Canadian Military History

Volume 20 | Issue 4 Article 3

4-30-2012

Crossing the Canal: Combined Arms Operations at the Canal Du Nord, Sept–Oct 1918

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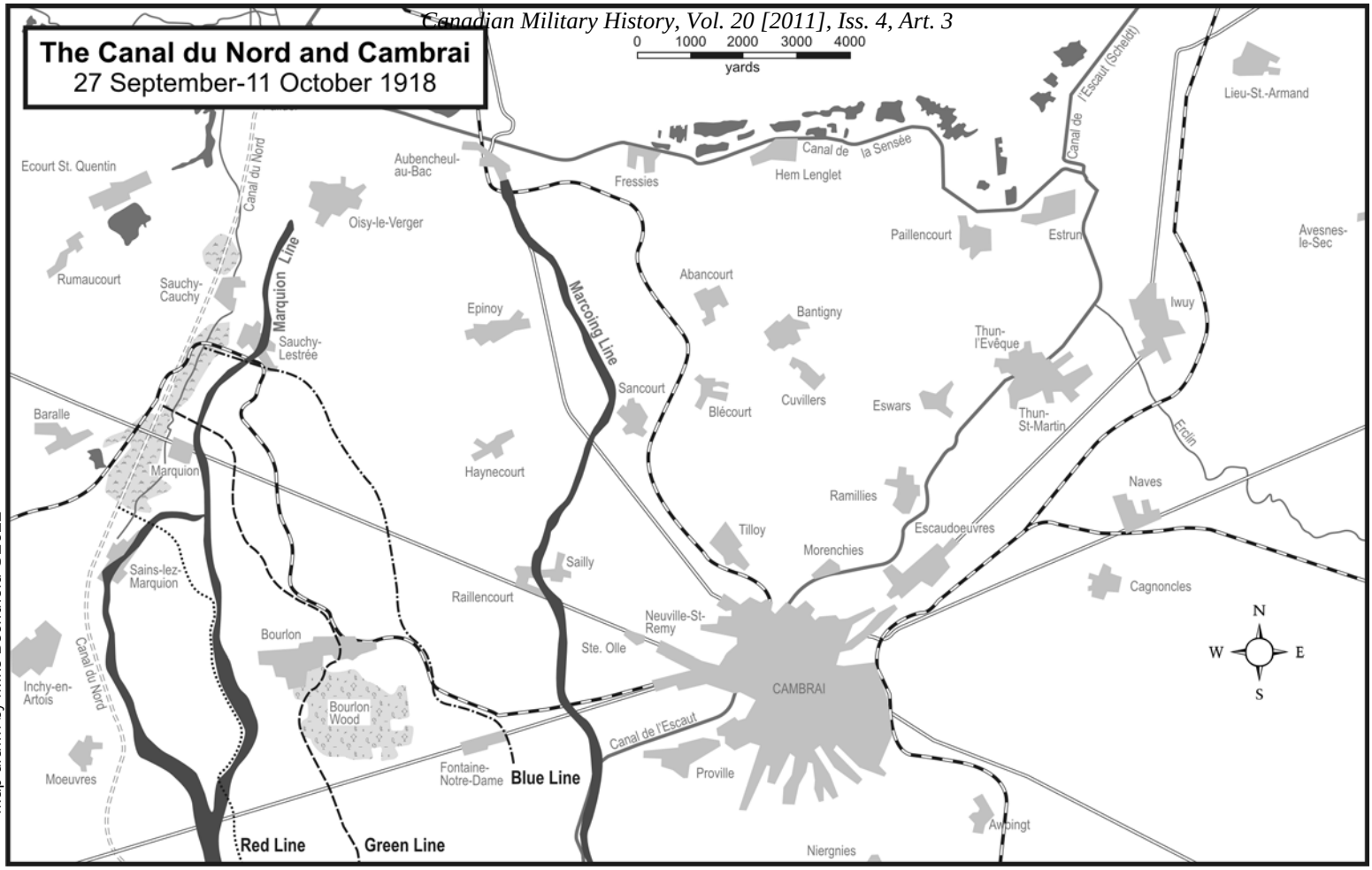
Abstract: The crossing of the Canal du Nord stands as one of the most impressive Canadian tactical operations of the First World War. Incorporating a risky battle plan, emphasizing combined arms operations and utilizing the recently re-organized Canadian Engineers, the battle stands as a benchmark for the evolution of 20th century combat. Although sustaining high casualties, the Canadian Corps overcame one of the strongest German defensive positions along the Western Front in an operation that foreshadowed the mobile, combined arms doctrine of the Second World War.

The First World War has traditionally been viewed as a tactically stagnant conflict that resulted in extremely high casualties with very little battlefield success. Although this notion is generally accurate for the first half of the war, recent scholarship suggests it is incorrect when studying the events of 1917 and 1918.[1] By that time, after several years of doctrinal development, the Allied armies had at their disposal sufficiently trained and well prepared formations under proven commanders that overcame highly complex German defences. Within the Allied armies, the Canadian Corps was regarded as an elite formation and spearheaded major offensives during the last year of the war.

The crossing of the Canal du Nord in late September 1918 was the Canadian Corps' greatest tactical achievement even though it has been overshadowed by the better known successes at Vimy Ridge in 1917 and at Amiens and the Drocourt-Quéant (D-Q) line in 1918. The Canal du Nord operation was a sophisticated combined-arms assault in which engineer, artillery and infantry units were seamlessly integrated. Indeed, the crossing of the canal represented a skilful application of the combined arms tactics developed in the trenches to semi-open warfare – a tactical model that came to full fruition on the battlefields of the Second World War. Some view the daring and unorthodox plan as the "operational masterpiece" of Lieutenant-General Sir Arthur Currie, the culmination of his inspired battlefield leadership. He had taken command of the corps in June 1917 and, in the victories at Hill 70 and Passchendaele during the summer and fall of that year, together with rigorous training and innovative changes in organization in 1918, further honed the formidable striking power the formation had achieved under its previous commander, Lieutenant-General Sir Julian Byng.[2]

Starting in March 1918 the Germans launched a series of major offensives which cut deep salients into Allied territory. The assaults failed in their strategic goal of breaking the ability of the Allied armies to mount an organized defence, and exhausted the German army in the process. By August the Allies were ready to respond with a counteroffensive which became known as the Hundred Days. Essentially, the campaign was a series of loosely coordinated offensives launched by American, British and French armies against the over-extended German lines. Beginning with the Battle of Amiens on 8 August 1918, in which the Canadian Corps led the British armies, the Hundred Days became a succession of Allied victories that inflicted heavy losses on the German forces and undermined their morale. This campaign led directly to the German call for peace negotiations and the armistice of 11 November. For the Canadians, the Hundred Days was one of the most successful but also tragically costly periods in Canadian military history.[3]

