the practice barrage further contributed to the degradation of the German defences. The Canadian Corps employed practice barrages extensively at Passchendaele, with Major Alan Brooke's "Artillery Plan for the Capture of Passchendaele" calling for two barrages daily during the preparation for the 26 October attack.²⁶⁹ Broadly speaking, Canadian artillery tactics followed the template of successful battles earlier in the year. Strong creeping barrages were used to shoot the infantry onto their objective, the counter-battery office struggled to silence the German guns, and heavy bombardments were employed to crush the German defences.²⁷⁰ In the end, the combination of heavy fire and persistent attacks inched the Canadians closer and closer to Passchendaele until, on 6 November 1917, they finally captured the shattered village.²⁷¹

While the Canadians rested and consolidated their positions in Flanders, the British fought one more battle in late 1917 near the French city of Cambrai. Instead of simply repeating

²⁶⁷ "Report on Passchendaele," 9-10.

²⁶⁸ "Report on Passchendaele," 5-7.

²⁶⁹ A. F. Brooke, "Canadian Corps Artillery Order No. 91 – Artillery Plan for the Capture of Passchendaele," 21 October 1917, RG9-III-C-1 Volume 3908 Folder 29 File 1, Library and Archives Canada, 3.

²⁷⁰ Nicholson, *Gunnery of Canada*, 307-311.

²⁷¹ G. W. L. Nicholson, *Canadian Expeditionary Force 1914-1919: Official History of the Canadian Army in the First World War* (Ottawa, ON: Queens Printer and Controller of Stationery, 1964), 318-327.

the tactics of 1917, the battle of Cambrai was a testing ground for new technology and tactics. Overall, the key element of the attack was surprise. Farndale credits the idea for the attack to the CRA of the 9th Division who proposed an offensive spearheaded by tanks while the artillery opened fire with no prior bombardment or registration.²⁷² The long preparatory bombardments at Arras and during the opening stages of Third Ypres had been successful at destroying fixed defences. Yet, a long preparatory period gave away the place of attack if not the moment of attack. Dispensing with the preliminary bombardment meant that new tactics were needed to clear the way for the infantry. One of the main tasks of the artillery throughout the war was to clear the barbed wire entanglements in no man's land to enable the infantry to advance. At Cambrai, this task was left to the tanks, which opened lanes in the barbed wire as they advanced.²⁷³ Shockingly, there was also no creeping barrage. The plan for Cambrai incorporated a lifting barrage which shelled each German trench in turn. The reason a creeping barrage was not judged to be needed was due to the surprise nature of the bombardment. One of the main advantages of the creeping barrage was that it also neutralized the defenders who evacuated heavily targeted main trench systems. Because the barrage would open with no warning, the German defenders did not have the time nor the inclination to man the shell holes in front of and behind the main trench systems.²⁷⁴ Compared with the elaborate counter-battery programs during the rest of 1917, there was relatively little need for counter-battery work at Cambrai. Indeed, there were only thirty-four German guns supporting that sector of the front. Departing from standard practice, there was also no preliminary counter-battery work. Instead, the six hundred guns detailed to the counter-battery program began neutralizing the German guns directly at zero

²⁷² Farndale, *History of the Royal Regiment*, 216.

²⁷³ Farndale, 216.

²⁷⁴ Marble, *British Artillery*, 200.

hour. Meanwhile, the heavy artillery program also began only at zero hour by targeting the enemy's command, control, and communications apparatus to disrupt their ability to react to the attack.²⁷⁵

While the artillery plan for Cambrai contained innovative new tactical ideas, achieving these goals in practice relied entirely on accurate gunnery. The need for accurate fire meant that, for the gunners, the problem of registration was acute. Because each gun varied slightly in its construction and wear, they each shot slightly differently. When guns were moved into new battery positions, they needed to be registered. The process of registration normally involved firing a few shells on a known point to provide data about how much, and in what ways, the gun varied from true accuracy. This data was then used to correct the fall of the shots and ensure that the guns could fire accurately without having to remeasure after each shot. Normally, a large concentration of guns being moved to a new front was noticed by German intelligence because all the guns needed to be individually registered by firing at one or more points. A large increase in the number of guns being registered was a tell-tale sign that an attack was imminent. However, the pioneering use of screen calibrating the guns was a vital breakthrough at Cambrai. Originally a French practice, screen calibration involved setting up a gun behind the lines to fire through a pair of screens. The screen set-up allowed the velocity of the shell fired to be measured and used to establish the precise information on the gun's accuracy. When emplaced at its battery position, the gunners then used this information to fire effectively based on map coordinates only. In effect, the artillery achieved accurate fire without revealing their positions when massed for an offensive.²⁷⁶ Screen calibration was a vital breakthrough in artillery technology that enabled accurate gunnery while also retaining the element of surprise.

²⁷⁵ Marble, *British Artillery*, 200-201.

²⁷⁶ Farndale, *History of the Royal Regiment*, 216-217.

The tactics employed at Cambrai represented a significant departure from standard British artillery tactics. There was no preliminary bombardment, no wire-cutting, no preliminary counter-battery work, and even no registration of the field guns. When the offensive at Cambrai began on 20 November 1917, it successfully took the German defenders by surprise. Surprise was so complete that the German defenders received no extra artillery reinforcements and only had access to reinforcing infantry due to sheer luck.²⁷⁷ For the first time in the war, British tanks advanced so far that they were beyond the edges of the barrage maps provided to the artillery! However, success was not uniform. Counter-battery officers struggled with the rapidly changing battlefield and, by the second day of the battle, German anti-tank guns remained very effective. Heavy fire support was available, but was applied unevenly across the battlefield due to hurried planning.²⁷⁸ Moreover, the BEF was not the only army experimenting with new combined arms tactics. Utilizing a heavy surprise barrage and the appearance of lightly armed and quickly moving stormtrooper infantry, a sharp German counter attack on 30 November largely reversed the gains made by the BEF.²⁷⁹ For both armies exhausted by a year of hard combat, Cambrai ended in stalemate. In many ways emblematic of Great War offensives for its high hopes and disappointing outcome, the battle was a vitally important template for Canadian offensive artillery tactics in 1918.

