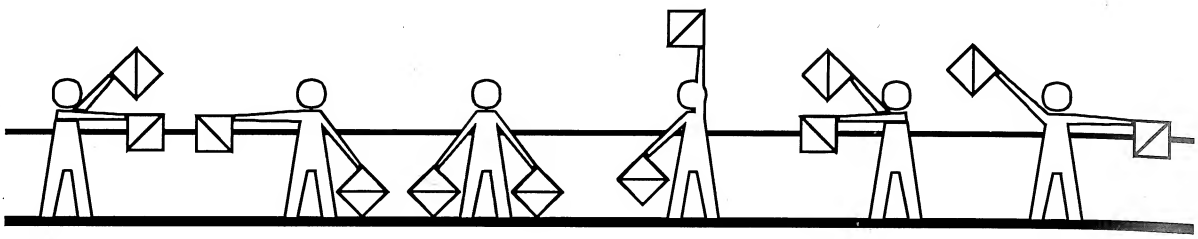
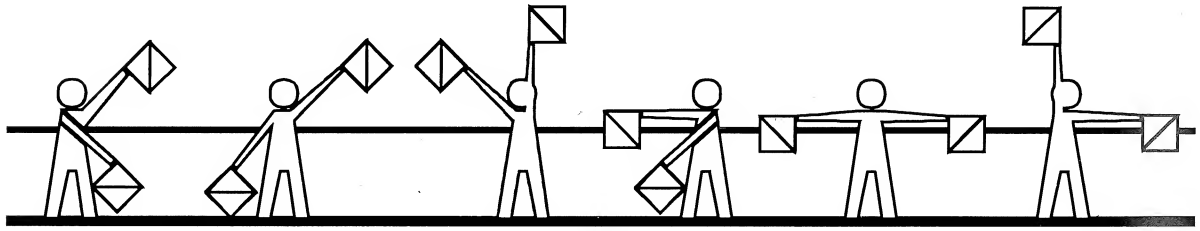


Communications in the Canadian Corps, 1915-1918

Wartime Technological Progress Revisited



Bill Rawling

Warfare has, for millenia, been a rich source of myth and legend, and one of the main reasons many historians proclaim Herodotus to be the first to ply their trade is because, at least, he discounted divine intervention as the prime explanation for the ebb and flow of battle. Myths, however, persist to this day, one of the most popular in our industrialized culture being a common belief that technological development accelerates in wartime. In many cases this might be true; the First World War, for example, saw much innovation (this author hesitates to use the word "progress") in the development of tanks, aircraft, submarines, and chemical warfare. In that same war, however, communications technology did not keep apace, ironic (especially in the British Expeditionary Force) given commanders' insistence that they needed to control their troops if they were to win battles. Though much has been said of the impact of machine guns and quick-firing artillery on the Western Front, another important source of heavy casualties was the lack of communication between the troops in combat and the officers responsible for providing artillery support or sending in reserves;[1] as a result men died in hopeless, unsupported assaults or were overwhelmed by counterattacks after capturing their objectives. Communications were further complicated by the addition of aircraft to the battlefield, with artillery observation and photo reconnaissance adding the war over land to the war on land.[2] Maintaining contact between aircraft and the troops they were supposed to support would be an ongoing challenge.

An indication of the state of the art in 1914 could be found in the the most technologically advanced arm of the British Expeditionary Force - the artillery. Batteries could call on wireless aircraft to correct fall of shot, and in December what had simply been called the wireless unit became 9 Squadron, which supplied aircraft and crews to other units as required, though its pilots did not lead easy lives, as the transmitter they carried was so bulky they could not take an observer. Further, it required so much space in the small observer's cockpit there was no room for a receiver, so the pilot could not be entirely sure his corrections were being monitored. As he had to carry out the observer's duties as well as his own, with no one to keep a look-out for enemy aircraft, it could not have been popular work.[3] Radio-telephony, the transmission of human speech by wireless, had been under development since 1910 but had not moved beyond basic experimentation at the end of 1914.[4]

On the ground signallers tried to sort out the communications problems of trench warfare. In late 1914 and early 1915 the Canadians in England, still waiting to be sent to the front, trained the men who would be responsible for sending and receiving messages, though within battalions means of communication were limited and trainees thus concentrated on flag drill and lamps.[5] Telephones, the most convenient means of communication then available, were the responsibility of brigade and division signalers, who faced an almost impossible task; when laid on the ground, wire was easily destroyed by shelling, and the Germans did not lack for artillery, and stringing it up on poles increased its endurance only slightly, so the only recourse left to the short-handed signallers was to bury it. Finding labour for such a task when infantry units, who normally provided work parties, were busy digging their own trenches and dug-outs was not easy, and a wire shortage made matters worse. By July 1916 cable-laying was quick, but only because an entire battalion worked on the project at any given time,[6] and soldiers digging trenches for telephone lines were subject to shelling and machine gun fire as they worked through the night. Wireless telegraphy, which as its name implies did away with wire, was in the early years of the war available only in small numbers, reflecting limited manufacturing resources.[7]