In September 1918 the Germans positioned themselves along the Hindenburg line, their heavily defended and final line of defence. Field Marshal Earl Haig, commander-in-chief of the British Expeditionary Force, and French Field Marshal Ferdinand Foch, supreme commander of the Allied armies, agreed upon a front-wide general assault including American, Belgian, French and British army groups. General Henry Horne's British First Army, which included the Canadian Corps, was instructed



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to capture Cambrai in conjunction with General Byng's Third Army. The capture of the city would secure the Third Army's left flank and deny the Germans their northern railway nexus. "It would have been difficult to overstate the importance of Cambrai to its German defenders,"[4] concluded historian Shane Schreiber; it was the centre for the German logistical system in the Flanders theatre. Cambrai's importance was already well known to British high command as the city was the springboard for a German counterattack in 1917 that turned a BEF victory into a serious defeat. According to historian Daniel Dancocks, "There was no doubt that the Germans would defend Cambrai with ruthless, even fanatical determination; its loss would be disastrous for the enemy because it would render the rest of the Hindenburg line untenable."[5]

In order to get to Cambrai, however, the Canal du Nord, to the west of the city, would have to be crossed and the heights of Bourlon Wood, which commanded the eastern bank of the canal, taken. Second Canadian Infantry Brigade, one of the formations involved in the operation, observed: "The capture of the Bourlon wood and high ground to the north and east of it were conditions precedent to the success of the major operation. For the advance of troops south of Bourlon wood would have meant a flank open to hostile attack, which developing, must have imperilled the whole enterprise."[6] Thus the Canadian Corps was tasked with capturing one of the most threatening positions along the German line.

The canal provided the Germans with a natural defensive obstacle. They had flooded most of the area in the Canadian Corps sector increasing the difficulty of crossing. As Currie pointed out, traversing the canal would be difficult enough, even without the well prepared German defensive measures,

> The Canal du Nord…was under construction at the outbreak of the war and had not been completed. Generally speaking, it followed the valley of the River Agache, but not the actual bed of the river. The average width was about 100 feet and it was flooded as far south as the lock, 800 yards south-west of Sains-lez-Marquion, just north of the Corps southern boundary. South of this and to the right of the Corps front the Canal was dry, and its bottom was at the natural ground level, the sides of the Canal consisting of high earth and brick banks.[7]

German defences covered the eastern bank of the canal with machine guns and this was further reinforced by the well constructed and heavily-wired canal defence line. As G.W.L. Nicholson, official historian of the Canadian Expeditionary Force, observed: "Air photographs revealed that its [the canal defence line] main strength lay in its dense barricade of

Taken nearly a year before the battle (2 November 1917) this oblique air photo shows the dry bed of the Canal du Nord as it snakes past Moeuvres towards Sains-lez-Marquion. The zig-zag lines of trenches are only the most visible part of the formidable defences on either side of the canal.

wire."[8] Farther back and parallel to the canal was another heavily wired defensive network, the Marquion Line, and behind that stood the imposing heights of Bourlon Wood a position which was "difficult to assess from air photographs because of the foliage still on its magnificent oak trees…But the ground between the wood and the Marquion Line was dotted with old excavations, dug-outs and shelters, all of them potential machine-gun sites."[9] It was hard to fathom that after overcoming two heavily defended positions the Canadians would then be expected to assault a dense forested area on high ground.

The impossibility of crossing the canal in the northern half of the corps sector created one of the most perplexing tactical dilemmas Currie had ever faced. Nearly the entire length of the canal facing the Canadian front was impassable due to flooding and areas not flooded were reinforced by strong German defences. Dismissing the option of a costly frontal assault, Currie decided to extend his southern boundary and attack through a narrow, dry stretch of the canal, intending to overwhelm the German flank. In his words, "The Corps had, therefore, to cross the canal on a front of 2,600 yards and expand fanwise in a north-easterly direction to a front exceeding 15,000 yards."[10] What further persuaded Currie to attack through this portion of the canal was the fact that only eight of the 21 German divisions in the area were in this sector, compared to 13 divisions farther north.[11] He had pinpointed the weakest link in the German defensive chain and decided to exploit it.

The 2,600-yard dry stretch of the canal that Currie proposed to cross was an extremely narrow front for a corps-strength attack. Currie's plan was to side-step the corps into this narrow gap, punch through with two divisions and then exploit the gap with two fresh divisions to

fan out and cover the 15,000 yard frontage he intended to command on the far side of the canal.[12] Currie would need to position all of his attacking troops into one small area. According to conventional military doctrine, this plan was risky at best, disastrous at worst. That worried Currie intensely: "The assembly of the attacking troops in an extremely congested area known by the enemy to be the only one available was very dangerous, especially in view of the alertness of the enemy. A concentrated bombardment of this area prior to zero, particularly if gas was employed, was a dreaded possibility which could seriously affect the whole of the operation and possibly cause its total failure."[13] There was a chilling premonition of what could happen on 26 September. While troops of 12th Canadian Infantry Brigade (CIB) waited to board trains to take them to the front "a bombing attack was carried out by hostile aircraft which resulted in casualties amounting to 2 officers, 123 other ranks."[14]

The difficulties inherent in Currie's operational plan disturbed his superior officer, General Horne, who recommended alterations. According to Shane Schreiber, when Currie adamantly refused to alter his program Horne went to the BEF commander, Field Marshal Haig. Haig, trusting in Currie's competence, sided with the corps commander. Horne's doubts were undiminished and he approached Currie's old commander, Julian Byng, now commanding Third Army, to request that Byng attempt to persuade Currie to alter his plan. Schreiber describes Byng and Currie's meeting: "After inspecting Currie's plan, Byng commented to the Canadian, 'Do you realise that you are attempting one of the most difficult operations of the war? If anybody can do it, the Canadians can do it, but if you fail, it means home for you.' Currie remained undaunted."[15] His plan remained unchanged. It is interesting to note that this debate is not mentioned in either the recent biography on General Horne, *The Silent General* by Don Farr, or *The Selected Papers of Sir Arthur Currie* edited by Mark Humphries.[16] Farr, in fact, devotes a couple of pages to the relationship between Horne and Currie citing three occasions when they clashed, but does not mention the tactical debate prior to the attack on the Canal du Nord.

On 22 September, headquarters assigned a third primary objective for Currie's corps, the high ground east of Cambrai and overlooking the Canal de l'Escaut. Currie adapted to these last minute additions and broke the assault into two phases. He set the first phase objectives as the Canal du Nord and the seizure of Bourlon Wood. The second phase would be the capture of the bridges over the Canal de l'Escaut and the high ground near Cambrai. The 1st Canadian Division, led by Major-General Archibald Macdonell, would lead the first phase of the attack, rolling up the Marquion Line along its flank from south to north. At the same time, the 4th Canadian Division, led by Major-General David Watson, would seize Bourlon Wood leaving the centre to be mopped up later. After the phase one objectives were taken, the 3rd Canadian Division, led by newly-appointed Major-General Frederick Loomis, and the British 11th Division, would cross the Canal du Nord and push on towards their phase two objectives.[17] General Henry Burstall's 2nd Canadian Division was to be kept in reserve.