During the first half of 1918, the Allies shifted to the defensive in preparation for a major German effort on the Western Front. With Russia defeated vast numbers of German troops were transferred to the Western Front. Beginning in the spring of 1918, the German army launched a series of major offensives designed to win the war on the Western Front. The Allied forces

²⁷⁷ Marble, *British Artillery*, 198-199.

²⁷⁸ Marble, 201.

²⁷⁹ Marble, 201-202.

weathered the German attacks, but only just.²⁸⁰ As a result, for the first time in the war, GHQ issued a pamphlet specifically dealing with the use of artillery on the defense.²⁸¹ The scope of this paper does not allow for detailed analysis of the defensive operations of the BEF. However, it is important to note that, although the Allies were on the defensive, artillery continued to be used in an offensive role. Particularly, British counter-battery methods were devastating. In the continually unfolding artillery duel, up to ten percent of German guns were destroyed per month by British counter-battery fire in some sectors.²⁸² While the BEF was heavily engaged trying to stop the German attacks, the Canadian Corps faced little action. Occupying a large sector of the front centred on Vimy Ridge, the Canadian Corps was not directly attacked. Indeed, the Canadian Corps was broken up despite the protest of Currie. However, while the infantry divisions were shuffled around the frontline, the Canadian artillery remained largely intact and under the command of the GOCRA. Although not attacked directly, the Canadian gunners maintained a policy of active fighting. Continual destructive shoots and aggressive counter-battery actions were characteristic of the Canadian gunner's efforts during the spring and early summer of 1918.²⁸³ This period of active fighting, while not directly in a planned offensive, served to keep the gunners skills sharp and battle tested. As a result, when the German offensives were finally stopped at the beginning of the summer of 1918, the Canadian Corps was one of the few fresh formations in the BEF.²⁸⁴ Thus, the Canadians were chosen to play a major role in the BEF's counterstroke near the French city of Amiens.

²⁸⁰ For a discussion of British defensive artillery tactics during the German spring offensives, see Marble, *British Artillery*, 216-223.

²⁸¹ See "Artillery Notes No. 7 – Artillery in Defensive Operations," February 1918, RG 24 Volume 21998, Library and Archives Canada.

²⁸² Marble, *British Artillery*, 224.

²⁸³ Nicholson, *Gunners of Canada*, 327-333

²⁸⁴ Cook, *Shock Troops*, 391-399.

The city of Amiens was an important rail junction, a factor which made it a target of the German spring offensives. While the German offensive effort had run out of steam before taking the city, they had advanced considerably beyond their main defensive lines. Thus, the German defences in the sector were weak, and judged an easier target for the Allied counterstroke.²⁸⁵ The battle of Amiens was a chance for the Canadian Corps to employ the tactics which had been pioneered at Cambrai. One of the main features of the operation was the short preparation period. The Canadian Corps was an important formation that the German army tried to track. If the Canadians were discovered moving towards Amiens, it would signal an attack was imminent and lose the element of surprise. As a result, the operation was conducted in such secrecy that preparations only began a few days before the offensive's planned start on 8 August.²⁸⁶ The limited amount of time for preparations seriously strained the gunners who worked furiously to prepare for the offensive. With the roads heavily congested, often no motorised transport was available. Consequently, the gunners of Brooke Claxton's 10th Canadian Siege Battery carried ammunition by hand to the gun pits.²⁸⁷ Due to the compressed timeline for siting the guns, nearly all the field artillery was sited "along existing roads and tracks, under trees and other natural cover." Moreover, the Canadian Corps' field gun artillery batteries were positioned within 2,500 yards of the German frontline, which was very close by the standards of the day.²⁸⁸ To retain the element of surprise, there was no preliminary bombardment at all. However, departing from the template of Cambrai, there was a creeping barrage. The creeping barrage was included primarily to provide cover for the advance of the tanks that were incorporated into the attack. As a result,

²⁸⁵ Cook, *Shock Troops*, 409-418.

²⁸⁶ Nicholson, *Gunners of Canada*, 336-338.

²⁸⁷ David Jay Bercuson, *True Patriot: The Life of Brooke Claxton, 1898-1960* (Toronto: University of Toronto Press, 1993), 35.

²⁸⁸ "Artillery Notes on --- Attack by Canadian Corps, August 8th 1918," 28 August 1918, RG9-III-C-1 Volume 3910 Folder 36 File 2, Library and Archives Canada, 3.

the creeping barrage was composed of a mix of shrapnel shells and smoke.²⁸⁹ To improve the accuracy of the field guns, all the Canadian Corps' 18-pounder field guns were screen calibrated before the battle.²⁹⁰ This reportedly produced "eminently satisfactory results in the barrage."²⁹¹ When the attack began on 8 August, all the preparations came together well. German guns were suppressed quickly by Canadian counter-battery, and the artillery provided fire support for the infantry, even though there was a general lack of resistance.²⁹²

Communication problems did exist for the Canadian Corps at Amiens, but were relatively minor. The telephone system held up quite well, and where it failed it was augmented by wireless sets at brigade and divisional headquarters. However, the Canadian Corps report notes that wireless would be more useful if a "means of transport were provided" given that "frequent moves were made" during the offensive.²⁹³ The CRA of 3rd Canadian Division also expressed concern about the dilution of communications resources at the battery level. In effect, the battery was split into two sections composed of an advanced section and a main section. As a result, signalers were needed to coordinate the two elements of the battery in addition to their duties communicating with all other levels of command.²⁹⁴ Interestingly, the fire of the heavy guns was also artificially limited during the later stages of the offensive out of fear of hitting the cavalry in the forward areas. Demonstrating just how much warfare had changed, the Canadian Corps report on the battle questioned the efficacy of employing cavalry in the pursuit when it noted that "it is an open question whether the unrestricted harassing fire of the retiring enemy by these

²⁸⁹ "Attack by Canadian Corps, August 8th, 1918," 3.