The limits of communications technology were all too evident when on 22 April and in the days that followed the Canadian Contingent fought its first major battle at Second Ypres, when the Germans attempted a limited offensive using large quantities of poison gas on the Western Front for the first time. As often happened, German artillery quickly cut telephone com-munications and

headquarters knew little of what was happening.[8] One possible means of dispelling confusion was the contact patrol, where an aircraft overflew the front lines to see how the troops were doing, and one of the first was during Second Ypres, when the British lost touch with units at St. Julien and sent aircraft to locate them.[9] There was, as yet, no way for troops on the ground to communicate with the aircraft that sought them out, and the pilots had to rely on their own eyes to pick out friendly from enemy soldiers and determine their condition, so as a technique it left much room for refinement. It was also dangerous, requiring pilots to fly low, within range of small-arms fire.[10]

Heavy reliance on the telephone could thus not be avoided, in spite of its vulnerable cables. Raiders sometimes took the device with them into enemy trenches, with a line crew laying wire through no-man's land. On one raid in mid-November 1915 a small Canadian assault fought its way into German positions, set up a telephone, and sent the message: "in and all going well."[11] Infantrymen also used telephones to keep in touch with supporting artillery. Though the system was far from perfect, troops often complained that "Communication between heavies [artillery] and the trenches is one of our weak points,"[12] as enemy shelling cut lines and prevented them from calling for retaliation.

A possible solution was soon forthcoming—laddering—a technique consisting in laying parallel cables about sixty yards apart connected by lateral lines. To shut down communications, artillery would have to cut both main cables between cross-pieces. The method was not without its disadvantages, calling for more than double the length of cable necessary for a single line, and requiring frequent overhauls, as the great number of connections made for increased resistance, which worsened over time.[13] It was, however, far quicker to prepare than buried line, and served well for short periods of time, such as the consolidation phase after an assault when front-line infantry needed reliable communications with artillery to help defend against German counterattacks.

Complicating the development of battlefield communications (as if the presence of the enemy was not enough) were rules and regulations designed to ensure security, as in mid-1915 the Germans were often well-informed of Allied intentions. "Carefully planned raids were met by hostile fire exactly timed and directed. Relieving troops would be greeted, if not by shells, by shouts of welcome from the opposing trenches. One day a Scottish battalion took over its new front to the strains of its regimental march played upon a German cornet!"[14] Induction, by which a signal travelling along a wire also escaped into the surrounding earth, allowed the Germans to listen in on front-line conversations, from as far away as six hundred yards, through loops of wire set up in no-man's land or even within their own positions. The solution, developed in 1915, was the Fullerphone, a telegraph which seriously diminished induction by way of a sophisticated electronic arrangement.[15] Given its complexity, however, the device was not universally available, and in 1916 signs posted in the front line still proclaimed that anyone giving away information which the Germans could pick up on listening sets would be court-martialled.[16] It had a further disadvantage, being a Morse system, in requiring operators trained in that technique. Thus, in the front line, officers and men were prohibited from discussing important matters over the telephone, nor were they allowed to mention unit identities, names of officers, locations of ammunition stores, and above all, timings for reliefs.[17] The same applied to those developing or working with wireless. One of the first times the device was used in the front trenches was in March 1916, by an officer of the Princess Patricia's Canadian Light Infantry to control indirect machine gun fire. His innovative approach led to his arrest.[18]

Such setbacks proved minor, however, and wireless telegraphy improved through 1915. In September the British attacked near Loos, and though the battle is best known for errors in allocating reserves that eventually led to the replacement of Sir John French by Sir Douglas Haig as Commander-in-Chief of the British Expeditionary Force, it

Canadian Signal Section laying cable during the advance east of Arras, September 1918.
NAC PA 3080

also saw the use of the Sterling wireless set in aircraft. Its transmission range of eight to ten miles was a two-fold improvement over previous sets, and though the plane trailed a 120-foot copper antenna weighted with a lead plumb, this does not seem to have affected performance.[19] The main advantage the new set offered was to allow the observer to retake his place, for by early 1916 he, and not a lone pilot, operated the wireless, though there was still no room for a receiver.[20] The new arrangement greatly eased artillery spotting, and was easy for higher authority to accept as security was not an important factor in calling fall of shot; for the information transmitted to batteries was obsolete before the Germans could make any use of it.