Currie designated three intermediate objective lines for the first phase of the attack on the 27th. The Red Line, which was to be taken first, included the Canal du Nord and the Marquion Line defences. The Green Line, 1,500 yards further east, was to be taken next and included Bourlon village. A further 2,000 yard advance would put the Canadians at the Blue line and in possession of the remainder of Bourlon Wood.

The attack was scheduled for the morning of 27 September and the night before was one of sleepless tension. In Currie's words: "This was for everybody a night full of anxiety, but apart from the usual harassing fire and night bombing nothing untoward happened."[18] Historian A.M.J Hyatt described the scene that evening:

> The infantry, bunched into the crowded assembly areas and oppressed by the fear of a routine enemy barrage on their dangerously dense numbers, waited apprehensively for zero hour. Rain began to fall and the cold ground became slippery, adding to the difficulty of the coming assault… the darkness of the sky remained ominous. Suddenly, at 5.20 a.m. the stillness and tension were shattered by the sickening crash of the creeping barrage and the infantry began moving forward.[19]

Canon Frederick Scott, a chaplain in the 1st Division, was awestruck by the artillery barrage that morning: "At 5.20 the savage roar burst forth. It was a stupendous attack. Field guns, heavy guns, and siege batteries sent forth their fury, and machine guns poured millions of rounds into the country beyond the Canal."[20] Under the protection of the artillery, the infantry moved forward virtually unmolested across the canal. Once through the gap the forward units fanned out, each one forcing its way towards its objectives.

This air photo mosaic, taken by the RAF at the beginning of September 1918, shows the sector of the Canal du Nord assaulted by the Canadian Corps on the morning of 27 September. A close look at the image shows the depth of the German defences: trenches are clearly visible and wire is visible as dark bands marked as "x x x x x."

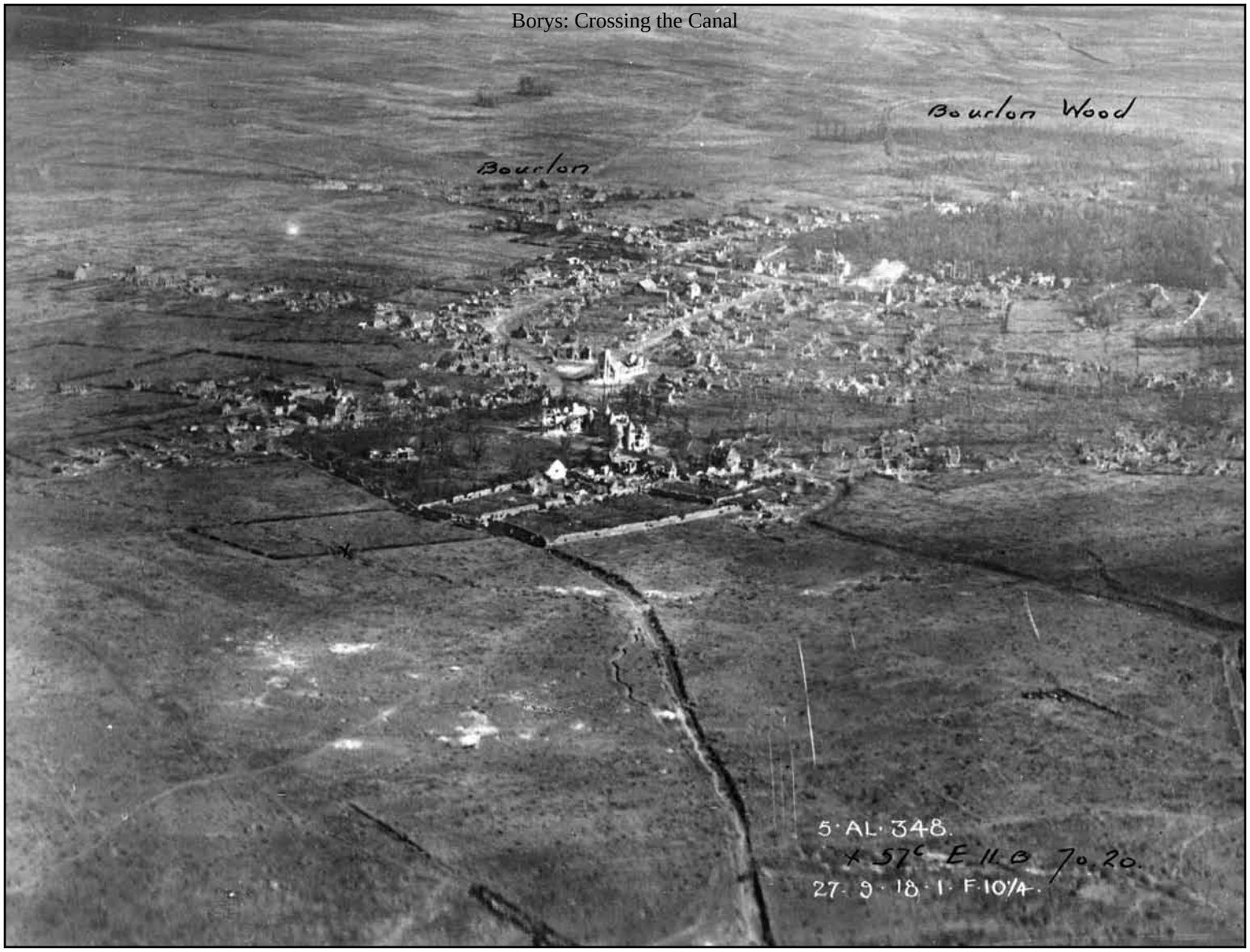

SAINS-LES-MARQUION.
Marquion
Sains-lez-Marquion
Inchy-en-Artois

The 4th Division had the most important task in capturing Bourlon Wood. If left in the hands of the Germans it would provide a strong position to mount a counterattack directly into the flank of the Canadian Corps. This could cut off any possibility of retreat and prevent any further advance towards Cambrai. Major-General Watson led his attack with 10th CIB, while 11th and 12th CIBs were to leap frog and envelop the German defences with a pincer movement. Brigadier-General Lord Brooke's 12th Brigade was given the left while the 11th Brigade under Brigadier-General Victor Odlum was the right arm of this pincer movement. Brooke was able to achieve his objectives but Odlum's brigade became caught in enfilade fire from its flank and "the right battalion suffered considerable casualties from art. and m. guns firing from the high ground in front of Bourlon Wood…"[21] The British 52nd Division, which was to support the corps' right flank, and thus the 4th Division, was unable to keep pace and left Odlum's brigade vulnerable to vicious flanking fire. Unable to advance any further, Odlum established a line to protect the right flank of the corps. Fortunately, 12th Brigade captured "…the Blue objective practically along the entire divisional front…" highlighted by the actions of Lieutenant McKnight and Private Graham who "took a Lewis gun and dashed across the open under heavy machine gun fire and took up a position enfilading the enemy, causing about 50 of them to surrender."[22] The success of 12th CIB allowed 4th Division to consolidate its hold on Bourlon Wood.[23]