²⁹⁰ Nicholson, *Gunners of Canada*, 336-339.

²⁹¹ "Attack by Canadian Corps, August 8th, 1918," 3.

²⁹² Nicholson, *Gunners of Canada*, 340.

²⁹³ "Attack by Canadian Corps, August 8th, 1918," 5.

²⁹⁴ J. S. Stewart, "3rd Canadian Divl. Artillery G.-23," 21 August 1918, RG9-III-C-1 Volume 3910 Folder 36 File 2, Library and Archives Canada, 1.

[heavy] guns would not have been much more effective than the presence of the cavalry in the Forward area.”²⁹⁵ All of these tactics were important to the success of the Canadian plan. However, it was in the use of close support artillery that the Canadian Corps most clearly combined old ideas with modern tactics.

The use of artillery operating in close support was an important part of the Canadian Corps plan for Amiens. One Field Artillery Brigade per division was detailed to “advance in close support of the Infantry.” In practice, this meant that at zero hour, the gunners continued to fire while reconnaissance elements moved forward with the infantry. The engineers immediately began clearing roads for the artillery to move forward. After about one and a half hours, the batteries began to move forward, aided by the engineers and portable bridges issued down the battery level. In general, once the batteries were across no man’s land they set about engaging German targets. Coordination with the infantry was maintained by “mounted orderlies.” While an impressively organized system, few batteries saw much action due to an overall lack of resistance.²⁹⁶ One of the problems with moving large numbers of batteries forward was that the roads very quickly became congested with traffic. As a result, the Canadian Corps after-action report suggested employing only a small number of batteries to advance almost immediately after the infantry, with the rest of the field artillery brigade following later.²⁹⁷ Rather than attempting to move and coordinate a whole six-gun battery, the report’s author suggests that a single two-gun section, under the direct command of an infantry battalion, offered more flexible artillery support. After centralizing command of the artillery for the entire war, the Canadian Corps began to decentralize artillery command back down to the brigade and even battery level

²⁹⁵ “Attack by Canadian Corps, August 8th, 1918,” 3-4.

²⁹⁶ “Attack by Canadian Corps, August 8th, 1918,” 4.

²⁹⁷ “Attack by Canadian Corps, August 8th, 1918,” 4.

during mobile warfare conditions. The infantry required the artillery to be flexible enough to aid in the pursuit, but also to be able to assemble adequate firepower to halt an enemy counter-attack on short notice.²⁹⁸

The employment of artillery operating in a mobile close support role was not unique to the Canadian Corps. Throughout the BEF, the use of mobile artillery was a consistent practice during the Hundred Days offensives. When the infantry advanced miles instead of yards, the gunners simply could not provide support from their initial battery positions. Better counter-battery work and the element of surprise also enabled the movement of artillery. With the German guns largely suppressed, the threat of German counter-battery fire to exposed gun teams was limited. Moreover, achieving the element of surprise meant that there was no need for a preliminary bombardment which in turn meant that the landscape was relatively intact and easy to advance over.²⁹⁹ Mobile artillery operating in close support of the infantry had been the centerpiece of British pre-war artillery tactics. After four years of static trench warfare, close support tactics returned to the battlefield, albeit in a heavily modified role.

The battle of Amiens knocked the German army back on its heels. As is often noted, German general Erich Ludendorff described it as “the black day of the German army.”³⁰⁰ After the success at Amiens, the Allied armies began launching a series of attacks all along the frontline to break the stalemate of the Western Front. After Amiens, the Canadian Corps was redeployed to familiar positions near Arras to continue attacking the German defences.³⁰¹ The continual offensives eventually led them to face the difficult task of breaking through a

²⁹⁸ “Attack by Canadian Corps, August 8th, 1918,” 4-5.

²⁹⁹ Marble, *British Artillery*, 230-231.

³⁰⁰ As quoted in J. L. Granatstein, *Canada's Army: Waging War and Keeping the Peace* (Toronto: University of Toronto Press, 2002), 137.

³⁰¹ Cook, *Shock Troops*, 455-466.

formidable obstacle known as Drocourt-Queant line. The Drocourt-Queant line was a ten-kilometre-deep series of defences between Arras and the city of Cambrai that was the hinge which linked the main German defensive Hindenburg line to the defences further north.³⁰² To continue their advance, the Canadians needed to break through the Drocourt-Queant line. The Canadian Corps undertook a preliminary operation to break through the Fresnes-Rouvroy line on the 26 August.³⁰³ However, the defences of the Drocourt-Queant line were so strong that the gunners needed to default to a heavy preliminary bombardment to destroy the defences and cut the German wire. The three-day bombardment by the heavy guns wore down the German defences in preparation for the infantry assault. Then, on 2 September, the Canadian infantry broke through a 7,000-yard-wide section of the Drocourt-Queant line covered by an intense artillery barrage.³⁰⁴ Many factors led to the Canadians breaking through one of the most heavily defended positions on the Western Front. In particular, the use of artillery operating in a close support of the infantry demonstrates how the Canadians employed new tactics in mobile warfare operations.