Among ground units on the Western Front, wireless had been part of the Canadian Contingent's communications inventory since its arrival in France, when it had eight sets, but it was not until after Second Ypres that Canadian forward observers on the ground began to use the devices to call fall of shot.[21] Communications could still break down in the heat of battle, however. In June 1916 the Germans attacked and captured Mount Sorrel after a hurricane bombardment. As usual, telephone lines were shot out, while wireless sets in the front lines also became useless as shrapnel simultaneously destroyed aerials and prevented repairs.[22] In the counterattack that followed the Canadians regained the ridge, and within five minutes of taking the final objective the 3rd Battalion managed to get a telephone working and was in contact with its headquarters. Aircraft could pick out the new line by coloured flags some of the troops carried, red for the left brigade and yellow and black for the right.[23] By combining modern technology—aircraft—with centuries-old techniques—flag-waving—the British and Canadians were learning to dissipate some of the fog of war. By the middle of 1916 the trend was obvious; there would be no single

development to link the various elements of the land and air battle. Rather, a wide variety of technologies and techniques would be gathered into an ever-more complex communications network.

The price of keeping such varied channels open was high. Bombardier William Shaw of the 151st Siege Battery remembered, "Signals came to be looked upon as a "suicide club." Fearful yarns of what happened to "flag-wavers" in that and past wars was sufficient to deter most men from volunteering for such hazardous duties . . . Sometimes the laying of line at short notice, to a new observation post at night, over roads, fields, across and along water-logged trenches, through shelled villages and at times in view of enemy flares, was a risky, hazardous adventure. The whole staff of signallers were (sic) often engaged."[24]

Bombardier Shaw was referring to British preparations for the Somme offensive, which opened on 1 July 1916, relying heavily on the telephone, so that headquarters were not easy to move, with runners, lamps, flags, and pigeons completing the system.[25] Communications, however, were not up to the task, and on the first day of the battle the British suffered almost sixty thousand casualties, a third of them fatal. Gunners had been unable to help, even though artillery observation was now the Royal Flying Corps' chief role.[26] Contact patrols did, however, go a long way towards keeping higher headquarters informed of how the troops were doing; that first day only the Fourth Army's XIIIth Corps on the far right made any headway and the aircraft following its progress found they could fly as low as six hundred feet even in the midst of a massive land battle, though pilots might have taken warning from the number of aircraft being brought down by ground fire. The first waves of infantry had mirrors on their backs and the contact aircraft kept in touch with corps headquarters by wireless and message drops.[27] How many mirrors survived the first clash of battle is unknown.

On 30 August the Canadian Corps began to take its place on the Somme front and prepared for the battles to come, which would last until mid-November. Casualties were high, and communications between the headquarters of battalions, brigades, and divisions difficult to maintain. After the offensive petered out the 78th Battalion reported that the Brigade Signals Officer could well have used an extra thirty or forty men, or twice the usual establishment. In general "Every means of communication must be adopted - telephones, visual with lamps and flappers, pigeons and runners,"[28] though experiences differed. The 5th Canadian Mounted Rifles, an infantry battalion in spite of its name, found that telephones worked well but visual signalling was obstructed by smoke and dust (it added that pigeons might have been useful).[29] The 22nd Battalion found its telephones working perfectly and dispensed with visual signalling and pigeons to send messages to higher headquarters.[30] When the Corps managed to advance into the German defences it faced the Herculean task of laying and burying cable to the new front line, though the 4th Canadian Mounted Rifles reported that work parties were up to the task and at no time was it out of touch with brigade headquarters.[31] The 22nd Battalion, attacking at Courcelette on 15 September, was fortunate in having a wireless and crew move up right after the battle; aerials were conspicuous, however, and the set drew enemy artillery fire.[32] Thus the trend towards multiplying the variety of means available to transmit information between higher headquarters continued.

Keeping in touch with the troops who were fighting their way into enemy trenches was a problem that proved almost insoluble. After an attack on 17 November the 5th Brigade reported that its battalions had kept in touch with the front line with visual signals, but such ease of communication was uncommon, and even the formation in question mentioned that it also relied on runners.[33] Forward of battalion headquarters the most common means of sending information was to have men hand-carry messages through shelling and, occasionally, machine gun fire.[34] After two months of fighting on the Somme, commanders simply assumed that runners would be the only way to get messages across no-man's land and

planned accordingly; preparing to assault Regina Trench on 10 November the 11th Brigade ordered its battalion commanders to "send in reports to Battalion headquarters by runners stating their location and giving information as regards the situation."[35] Two years after the war started Canadian battalions still relied on a means of communication made famous at Marathon twenty-four centuries earlier.