Stiff resistance was encountered by 1st Division, especially by 2nd CIB on the right, whose "time table barrage had passed the enemy's resistance points" and thus "heavy shelling and a certain amount of machine gun fire were encountered… all companies suffered casualties. As they advanced, they expanded into battle formation coming under heavy rifle and machine gun fire."[24] Overcoming this opposition, 2nd CIB along with the rest of 1st Division, attacking along the corps' left flank, carried out a spectacular assault capturing "all objectives in the first phase…all high ground within the Divisional boundaries."[25] At one point 1st Division was "fighting in four directions simultaneously: east, northeast, north and west."[26] With the help of the British 11th Division, which reinforced exhausted Canadian units after the second phase, the division's objectives were all reached by the end of the day.

By nightfall the Red, Green and Blue Lines had been reached but the second phase objectives, the Canal

Canadians moving forward into attack on Cambrai.



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Above: This air photo of Bourlon and Bourlon Wood was taken on 27 September 1918, the first day of the offensive and looks eastward from behind the Canadian front line. The village of Bourlon has been wrecked by the fighting of 1917-18.

Right: The ruins of Bourlon as they appeared in 1919. In the foreground is the shattered remains of a church while the heights of Bourlon Wood can be seen in the distance.

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Canadian trucks pass through Marquion as they transport shells to the guns, September 1918.

de l'Escaut and the heights near the city of Cambrai, were still held by the Germans, who were not idle. "[T]he enemy had gauged the strength of our advance," in the words of the war diary of the 2nd CIB, "and had found courage…to cling to and reinforce his strong positions on the high ground…and at dusk was assembling in strong force and in excellent positions to dispute our further advance."[27] Thus the Canadian Corps became engaged in vicious fighting as the Germans counterattacked at a number of locations attempting to recapture the ground they had lost. For the next five days, tired Canadian soldiers pushed on towards the heights around Cambrai against well-entrenched German positions, "Enemy machine guns fired at point blank range. A perfect hell of bullets swept about them and yet they went against these wire entanglements and calmly commenced to tear a passage through them."[28] The war diary for 7th CIB reported "Heavy casualties resulted from machine gun fire…Opposition was strong and progress difficult."[29] The tenacity of the Canadian soldiers won out and by 1 October all the objectives designated by Currie were captured.

Currie recalled after the war that "In late September and early October, [the corps] fought the battle of Cambrai, and no position it ever assaulted offered more seemingly insurmountable difficulties."[30] In the five days of fighting from 27 September to 1 October, the Canadians had taken 7,059 prisoners, and 205 guns. They had faced 13 German divisions as well as numerous independent machine gun units. As Currie stated, "We had gone through the last organized system of defences on our front, and our advance constituted a direct threat on the rear of the [German] troops immediately to the north of our left flank, and their withdrawal had now begun."[31] Although the city of Cambrai was still in German hands at the beginning of October, their primary defence lines were over run and it was only a matter of time before an Allied attack on Cambrai was launched. The capture of Cambrai on 11 October marked the end of the successful battle of Arras-Cambrai. For Arthur Currie, in the assessment of historian Shane Schreiber, "the Canal du Nord was his operational masterpiece, the culmination of his education as a general."[32]

The extensive preparation and synchronized actions of the various branches in the Canadian Corps resulted in the stunning tactical victory at the Canal du Nord. The Canadian Corps operated as a semi-autonomous unit within the British Expeditionary Force. Firstly, the Canadian Corps did not ultimately answer to the British Government but to the Canadian Government. The Canadian Corps was represented in London by the Ministry of Overseas Military Forces of Canada, a full-fledged department of the government of Canada. Furthermore, there was a Canadian Section at British General Headquarters that acted as a liaison for the Canadian ministry and the Canadian Corps. Most important, Currie "had both the right and the duty to exercise a de facto veto over what Haig and British Army Commanders could or could not ask the Canadian Corps to do."[33]

This semi-autonomous status allowed the corps to be organized differently from other BEF corps. In 1918 a Canadian division's three brigades still had four infantry battalions each, for a total of 12, whereas the British, because of manpower shortages, had reduced their brigades to three battalions, for a total of only nine in each division. As well, a Canadian division contained an entire engineer brigade consisting of roughly 3,000 men, whereas a British division contained only an engineer battalion of around 700 men. A further significant difference was in firepower. A Canadian division had an average of one automatic weapon for every 13 soldiers, whereas a British division had one automatic weapon for every 61 soldiers.[34]

The Canadian Corps was also stronger in artillery than an average British corps. The corps had gained two extra field artillery brigades in August 1917 from the 5th Canadian

Division organizing in England, which was ultimately disbanded early in 1918 in order to reinforce and strengthen the existing corps, as has been described above. The British urged Canada to field additional divisions, but Currie insisted the strengthening of the existing, proven divisions was a far wiser use of increasingly strained manpower resources than inflating the size of the Canadian Expeditionary Force to a level where it would be forced to trim battalions as the British had done at the expense of fighting power. From the 5th Division the corps also acquired additional heavy trench mortar batteries, for a total of four, one per division, as compared to only one battery per corps in British formations. The fact that the Canadian Corps fought as one homogenous unit, without divisions being shifted from corps to corps as was the case in the British and other armies, led to nearly seamless integration of the four divisional artillery units and those, including the heavy artillery, that were controlled at corps level. In the words of Brigadier A.G.L. McNaughton, one of the corps' senior artillery officers, "During the battle we…organized and fought as a corps, with the result that the whole force of our artillery within range was immediately available to support any sector."[35]

In essence, each Canadian division could act like a small BEF corps and the Canadian Corps could perform at the level of a small BEF army. The heavier firepower and greater manpower available to the Canadian Corps, as well as the numerous ancillary units available at the divisional and corps level, provided Currie with a highly potent and flexible fighting force. With its proven leadership, intense training, and the instinctual cooperation that grew from the stable, closely knit composition of the corps, the Canadians became an elite formation within the BEF.[36]

* * * * *

The crossing of the Canal du Nord would never have succeeded without the engineers. In fact, the extensive and effective use of the engineers in this battle is what marks it as such a unique First World War action. Historian Bill Rawling argues that "the operation became a foreshadowing of the next war, when engineers in many theatres would be hard pressed to keep tanks, artillery and truck borne infantry moving over rivers and rough terrain."[37]

Prior to 1918, engineer units within the Canadian Corps were of the same size and employed in the same manner as those of a British corps. Standard practice was to utilize infantry units in reserve as the manual labour in engineer projects. Often this would mean soldiers fighting a battle one day and performing heavy manual labour the next. What further complicated matters was that the engineers did not have direct control over their labour force, since these soldiers were still under the control of their commanding officer who could remove them from work at any given moment.