Drawing on the experience gained at Amiens, during the Drocourt-Queant operation the Canadian Corps began to employ what they called “super mobile” batteries. Essentially, these were advanced batteries of field guns which operated as a single cohesive unit in very close support of the infantry for whatever tasks were needed. Learning from the lesson discovered at Amiens that a whole field artillery brigade was too large a formation to effectively provide close support, during the Drocourt-Queant operations the Canadian Corps employed super mobile batteries to good effect. In one instance, a single gun of a super mobile battery “galloped into

³⁰² Shane B. Schreiber, *Shock Army of the British Empire: The Canadian Corps in the Last 100 Days of the Great War* (Westport, CT: Praeger, 1997), 71-73.

³⁰³ Nicholson, *Gunners of Canada*, 349.

³⁰⁴ Nicholson, 352-355.

action over a small crest with the special purpose of engaging three hostile guns in action.” The Canadian Corps report on the Drocourt-Queant operations notes that this action “resulted in complete success.”³⁰⁵ While super mobile batteries provided flexible close support firepower for the infantry, each infantry brigade was also detailed a whole brigade of field artillery to provide more substantial fire support in case the enemy put up a determined resistance. This flexibility allowed advanced units to lay down improvised creeping barrages at very short notice. For example, the Canadian Corps report notes that “on one Infantry Brigade front [*sic*] a creeping barrage was placed in support of a local attack, very short notice being given, and met with success, judging from the exceptionally large number of enemy dead found.”³⁰⁶ The lesson the Canadian Corps drew from this experience was that forward guns should be assigned to different tasks. It was not enough to simply have the guns move forward and engage targets of opportunity. Instead, a relatively small number of guns accompanied the infantry, offering traditional close support firepower by engaging targets of opportunity over open sights if necessary. However, the report mentions that “the second wave, which should include the bulk of the close support Artillery, should at all times be well in hand and available for an organized barrage at short notice.”³⁰⁷ The handling of the advanced artillery during the Drocourt-Queant highlights not only the flexibility but also the sophistication of Canadian artillery tactics in 1918. Super mobile batteries were not simply the reappearance of old close support tactics. Instead, when coupled with the use of quickly planned creeping barrages, the use of super mobile batteries represents the fusion of the close support concept with the modern barrage tactics the Canadians had spent a year perfecting.

³⁰⁵ “Artillery Notes on Operations – August 26th to September 4th, 1918,” 19 September 1918, RG9-III-C-1 Volume 3911 Folder 39 File 7, Library and Archives Canada, 1-2.

³⁰⁶ “Artillery Notes on Operations – August 26th to September 4th, 1918,” 2-3.

³⁰⁷ “Artillery Notes on Operations – August 26th to September 4th, 1918,” 2-3.

Incorporating close support tactics into the Drocourt-Queant operations was not solely a Canadian innovation. The return of artillery operating in close support was a wider phenomenon. As historian Jonathan Boff notes, fully fourteen percent of the attacks launched by the BEF Third Army during the Hundred Days offensives employed artillery operating in close support, often with good results.³⁰⁸ However, it took some time for GHQ to note the developments in close support tactics. The publication of the pamphlet “Notes On Recent Fighting No. 21,” issued 25 September 1918, addressed the use of guns acting in close support. Overall, this pamphlet emphasized flexibility. The author exhorted the gunners not to focus solely on supporting one unit, but to be aware of targets on the flanks. Moreover, the pamphlet argues that, since ammunition supply was very limited in mobile conditions, only those targets whose destruction best aided the infantry should be engaged.³⁰⁹ As the Canadian Corps fought its way through the Drocourt-Queant line, the rest of the Allied armies delivered heavy blows across the frontline. In September, the British broke through the main German defences at the Hindenburg line. By the end of September 1918, the Allies forced the German army decisively backwards.³¹⁰ Building on the experience gained during the Amiens and Drocourt-Queant operations, the Canadian Corps set its sights on breaking through German defensive positions along the Canal du Nord.

The crossing of the Canal du Nord was perhaps the Canadian Corps’ most complicated operation of the war due to the difficult nature of the terrain. The unfinished Canal du Nord was deep but dry. However, marshy land on either side of the Canadian frontage meant that there was only 2,500 yards of clear ground upon which the infantry could advance up to the canal.

³⁰⁸ Jonathan Boff, “Combined Arms during the Hundred Days Campaign, August-November 1918,” *War in History* 17, no. 4 (2010): 464. <https://doi.org/10.1177/0968344510376456>

³⁰⁹ General Headquarters, “Notes on Recent Fighting – No. 21,” 25 September 1918, RG9-III-C-1 Volume 3912 Folder 42 File 9, Library and Archives Canada, 1.

³¹⁰ Marble, *British Artillery*, 236-240.

Meanwhile, once they crossed the canal the infantry needed to fan out and fill 9,000 yards of frontage by the end of the barrage line.³¹¹ A whole infantry division needed to pass through a zone only 1,500 yards wide on an elaborate and complex timetable. Due to congestion along the front and the different times at which units reached their objectives, there was no general creeping barrage. Instead, each battery's fire was planned to start and stop automatically based on the planned advance of the infantry so that fire was staggered along the front.³¹² The planned depth of the advance also presented a problem. The enemy's frontline was "300 to 750 yards" in front of the Canal, meaning that the artillery could not effectively support the depth of the attack from their starting positions. Moreover, because of the large concentration of the infantry in the narrow frontline, the artillery deployed no closer than 1,500 yards from the German frontline. Thus, while most of the guns remained on the west side of the canal providing support for the infantry to the final objective lines, some of the guns were required to advance to the canal to provide support for the later stages of the infantry offensive, which were 7,500 yards beyond the initial jumping off point.³¹³ The depth to which the artillery needed to control the battle is quite an apt demonstration of the advances in artillery technique. To effectively support the infantry, the gunners needed to suppress and destroy German defences over 9,000 yards away from their battery positions. The gunners simply could not remain in their original battery positions. They needed to be mobile and flexible.