Currie's chief engineer, Major-General W.B. Lindsay, felt that the engineers could be expanded and reorganized to provide a more adequate labour force without the complications and hardships inherent in the employment of infantry battalions. He proposed an integration of the loosely connected field, pioneer and tunnelling companies into cohesive engineer brigades designed roughly along the lines of a standard infantry brigade, with a headquarters staff, three battalions and a bridging company. Currie was easily convinced of this plan and the reorganization was complete by July 1918. As Currie stated, "I am of the opinion that much of the success of the Canadian Corps in the final 100 days was due to the fact that they had sufficient engineers to do the engineering work and that in those closing battles we did not employ the infantry in that kind of work. We trained the infantry for fighting and used them only for fighting."[38] The crossing of Canal du Nord showcased the strength and efficiency of this new formation and as Dancocks argues, "No one worked

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Canadian engineers construct a bridge across the Canal du Nord, September 1918.

Supply wagons cross the dry bed of the Canal du Nord as they move supplies to the front, September 1918.

harder for victory on 27 September than the Canadian engineers."[39]

The engineers performed feats at an unheard of rate and scale compared with previous allied action on the Western Front. They repaired 18 miles of road and built seven miles of tramway lines in preparation for the battle. During the attack, the engineers constructed seven infantry bridges spanning the canal as well as ten larger bridges for artillery.[40] Transporting the artillery across the canal was a particularly challenging task as the artillery, in order to make room for the infantry in the severely constricted forward areas, was positioned farther back than usual. Soon after zero hour the guns would have to advance and get across the obstacle of the canal quickly in order to keep the objectives ahead of the infantry within range. The official history of Canada's military engineers records how this was achieved:

> The Chief Engineer's orders provided for a company from every forward C.E. brigade to be assigned to the duty of assisting the artillery to get their field-guns ahead, and a second company to construct foot-bridges for the infantry in accordance with the requirements of the divisional commander concerned. Special parties were assigned to move with the attacking troops to examine the ground for mines. Provision was also made for the other parties to follow immediately behind them to make rapid temporary repairs to cratered roads and damaged canal-crossing facilities.[41]

By 0800 hours on 27 September the first batteries crossed the canal. Specially trained teams constructed two 110-foot steel bridges that were operational by 28 September.

The work of the 3rd Battalion Canadian Engineers (CE), commanded by Lieutenant-Colonel E. Pepler, highlights one of the most complicated operations of the crossing. The 3rd Battalion was assigned the task of constructing most of the infantry and artillery crossings over the canal on 27 September. "C" Company went forward at zero hour with the infantry in order to set up four infantry bridges for the 15th Canadian Infantry Battalion, two light transport bridges and two bridges over the Agache River. Under heavy machine gun and rifle fire the engineer units began construction on the four infantry bridges. After the completion of the first bridge, "Sapper J.E. Wyatt dashed across the bridge, shot one of the [German] machine gunners and captured two others with the same gun."[42] The following three infantry bridges were completed shortly thereafter and the first units of the 15th crossed the canal at 1000 hours. The eastern bank was then cleared of the remaining German troops allowing the engineers to begin construction of the pontoon and trestle bridges.

The material required for these large crossings was located in Inchy and once the infantry had secured the eastern bank of the canal a signal from the forward engineer officer was sent to the rear and the movement of the necessary materials began. The Germans, however, had blown a large crater in a section of the dry canal bed and units were required to repair this 30-foot-deep obstacle prior to the construction of the first artillery crossing:

> Lieut. D. Justice and two sub-sections commenced work and made a road diversion around the crater, over which the field guns passed at 8:50

> am. This party remained all day filling in the crater with material obtained close by and the road was ready for two-way traffic by 5:30pm. Heavy shelling was directed at this point at various times throughout the day, a shell landing in the crater itself. The crossing took practically all the traffic across the Canal throughout the day.[43]

Construction of one of the pontoon bridges was held up by the heavy shell fire and the commanding officer of this particular bridging company was the unit's first casualty. The bridge was completed at 1835 hours and comprised three pontoons and two trestles spanning 60 feet.[44]

Captain C.E. Whyte of "A" Company, 10th Battalion, CE described the construction of another crossing.[45] Whyte split his company into an advanced section and a main section. The advanced party under Lieutenant Duckworth took up their forward positions at 0400 hours on the morning of 27 September carrying picks, shovels, wire cutters, sledgehammers, sand bags, a cross cut saw, a fuze and detonator, and a red flag to signal when a gap in the wire was cut. At 0530 hours the advanced party began removing barbed wire on the road west of the canal. As this occurred, a tank rolled past them through the wire and detonated two mines. The first one exploded under the tail of the tank inflicting little damage, however, the second mine "destroyed the left tractor belt putting it out of commission and completely blocking the gap [where construction was to begin]."[46] The main party came forward and joined the work at 0800 hours, helping clear the area of further mines. Shell fire was intermittent and on two occasions "A" Company's work was "interrupted by machine gun fire. Over 30 enemy were found in dugouts along the embankment and these were taken prisoner."[47] Whyte's "A" Company eventually removed the destroyed tank and completed the crossing by 0930 hours.

Another task assigned to the engineers was escorting field artillery across the canal and into their advanced positions. "Special parties were detailed and allotted to the artillery for this purpose. These parties remained with the guns until they had crossed the canal, and were of material assistance in helping them over the roads that had been destroyed by shell fire."[48] An example of this cooperation can be found in the 3rd Battalion, CE war diary:

> No. 3 sub-section reported to 5th battery…The battery did not move forward until 8:15 am following the low ground north of Inchy. The sappers went ahead of the

Canadian engineers bridge a dry section of Canal du Nord, September 1918. Note the original bridge blown by the Germans in the background. Behind that is a concrete lock on the canal.

> battery and had to make a bridge over a small stream…There was considerable shelling here but the party and the battery crossed safely.[49]

Other tasks for the engineers included road maintenance and consolidation of trenches and dugouts taken from the enemy (1st Battalion, CE), light railway maintenance (6th Battalion, CE), maintenance of water supply to the front (5th Battalion, CE) and construction of forward dugouts, headquarters and billets (4th Battalion, CE). In some instances a battalion carried out several different tasks as in the case of the 12th Battalion, CE whose companies simultaneously escorted artillery units, repaired roads, built a forward headquarters, and swept the village of Bourlon for mines.[50]

The corps' orders for the Canal du Nord assault had underscored that the "success of the whole operation beyond the blue line depends on the speed with which the canal is bridged…this applies particularly to transport carrying bridge material which must be given priority on all roads."[51] In the event, the Germans destroyed every possible crossing during their retreat, increasing the difficulties facing the engineers. They were able to master the challenge in no small part because the organization of the engineer brigades made sufficient, dedicated manpower readily available. For Currie, the Canal du Nord vindicated his decision to create the formidable engineer organization: "The success… was to a large extent due to the exertion and skill displayed by the Canadian Engineers in every branch of their activities, notably in bridge-building and repair of roads."[52]

Another crucial component of victory at the Canal du Nord was the effective use of artillery. During the Hundred Days, over 73,000 tons of Canadian ammunition was expended.[53] As Lieutenant-Colonel McNaughton wrote, "I know of no organisation in the history of the War which was able to produce such a high ratio in shell to troops, nor any in which the price paid for victory was lower in personnel."[54] For much of the first two years of the war, however, the artillery had been used in a preparatory role. Artillery batteries would unleash a heavy bombardment on the enemy trenches attempting to inflict casualties, soften up defensive positions and cut through barbed wire. The infantry would wait until the artillery barrage had lifted and then storm across no man's land preparing to encounter destroyed German positions.

By the summer of 1916, in the Somme campaign the gunners were employing a "creeping barrage" technique. The artillery barrage moved through the enemy's defensive positions according to a strict time schedule. As the artillery barrage "crept" along these positions, the infantry would advance, staying as close to the barrage as possible. "The creeping barrage was a vital innovation in Great War tactics because it represented a decisive shift from 'destructive' fire to 'neutralizing' fire."[55] The intended result was that the German defenders would have

Cambrai as viewed from the Canadian front line, 1 October 1918. Note the dead soldier lying in the foreground.

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no time in between the lifting of the barrage and the infantry advance to rush from their dugouts and man their posts. The infantry would be upon the Germans immediately as the artillery lifted to the next target. "The idea of the barrage is to tie the enemy to the ground, to inflict casualties and to demoralize him and prevent his using his rifles, machine guns, trench mortars, etc., and to screen the advance of our infantry by a wall of bursting shell, and smoke and dust."[56] This result, however, required unheard of levels of precision in artillery fire, and in coordination between the artillery and the infantry, lest shells "fall short" into the infantry they were supposed to screen, or the barrage moved too quickly forward ahead of the infantry, allowing the enemy time to come up from his dugouts after the barrage passed, and fire, unmolested into the on-coming Allied infantry.

The Canadians used a refined application of the creeping barrage with enormous success at the Battle of Vimy Ridge. These tactics, with the infantry "leaning" closely into a screen of fire delivered with precision by the gunners, was standard throughout the Hundred Days. In the case of the Canal du Nord attack, the artillery firing plan allowed ample time for the infantry to make its way over the broken ground and thus keep close to the protective screen of shells: "The initial barrage will fall 200 yards in front of the jumping off line where it will rest for 4 minutes and then make two lifts of 100 yards, 3 minutes each, after which it will advance at the rate of 100 yards in 4 minutes."[57]A Canadian private described his first experience with this type of attack:

> In extended order with few blanks they were following close behind a rolling barrage. The barrage showed up as a wall of smoke so perfect were the shells laid down that there were no gaps and the line was kept as straight as a die, as the saying goes. It showed the artillery at their very best. The movable wall of bursting shells outlined by smoke was a pretty sight to watch.[58]

Currie was faced, however, with unusual difficulties in arranging artillery support for the crossing of the canal. The narrow attack frontage, as we have seen, displaced the artillery farther back than was normal for an attack. Furthermore, the extension of the front once across the canal entailed further challenges, both in moving the guns forward so that the could command the larger area, and accurately positioning the guns to carry out what was a substantially new fire plan for the more distant objectives. To keep pace with the infantry the artillery implemented a relay barrage:

> Of ten brigades supporting the 4th Division, only six fired the barrage up to the first objective, while the other four moved forward. Eight brigades fired the barrage to the second objective, four from their original locations plus the four that had just moved forward. Meanwhile, two brigades joined the latter, and these six then fired the barrage to the third objective.[59]

In essence, the artillery employed an unorthodox method of "leap-frogging" in order to maintain the effectiveness of the creeping barrage and provide cover for the infantry. As Currie explained:

> The provision of an effective Artillery barrage presented considerable difficulty owing to the depth of the attack and its general direction. On the 4th Canadian Division front particularly, the depth to the initial objectives was such that the batteries were compelled to move forward into captured ground and continue firing the barrage from these new positions. Provision was made for the advance of a number of batteries with their Echelons to the Canal line and beyond whilst the attack was in progress.[60]

Covering fire for the infantry was only one of the artillery's tasks. There was also the requirement for "counter battery" fire to destroy, or at least suppress, the enemy's artillery. The Canadian Corps had developed a powerful counter-battery capability since early 1917 under the leadership of Lieutenant-Colonel McNaughton, the counter-battery staff officer. In McNaughton's words, "The primary object of all Counter Battery work is the protection of the infantry from the fire of the hostile artillery. Inflicting casualties on the enemy, breaking their morale or destroying his materials are merely means to an end. Counter Battery Work depends for success on the correct application of sufficient fire."[61]

The key to successful counter-battery operations was the ability of McNaughton's staff to accurately locate enemy batteries prior to the attack, so that at zero hour the heavy guns assigned to the counter battery role could blanket the enemy batteries with fire. Information about the enemy positions was acquired by air observation, reports from reconnaissance parties, captured documents, interrogation of prisoners, and two methods the scientifically minded McNaughton did much to promote and develop, flash spotting and sound ranging. Flash spotting involved the use of several observation posts with surveying equipment that reported the location of flashes when the enemy guns fired; mathematical calculations based on this data could pinpoint the positions of the guns quite accurately in good conditions. Sound ranging used similar techniques, but with the data being supplied by arrays of microphones that gave bearings on the sound of a gun's discharge. As historian Gary Sheffield writes, "The

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Allied leaders meet on the front steps of the Cambrai city hall in October 1918. The group includes Field Marshal Sir Douglas Haig (third from left); Lieutenant-General Sir Julian Byng (fourth from left); and French prime minister Georges Clemenceau (third from right).

evolution of the BEF's artillery, from the unscientific and 'rule of thumb' approach of 1914 to the distinctly scientific and highly accurate gunnery of 1918 was the factor, more than any other, that brought about victory."[62]