The solution to the problem presented by the terrain was the employment of a "relay" barrage. The action of the artillery supporting the 4th Canadian Division demonstrates the

³¹¹ E.W.B. Morrison, "Artillery Notes on Operations of the Canadian Corps: September 27th to October 1st, 1918," RG9-III-C-1 Volume 3912 Folder 42 File 11, Library and Archives Canada, 1.

³¹² 1st Canadian Divisional Artillery, "Report on Operations, 27th Sept. to 1st Oct., 1918," RG9-III-C-1 Volume 3913 Folder 44 File 11, Library and Archives Canada, 1.

³¹³ Morrison, "Artillery Notes," 1.

concept of the relay barrage. To support its advance across the canal, the 4th Canadian Division was allotted ten brigades of field artillery. Of these, six brigades of the field artillery laid down a normal creeping barrage at zero hour. Meanwhile, the four brigades of field artillery not involved in firing in the barrage began advancing towards the canal. Once the infantry had achieved their first objective, the four advanced brigades stopped advancing and set up a creeping barrage to cover the advance of the infantry from the first objective line to the second objective line. The fire of the four advanced brigades was augmented by four brigades firing from their original battery positions. The remaining two brigades then advanced from their original battery positions to the canal. Once these two brigades reached the canal, the six brigades of the field artillery, now deployed on the west side of the canal, then supported the infantry attack from the second to third objective lines with a creeping barrage.³¹⁴ The complicated dance of the field artillery augmented the fire of the barrage and pushed it out further than was possible from the original battery positions. This was necessary because as the Canadian Corps report notes “that practically all the gains made during the five days [of the offensive] were effected under the cover of a creeping barrage.”³¹⁵ This system of relay barrages differs from the use of artillery in a traditional close support role. The strong German defences meant that the artillery could not be used to fire over open sights as had been the case at Amiens and during the Drocourt-Queant operations. Nonetheless, the gunners still needed to be mobile enough to support the infantry’s drive forward to a much greater extent than had been possible earlier in the war. The very fact this system worked at all was a testament to the increased command and control capabilities of the Canadian Corps.

³¹⁴ “Artillery Notes on Operations of the Canadian Corps September 27th to October 1st, 1918,” RG9-III-C-1 Volume 3912 Folder 42 File 10, Library and Archives Canada, 2. This appears to be an unsigned and undated draft with different information than the report of the same title signed by E. W. B. Morrison.

³¹⁵ “Artillery Notes on Operations of the Canadian Corps September 27th to October 1st, 1918,” 3.

A unique tactic during the Canal du Nord operation was the addition of a rolling heavy artillery barrage beyond the final barrage lines for the main offensive push. At Amiens and Cambrai, the success of the offensive meant that friendly forces pushed beyond the edges of the barrage maps into areas typically assigned as heavy artillery barrage zones. The potential for friendly fire was so serious that, at the Canal du Nord, heavy artillery fire beyond the final objective lines was organized into a giant rolling barrage which lifted 500 to 1,500 yards at set increments. This allowed the infantry and cavalry to continue the exploitation beyond the normal barrage map. At Canal du Nord, this was judged to have worked satisfactorily for both the gunners and the infantry.³¹⁶ There were also significant variations in a barrage as complicated as the Canadian Corps plan. For example, the 1st Canadian Divisional artillery employed complicated barrages which rolled forward over more distant defensive positions, then backward over the first objective line while the infantry were attacking.³¹⁷ The combination of separate field artillery and heavy artillery rolling barrages demonstrates how the Canadians were controlling the battlefield much more effectively than they had even a year before.

The battle of Canal du Nord also marks the maturation of the system of artillery control pioneered by the Canadian Corps. Command and control had often been inflexible due to the difficulty of controlling large masses of artillery and the associated communication difficulties of a modern battlefield. However, by late 1918, the Canadian Corps finally had the training and experience to carry out continuous artillery operations. The Canadians employed a three-level system of command and control. Corps control, as historian G. W. L. Nicholson terms it, involved the GOCRA commanding all artillery attached to the corps. This level of control was

³¹⁶ Morrison, "Artillery Notes," 2.

³¹⁷ 1st Canadian Divisional Artillery, "Report on Operations," 4

normally used for large offensive actions or counter-battery work that involved the entire corps frontage. Divisional control usually followed major set piece bombardments when each divisional artillery needed some flexibility in carrying out their objectives. Finally, during standard trench warfare conditions, such as consolidation or defensive actions, the CRA of each division commanded their divisional artillery units and the GOCRA commanded all other forces attached to the corps.³¹⁸

To demonstrate the use of this command and control system, it is instructive to look at a few days of fighting during the Canal du Nord operations. During the crossing of the Canal du Nord, the initial Corps barrage allowed the infantry to advance through the series of defensive belts around the canal. Then, once the canal had been crossed, each divisional artillery immediately took control of the situation and continued to advance by utilizing the divisional guns, which took turns covering the advance and then leapfrogging forward to continue the cycle. During 28 and 29 September, this method of divisional control was maintained as the infantry pushed forward in the face of determined resistance. On 30 September, the entire Corps, minus one division, coordinated a corps-wide barrage to advance to the line Ramilles – Batigny – Abancourt, which was then defended by the massed Corp artillery complement. This flexibility on a day by day basis was impossible only a year before. However, due to the accumulated experience of the Canadian staff officers, “the respective changes of control throughout these operations were accomplished with complete facility as a result of previous experience.”³¹⁹ Communication problems remained serious, so that it was never easy to carry out continuous operations particularly when the frontline infantry rapidly outpaced the headquarters units.³²⁰

³¹⁸ Nicholson, *Gunners of Canada*, 242-243.

³¹⁹ Morrison, “Artillery Notes,” 3.

³²⁰ Cook, *Shock Troops*, 549.

Wireless could bridge the communications gap if necessary but it was not able to completely solve the communications issues. The 3rd CDA reported that “wireless gave good results the first day but the difficulty of keeping the equipment in adjustment is great. There is a tendency to use it only as a last resort and not to rely on it when any other means is available.”³²¹ It is important to note that the Canadian Corps was not the only BEF formation be able to carry out continuous operations with alternating command and control arrangements. During the pursuit of the retreating German armies in October, divisional control was the norm for British formations. However, when the infantry ran up against a strong German defensive position, corps control was reasserted to organize an effective bombardment to crack the defensive position.³²² The achievement of continuous operations was not due solely to any tactical change. Rather, it was a consequence of the accumulated experience of the officers commanding the Corps as well as the application of more effective tactics.

The crossing of the Canal du Nord was one of the last major set piece battles the Canadian Corps fought during the war. Faced with unrelenting attacks from the Allied armies, the German army was forced into a continual fighting retreat from one improvised position to another.³²³ As the German army retreated, the importance of counter-battery work increased dramatically in the final days of the war. With the German infantry rarely offering much of a fight, what was needed to maintain the advance was for the counter-battery guns to suppress the German artillery. As Marble notes, during the last days of the war the Counter-Battery Staff Officer (CBSO) often controlled 50-70 percent of the heavy artillery.³²⁴ The Canadian Corps

³²¹ 3rd Canadian Divisional Artillery, “G.182,” 7 October 1918, RG9-III-C-1 Volume 3913 Folder 44 File 12, Library and Archives Canada, 2.

³²² Marble, *British Artillery*, 240-241.

³²³ Boff, “Combined Arms,” 471.

³²⁴ Marble, *British Artillery*, 241.

advanced steadily throughout October. The final obstacle before the Armistice was the crossing of the Canal de l'Escaut and the taking of the city of Valenciennes. The key to the battlefield was the German defensive positions on the heights of Mont Houy which overlooked the city. In late October 1918, a single British battalion had almost taken Mont Houy, but had failed in the face of a German counter-attack.³²⁵ Because of the failure of the British attack, it fell to the Canadians to take Mont Houy and push the Germans out of Valenciennes.

The artillery tactics used by the Canadians to take Mont Houy represented a mixture of old and new methods. The planning for the crossing of the Canal de l'Escaut demonstrates how much of the tactical handling of the artillery had become routinely formalized by the continual fighting of the Hundred Days campaign. The artillery cover for the advance of the one infantry brigade from the 4th Canadian Division simply called for one brigade of artillery "employing normal 'close support tactics', including anti-tank defence."³²⁶ As was now the norm, there was no preliminary bombardment. When the offensive began, the barrages laid down on Mont Houy were heavy and systematic. A complicated set of barrages walked up and down the slope as well as from side to side, disorienting the German defenders to the point that they did not know where the attacking infantry were. Many simply surrendered to the first Canadian soldier they saw.³²⁷ Additionally, counter-battery work began at zero hour on 1 November with direct neutralizing fire on the German guns. Counter-battery work was thorough, but also limited by the German practice of continuously moving batteries which were difficult to track and neutralize. Heavy unrelenting fire pounded the German guns, which put up a stiff resistance at first but were subsequently destroyed as the Royal Air Force, working in concert with the Canadian Counter-

³²⁵ Cook, *Shock Troops*, 556.

³²⁶ "Artillery Order No. 145 by G.O.C., R.A. Canadian Corps," 31 October 1918, RG9-III-C-1 Volume 3914 Folder 46 File 1, Library and Archives Canada, 1.

³²⁷ Cook, *Shock Troops*, 559.

Battery Office, silenced them all in turn.³²⁸ Interestingly, the flexibility of the heavy artillery was also demonstrated by the fact that some counter-battery guns were diverted from targeting the enemy's artillery positions to shelling German artillery supply routes and assembly areas for the enemy infantry. The Counter-Battery Office's report noted that "in some cases the road [leading towards German battery positions at Estruex and Saultain] was practically blocked by the destroyed wagons and dead animals."³²⁹ The success of the offensive at Mont Houy was quite stunning. The German defenders had all the natural advantage of a strong defensive position and outnumbered the Canadian attackers by at least three to one. Yet, through the ferocity of the bombardment and the courage of the infantry, only two Canadian battalions were required to capture the objective, instead of a much larger infantry force which was required only a year before.³³⁰

During the Hundred Days operations, Canadian gunners leveraged the power of their guns to the absolute maximum. The Canadian Corps' record of success proves this much. With the help of the artillery, the Canadians captured 30,000 prisoners, engaged at least a quarter of all German divisions on the Western Front, and advanced through some of the toughest defensive positions the German army occupied.³³¹ The Canadians achieved this level of success in part because of the effectiveness of the artillery. In 1918, changing conditions on the ground necessitated a fusion of old and new tactics. After years of static warfare, the artillery needed to adapt to mobile and semi-mobile warfare as well as seize the element of surprise. Cambrai provided a template for the operations in 1918 because it was the first British battle to synthesize

³²⁸ Counter Battery Office, "Notes on Counter Battery Support in Capture of Mont Houy by the Canadian Corps on the 1st.November 1918," 3 February 1919, RG9-III-C-1 Volume 3913 Folder 45 File 8, Library and Archives Canada, 2-3.

³²⁹ Counter Battery Office, "Notes on Counter Battery Support," 3.

³³⁰ Schreiber, *Shock Army of the British Empire*, 123-125.