Artillery support during the Hundred Days was exceedingly effective, and the operations on 27 September marked a high point in cooperation between the artillery and infantry. Aided by the engineers, the artillery was able to continually push forward maintaining their covering fire for the advancing infantry. "Two guns of the 1st Battery C.F.A. gave the 1st Brigade a good start by moving in front of Inchy-en-Artois and firing point-blank into enemy positions along the canal. Thus aided, the 4th Battalion, having crossed the dry bed with little difficulty, was able to jump ahead to the north-east and capture its assigned portion of the Marquion Line."[63] The Canadian artillery's official history records that "The achievement of that arm in successfully dealing with the unique conditions arising from the unusual depth to which the initial attacks penetrated may be said to have surpassed in sound planning and brilliant execution anything previously accomplished by the Canadian Corps."[64]

McNaughton's counter-battery group performed their most magnificent feat of the war, with "an intense neutralization of hostile battery positions."[65] As the war diary for the Canadian heavy artillery explains, "the batteries of the counter-battery brigades were moved by sections into their positions…where they remained silent until the opening of the barrage. The attack took the enemy completely by surprise and all objectives were gained."[66] Prior to the Canadian assault the Germans had quietly manoeuvred 230 guns into the vicinity of the Bourlon Wood. This potentially devastating concentration of enemy guns withheld its fire in the hope of escaping detection, but 80 percent of the guns were destroyed within the first minutes of the attack. Counter-battery officers had located 113 of these guns prior to the battle and McNaughton's artillery eliminated them.[67] In contrast to the roar of the Canadian guns at zero hour, "the German reply was almost non-existent. This was due to the brilliance of the Canadian counter-battery fire, which was never more effective than in this operation."[68]

Much as the highly effective integration of the engineers and artillery into a combined arms assault contributed to the Canadian Corps' greatest victory on the Western Front, their whole purpose was to facilitate the infantry's advance. By 1918, the Canadian Corps had, drawing on its own experience and that of other British and French formations, organized its infantry into heavily armed small units, capable of rapid manoeuvre and concentration of firepower. The platoon sized assault units featured newer weapons such as light machine guns, bombs, rifle-grenades and light mortars, each served by specialists. Advances by full companies or battalions in line had been abandoned in favour of more flexible assault formations, applied by each platoon in accordance with the conditions it encountered.[69] Full information on the objectives and the resistance expected was provided to all, including the lowest ranking soldiers, so that they would understand their role in the operation, and could intelligently apply the more flexible tactics.

Even with the advancements in weapons and tactics the casualty numbers were staggering. According to Rawling, the Canal du Nord operation equalled Passchendaele in the percentage of lives lost.[70] In three days of operations, from the crossing of the canal to the capture of Bourlon Wood Canadian casualties numbered approximately 2,500. In the entire operation for the Canal du Nord and the heights around Cambrai casualties numbered 13,672. Rawling points out that "Even in the last three months the evolving technology of

war could not drastically reduce casualties."[71] Thus, although the Canal du Nord stands as a remarkable operation in terms of combined-arms tactics and feats of engineering it was also one of the bloodiest Canadian operations of the war. One measure of the intensity of the combat is that eight Victoria Crosses were awarded to members of the Canadian Corps for actions between 27 September and 11 October.

German casualties during the same period are unknown, but it is estimated that the Canadian Corps faced approximately 31 divisions during this period, more than any other Allied corps on the front line.[72] The Canadians captured over 18,000 prisoners, 371 guns and howitzers, and nearly 2,000 machine guns.[73] The crossing of the Canal du Nord made possible the capture of the vital rail centre of Cambrai which in turn led to the ultimate withdrawal of two entire German Army groups and the loss of their last fully developed defence line.

Currie's daring and unorthodox plan was implemented with great success. The tactical doctrine of combined-arms attack integrated with set piece and limited objective battle plans led to a remarkably effective operation.[74] As Schreiber states, "Whereas both Amiens and Vimy were simple frontal attacks, the Canal du Nord incorporated risk and manoeuvre, belying the popular myth that all major BEF attacks on the Western Front were unimaginative and predictable."[75] The narrow crossing of the canal followed by a widening of the front constituted an extremely complicated corps manoeuvre. A further significant aspect of the Canal du Nord was the effective use of engineers who provided the highest possible mobility to both the artillery and infantry. Since the reformation of the engineer corps, there had been no opportunity to employ them at full strength. The crossing of the Canal du Nord provided this opportunity and allowed Currie and his engineers to prove the new organization. These achievements made the crossing of the Canal du Nord an exceptional and historically important action. After the breaching of the Hindenburg line the German army began to fight a series of small rear-guard actions as the bulk of their army continually withdrew in the face of the advancing Allied armies. For the Canadians, the Canal du Nord was the last major offensive, although they were to continually encounter German resistance to the last day of the war.

The Hundred Days campaign must be studied within the context of the evolution of warfare throughout the First World War. Rawling provides an effective framework in order to do this.[76] He divides the war into two phases, the first phase ending at the conclusion of the Somme offensive and the second phase carrying through to the end of the war. The first phase represented a gradual break from traditional military doctrine while the second phase witnessed a synthesis of military thought creating an efficient doctrine incorporating various new technologies and ideas. This phase witnessed a more rapid shift towards modern military concepts including mass use of engineer units, implementation of newer technologies, small unit infantry tactics of fire and movement, combined-arms assault techniques and a return to mobility on the battlefield. The Canal du Nord was a benchmark in all these developments, the precursors of the most successful approaches to combat in the Second World War.

During the Hundred Days, the Canadians spearheaded the most successful Allied offensive of the entire war. They fought through 23 miles of German-held territory, overcame numerous German defences including the formidable Drocourt-Quéant line and the nearly impenetrable Canal du Nord. They liberated 116 square miles of French territory while encountering and defeating numerous German divisions. The Canal du Nord crossing was the apogee of this remarkable Canadian achievement.

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Three wounded but cheery Canadian soldiers grab a bite to eat at an advanced dressing station during the Cambrai battle, October 1918.