³³¹ Schreiber, 132-133.

the fundamentals achieved in 1916 and 1917 with new methods such as a lack of preliminary bombardments and screen calibration. The study of Canadian artillery demonstrates how mobile warfare tactics were applied after Cambrai. Using super-mobile batteries, advanced sections, a stronger command and control apparatus, and the accumulated experience of mature tactics like the creeping barrage and counter battery work, the Canadians employed a mix of old and new tactics to sustain their offensives during the Hundred Days.

Conclusion

Returning almost exactly to where the BEF began its war four and a half years earlier, the Canadian Corps was near the Belgian town of Mons as the war ended on the morning of 11 November 1918. With the war finally over, the gunners of the Canadian Corps could be rightfully proud of their accomplishments. The Canadian gunners were a vital part of the Canadian Corps' war-fighting capabilities. The Canadian artillery evolved from a tiny pre-war artillery complement to a well-organized and effective fighting machine that advanced continuously through some of the most sophisticated German defensive networks. The gunners provided the firepower for the infantry to advance through German defences and to suppress German machine guns and artillery. However, the Canadian gunners did not operate alone. As was demonstrated in each chapter of this thesis, the Canadian artillery component was inseparably linked with developments in the British Royal Artillery.

As chapter one demonstrated, there was no separate Canadian inquiry into the role of the artillery on the battlefield before the outbreak of the war. The Canadian artillery complement was tiny, there were precious few Canadian staff officers, and most of the attention was simply on training the militia. As a result, it was entirely up to the British Royal Artillery to shape the pre-war artillery doctrine, particularly a conception of the role of the artillery based around mobile close support field artillery. As seen in chapter two, when the war came, the Royal Artillery faced a terrible baptism of fire in the first few months of the war. The first battles demonstrated the inadequacy of the Royal Artillery's pre-war conceptions of battle, so the gunners adapted. When defences were still limited, the dominant idea was to destroy the trenches and barbed wire to restore mobility to the infantry. However, German defensive tactics improved much more rapidly than the firepower of the artillery. Consequently, the BEF struggled to

develop a set of artillery tactics that could break the stalemate. It is important to emphasize that the crucial period of early experimentation in artillery tactics was spearheaded by the British gunners. For much of the first year of the war, the Canadians were focused on forming and equipping an expeditionary force. The first sustained action the Canadians faced was at Second Ypres in April 1915, but this was defensive fighting. Moreover, the Canadians played only a minor part in the BEF's 1915 offensives and it was not until late summer 1915 that the Canadian Corps was even formed. Consequently, Canadian artillery was heavily influenced during this formative period by developing British artillery practices. The offensive action of the Canadian Corps in retaking Mount Sorrel demonstrated how closely the Canadian artillery followed prevailing British artillery tactics.

For both the BEF and the Canadian Corps, the Somme campaign proved to be a major turning point in artillery tactics. With more ammunition available, the gunners developed new tactics. At the Somme, the creeping barrage and new counter battery methods were introduced, improved, and became standard. These tactics, further refined and codified in the "Artillery Notes" series of pamphlets over the winter of 1916-17, were then successfully employed by the Canadian Corps during the taking of Vimy Ridge. Throughout the intense battles of 1917, the Canadian and British gunners honed fundamental artillery tactics such as the creeping barrage and better counter-battery fire. However, despite a string of victories in the spring and summer of 1917, the BEF foundered in the mud of Flanders at Passchendaele. Due to the innate difficulty of the terrain and stiff German resistance, increasingly violent artillery barrages were not able to break the stalemate at Passchendaele. However, a breakthrough in artillery tactics came at Cambrai. The new artillery tactics employed at Cambrai provided a template for the Canadian artillery to employ in mobile warfare. The Canadians took the tactics pioneered by the British at

Cambrai, like the use of screen calibration and mobile close support artillery, and used them during the Hundred Days offensives. The Canadians rapidly improved their tactical handling of artillery during the Hundred Days from one attack to the next, reaching a peak of efficiency during the fall of 1918. However, throughout the war, Canadian improvements in artillery tactics should not be seen as evidence of purely Canadian innovation, rather they reflected the wider trends within the BEF.

This study has attempted to draw a line between British doctrine and Canadian tactics. However, caution should be exercised when considering British doctrine in the First World War as a homogenous group of ideas. The interplay between doctrine and tactics was very fluid in the BEF during the war. As Johnathan Boff notes, a spirit of personal experimentation from the pre-war army permeated the lower levels of command.³³² Thus, tactics and techniques could vary widely between units. GHQ did exercise a measure of influence through the circulation of official publications such as the “Artillery Notes” series. By drawing attention to certain tactics and techniques through the issuing of doctrinal pamphlets, central staff officers attempted to lay down a base level of tactics. While the level of official doctrine remained tied up to publications and pamphlets from GHQ, which were disseminated down to the component parts of the BEF, innovation was never a top down affair in the BEF.³³³ The process of adapting to the conditions on the ground existed within several official and unofficial channels. As Boff notes, corps, divisions, and even brigades all had best practices disseminated through personal connections, “Lessons Learnt” reports, and other channels. These practices could be different than the official doctrine espoused by GHQ or could simply reinforce it.³³⁴ Rather than an entirely top-down or

³³² Jonathan Boff, “Combined Arms during the Hundred Days Campaign, August-November 1918,” *War in History* 17, no. 4 (2010): 476-77. <https://doi.org/10.1177/0968344510376456>

³³³ Boff, 474-475.

³³⁴ Boff, 474.

bottom-up approach, there was an interplay between tactics adapted to the conditions on the ground and the framework of strategic and operational needs. Thus, it is important to stress that tactics and doctrine could diverge at times, but also reinforce each other at other times.