Notes

1. See Bill Rawling, *Surviving Trench Warfare: Technology and the Canadian Corps, 1914-1918* (Toronto: University of Toronto Press, 1992.); 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); Tim Cook, *Shock Troops: Canadians Fighting the Great Way, 1917-1918* (Toronto: Viking Canada, 2008).
2. Schreiber, *Shock Army of the British Empire*, p.110.
3. An estimated 45,000 Canadian casualties.
4. Schreiber, *Shock Army of the British Empire*, p.96.
5. Daniel G. Dancocks, *Spearhead to Victory: Canada and the Great* War (Edmonton: Hurtig Publishers, 1987), pp.127-8.
6. Library and Archives Canada [LAC], War Diary, 2nd Canadian Infantry Brigade, October 1918, Mikan no.2005784.
7. Arthur Currie, *Canadian Corps Operations During the Year 1918* (Ottawa: Department of Militia and Defence, 1919), p.55.
8. G.W.L. Nicholson, *Canadian Expeditionary Force: 1914-1919* (Ottawa: Queen's Printer and Controller of Stationery, 1964), p.442.
9. Nicholson, *Canadian Expeditionary Force*, p.443.
10. A.M.J Hyatt, *The Military Career of Sir Arthur Currie* (Michigan: University Microfilms, 1967), p.229.
11. Schreiber, *Shock Army of the British Empire*, p.98.
12. Dancocks, *Spearhead to Victory*, p.132.
13. Currie, *Canadian Corps Operations*, p.57.
14. LAC, War Diary, 12th Canadian Infantry Brigade, October 1918, Mikan no.2005874.
15. Schreiber, *Shock Army of the British Empire*, p.98.
16. Don Farr, *The Silent General, Horne of the First Army: A Biography of Haig's Trusted Great War Comrade-In-Arms* (London: Helion and Company Ltd., 2006); Mark Humphries, ed., *The Selected Papers of Sir Arthur Currie* (Waterloo, ON: LCMSDS Press of Wilfrid Laurier University, 2008).
17. Schreiber, *Shock Army of the British Empire*, p.99.
18. Currie, *Canadian Corps Operations*, p.59.
19. Hyatt, *The Military Career of Sir Arthur Currie*, p.231.
20. Canon Frederick George Scott, *The Great War As I Saw It* (Vancouver: The Clarke and Stuart Co. Limited, 1934), p.309.
21. LAC, War Diary, 12th Canadian Infantry Brigade, October 1918.
22. Ibid.
23. LAC, War Diary, 4th Canadian Division, September 1918, Mikan no.1883120.
24. LAC, War Diary, 2nd Canadian Infantry Brigade, October 1918.
25. LAC, War Diary, 1st Canadian Division, September 1918, Mikan no.2034166.
26. Dancocks, p.141.
27. LAC, War Diary, 2nd Canadian Infantry Brigade, October 1918, Mikan no.2005784.
28. Ibid.
29. LAC, War Diary, 7th Canadian Infantry Brigade, October 1918. Mikan no.2005839
30. Arthur Currie, *The Canadian Corps and its Part in the War*. (Speech given in 1920.), p.7.
31. Currie, *Canadian Corps Operations*, p.58
32. Schreiber, *Shock Army of the British Empire*, p.110.
33. Schreiber, *Shock Army of the British Empire*, p.19.
34. Schreiber gives an excellent comparative analysis between the Canadian Corps and a standard BEF Corps.
35. A.G.L. McNaughton, *The Development of Artillery in the Great War: Counter Battery Work: The Capture of Valenciennes: Machines and the Weapons of War: Trend of Army Organisation With Particular Reference to Recent Engineering Developments* (Ottawa: Queen's Printer and Controller of Stationary, 1933), p.7
36. Schreiber, *Shock Army of the British Empire*, p.140.
37. Rawling, *Surviving Trench Warfare*, p.210.
38. Currie, *Canadian Corps Operations*, p.24.
39. Dancocks, *Spearhead to Victory*, p.145.
40. A.J. Kerry and W.A. McDill, *The History of the Corps of Royal Canadian Engineers: Volume 1- 1749-1939* (Toronto: Thorn Press, 1962), p.284.
41. Ibid., p.191.
42. LAC, War Diary, 1st Brigade Canadian Engineers, October 1918, Mikan no.2004864.
43. LAC, War Diary, 3rd Battalion Canadian Engineers, September 1918, Mikan no.2005994.
44. LAC, War Diary, 1st Brigade Canadian Engineers, October 1918, Mikan no.2004864.
45. LAC, War Diary, 10th Battalion Canadian Engineers, September 1918, Mikan no.2006002.
46. Ibid.
47. Ibid.
48. LAC, War Diary, 1st Brigade Canadian Engineers, October 1918.
49. LAC, War Diary, 3rd Battalion Canadian Engineers, September 1918.
50. LAC, War Diary, 12th Battalion Canadian Engineers, September 1918, Mikan no.2006003.
51. LAC, War Diary, Chief Engineer Canadian Corps, September 1918, Mikan no.2005982.
52. Currie, *Canadian Corps Operations*, p.63.
53. McNaughton, *The Development of Artillery in the Great War*, p.12.
54. Ibid.
55. Paddy Griffith, *Battle Tactics of the Western Front: The British Army's Art of Attack 1916-18* (New Haven: Yale University Press, 1994), p.142.
56. McNaughton, *The Development of Artillery in the Great War*, p.10.
57. LAC, War Diary, 1st Canadian Division, September 1918, Mikan no.2005715.
58. Donald Fraser, *The Journal of Private Fraser: Canadian Expeditionary Force 1914-1918* (Nepean: CEF Books, 1985), p.265.
59. Rawling, *Surviving Trench Warfare*, p.210.
60. Currie, *Canadian Corps Operations*, p.58.
61. McNaughton, *The Development of Artillery in the Great War*, p.14.
62. G.D. Sheffield, "How Even Was the Learning Curve? Reflections on the British and Dominion Armies on the Western Front," contained in Yves Tremblay, ed., *Canadian Military History Since the 17th Century: Proceedings of the Canadian Military History Conference, Ottawa, 5-9 May 2000* (Ottawa: National Defence, 2000), p.126.
63. Nicholson, *Canadian Expeditionary Force*, p.446.
64. G.W.L. Nicholson, *The Gunners of Canada: The History of the Royal Regiment of Canadian Artillery*, Volume 1: *1534-1919* (Toronto: McClelland and Stewart Limited, 1967), p.356.
65. LAC, War Diary, Canadian Corps Heavy Artillery, October 1918, Mikan no.2004789.
66. LAC, War Diary, Canadian Corps Heavy Artillery, September 1918, Mikan no.2004789.
67. Dancocks, *Spearhead to Victory*, p.136.
68. Dancocks, *Spearhead to Victory*, p.136.
69. One example was the worm formation. One soldier would be in the lead and the others would be behind in a curved, linear formation, much like that of a worm moving along the ground.
70. Rawling, *Surviving Trench Warfare*, p.221.
71. Rawling, *Surviving Trench Warfare*, p.215.
72. Rawling argues that the Canadian Corps faced 31 divisions where as Schreiber argues that the Corps actually faced remnants of 68 divisions.
73. Hyatt, *The Military Career of Sir Arthur Currie*, p.234.
74. Eight tanks were also allotted to the Canadian Corps however they proved mechanically unreliable and much too slow to play any significant part in the Canadian advance.
75. Schreiber, *Shock Army of the British Empire*, p.110.
76. Rawling, *Surviving Trench Warfare*, p.221.

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