By analyzing the whole war, it is possible to understand the scope of British artillery influences on the Canadian gunners. One of the limitations of this study is understanding the pivotal months near the end of the war. The BEF consistently advanced in the face of German defences, crumbling though they were, which were still formidable. Tim Travers claims in his book *How the War Was Won: Command and Technology in the British Army on the Western Front, 1917-1918* that technology and attrition, more than tactics, wore the German army down. Moreover, he presents infantry-artillery combined arms tactics as traditional, in comparison with the modern application of tanks that he claims GHQ neglected.³³⁵ It is true that although efforts at rationalizing the training apparatus intensified, doctrine stagnated. Artillery circulars containing lessons learnt from recent fighting were still published, but the main doctrinal pamphlets, the “Artillery Notes” series, were not updated for most of 1918. In many ways, the corps and armies of the BEF stumbled through the Hundred Days campaign without much guidance from GHQ.³³⁶ The interplay between doctrine and tactics was much more fluid during the Hundred Days offensives than for most of the war, which necessitates the need for further study.³³⁷

³³⁵ Tim Travers, *How the War Was Won: Command and technology in the British Army on the Western Front, 1917-1918*, (London: Routledge, 1992), 180-182.

³³⁶ Defensive artillery doctrine advanced rapidly in 1918, but the central tenants of offensive artillery doctrine were largely the same as 1917. Marble, *British Artillery*, 214-216, 223.

³³⁷ Shane B. Schreiber, *Shock Army of the British Empire: The Canadian Corps in the Last 100 Days of the Great War* (Westport, CT: Praeger, 1997) focuses specifically on this question.

Studying the Canadian Corps provides a unique opportunity to examine the interaction between artillery doctrine and tactics in action. As a more homogenous force than most other British corps, the Canadians should have been in a position to generate their own approach to the handling of the artillery on the battlefield. This is not a new idea. The extent to which the Canadian Corps is unique remains a large part of the historiographical debate. It is interesting to note that in the BEF, corps were administrative structures where divisions cycled into and out of the corps on a temporary basis. However, while divisions would move around from corps to corps, the corps itself would stay along a certain portion of the front. Corps commanders would become familiar with the terrain of their corps, while the divisional complements would be constantly thrust into unfamiliar locales. In the Canadian corps, this process was somewhat the inverse. The Canadian divisions, once formed and part of the corps, remained attached while the Corps was shuffled around the front in support of offensive operations.³³⁸ There is a bit of debate about the practical effect this had on combat effectiveness. Many historians, including the British *Official History*, have tended to stress homogeneity and stability of the Canadian Corps as one of the factors in its success. As the *Official History* notes, “the co-operation between the divisions of a homogenous corps, like the Canadian or Australian [corps], was invariably better than between divisions fortuitously thrown alongside each other in a corps, the name of whose general they did not know and the faces of whose staff they did not recognize.”³³⁹ However, some research suggests that several of the best British divisions, like the 9th Scottish Division, cycled through several corps or changed divisional commanders frequently with no noticeable

³³⁸ G. W. L. Nicholson, *The Gunners of Canada: The History of the Royal Regiment of Canadian Artillery, 1534-1919*, vol. 1 (Toronto: McClellan and Stewart Limited, 1967), 114.

³³⁹ Sir James E. Edmonds and R. Maxwell-Hyslop, compilers, *Military Operations France and Belgium, 1918; Volume V: 26th September – 11th November; The Advance to Victory*, History of the Great War, (London: Imperial War Museum, 1947), 179.

deleterious effect.³⁴⁰ Furthermore, research presented in this thesis seems to indicate that, at least for the artillery, the Canadians were not particularly unique in their handling of the artillery. The Canadians certainly used the artillery effectively, but they followed very closely to artillery tactics common to the BEF.

Further research is required on the topic of artillery in the First World War more generally. Each chapter of this thesis is necessarily limited to a case study of a small part the BEF's approach to artillery tactics during a specific period of the war. However, drawing in more British primary documents, as well as widening the scope of examination to cover the whole of the imperial forces would provide a way to discover further differences and similarities in the approaches to the use of artillery on the battlefield. Understanding how dominion units fit into the BEF is important. The BEF was composed of units from all over the British Empire. British, Canadian, Australian, New Zealander, Newfoundlander, and other units worked together to solve the problem posed by trench warfare on the Western Front. It is not without reason that the Canadians and ANZAC's were consistently thrown into difficult and important battles. Diagnosing the differences and similarities in artillery tactics and the resources committed to each attack is important to understanding why the dominion units were consistently successful later in the war. However, focusing on the dominion formations alone risks obscuring the close cooperation which existed between the component parts of the BEF.

The Canadian Corps was an effective fighting formation. Throughout the war the Canadians were thrown into difficult battles, from which they usually emerged victorious. Consistent successes on the battlefields of the First World War were enabled by the effective

³⁴⁰ Peter Simkins, "Co-stars or supporting cast? British Divisions in the 'The Hundred Days,' 1918," in *British Fighting Methods in the Great War*, edited by Paddy Griffith (Portland, OR: Frank Cass & Co. Ltd., 1996), 59-60.

application of the artillery. Thus, understanding the artillery helps explain why the Canadian Corps was an effective formation. As this thesis demonstrates, the Canadian artillery very closely followed developments in artillery tactics in the wider BEF. From the way artillery operations were consistently envisioned within the context of prevailing British doctrine, or even copied from doctrinal manuals, the Canadian gunners employed the artillery according to the BEF's dominant tactics. It is impossible to understand the evolution of Canadian artillery tactics in the First World War without also understanding linkages between the Canadian gunners and the wider Royal Artillery. The Canadian artillery was closely integrated with the Royal Artillery. The gunners used the same equipment, spoke the same language, worked and fought beside one another, and employed the same tactics to achieve victory on the battlefield.

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