Contact patrols were supposed to keep commanders in touch with the situation, but the system was still experimental. The 78th Battalion suggested that "Communication to contact aeroplanes is best maintained by flares,"[36] but such techniques required perfect timing to ensure the signals were lit while the aircraft was in position to see them, and such synchronization was difficult to achieve when men were fighting for their lives. In the absence of flares, aircraft flew low in an attempt to distinguish uniforms, but as we have seen this was a dangerous manoeuvre.[37] Forward troops sometimes carried white sheets, though their effectiveness is unknown.[38] After the offensive the 2nd Canadian Mounted Rifles suggested that "Infantry need more instruction in contact patrol work with aeroplanes,"[39] while the airmen themselves needed more training; in an attack on Regina Trench on 8 October a contact patrol reported that the 1st Division was on its objective, when in fact the formation had made no progress.[40]

In early 1917 Lieutenant-General Sir Julian Byng, commanding the Canadian Corps, learned that his formation had been given the task of capturing Vimy ridge in the Arras offensive, due to take place in April. Aircraft were to play an important role, especially in counter-battery work; for German shellfire had inflicted heavy casualties on the Somme, and Lieutenant-Colonel A.G.L. McNaughton, recently appointed to the newly-created position of counter-battery staff officer, relied on the RFC to augment the information coming from flash spotters and sound ranging. Aircraft spotted enemy guns and relayed information over wireless or in message drops (they also took air photographs),[41] while the counter-battery office had a direct wireless link to the air reconnaissance unit so it could fire on German guns as soon as they were located.[42] While destroying trenches, gunners tried to get one observation aircraft for every one of their six-gun batteries.[43] All-in-all the Royal Flying Corps faced a wide variety of demands as a communications link between gunners and the front line at a time when air operations had become so hazardous the period was later called "Bloody April."

To keep wires off the ground Canadian Signallers use a German rifle as a telephone pole. September 1918. *NAC PA 3100*

On the ground the Canadian Corps sought to maintain communications by exploiting every means available, so runners, flags, pigeons, and telephones abounded. The power buzzer, one of the strangest and hence most intriguing communications developments of the war, was a recent addition to the formation's message network, though the principles guiding its use had been conceived before the turn of the century. In an angry letter to the Royal Society's War Committee soon after the First World War broke out, Glover Lodge claimed to have experimented with earth-tapping as a means of wireless

During a brief rest, Canadian Signallers enjoy a light moment resting beside an old German bunker near Lens, September 1918. *NAC PA 1836*

signalling in 1898 and, fruitlessly, suggested it for use in the Boer War.[44] Certainly, since the Russo-Japanese War of 1904-1905 it had been known that electric impulses could travel through the ground, allowing listening posts to intercept enemy communications. Early in the First World War it had occured to some on both sides that the same principle could be used to transmit messages without using cable; after some disappointing experiments, the British turned to the French, sending Captain Sir Henry Morgan, MP, to France.

In his report of 25 April 1916, Sir Henry explained the main problem the British and French were trying to solve—breakdown in communications between advanced units and their supporting artillery batteries, some two to four thousand yards behind. Telephones, flares, pigeons, whistles, visual signalling, wireless, and cyclists had all been tried with only limited success, but the Captain was impressed with the experiments of Colonel Ferrié, the then well-known head of French military radio-telegraphy. "Indeed I think it

may be said that one series of the[se experiments] shows the problem to be solved, under conditions when it is possible to efficiently earth a long wire at both ends in the most advanced situation."[45] The device weighed only six kilograms and was operated by a single switch to set it for receiving or transmitting. Powered by accumulators (recharchable batteries), however, weighing twelve kilograms, the complete set required three men to carry and operate. Experiments had already shown that it was possible to use a telephone with a fifty-metre gap in the line if the wires were stuck in the ground, but nine months of British experiments had not been able to improve the range significantly. The French device, however, using a fifty-metre cable as base-line at the transmitting end and one to two hundred metres at the receiving end, allowed one-way communication up to four kilometres.[46]

The power buzzer, as the British came to call the device, was not the kind of comprehensive solution that could eliminate alternatives. As Brigadier J.S. Fowler, the director of army signals, reported in June 1916, it could be jammed by the buzzing emanating from telephone buzzers and was easy to pick up on enemy listening sets. Further, the accumulators needed special maintenance and care in handling,[47] for they had a tendency to leak. Finally, as many veterans were wont to point out in articles after the war, "its one outstanding disadvantage was the weight of the batteries required for the forward station."[48] The French power buzzer was, however, the best of its kind, about 250 sets being supplied to the BEF in October 1916,[49] with some of them allocated to the Canadian Corps.

For the assault on Vimy Ridge wireless sets were also available, but only in limited numbers. DeForest vacuum tubes, with which many sets were manufactured, were difficult or impossible to procure as the Americans placed themselves on a war footing and purchased all those available, while Western Electric tubes, the only other source of major supply, were not adaptable to mass production.[50] At least the few sets available in early 1917 were of a more advanced design; for in January continuous wave wireless had made its appearance, relying on a thermionic valve (or vacuum tube as the Americans called it) instead of a spark chrystal. The new device was lighter and more portable, required far shorter aerials, and had a greater range for less power expenditure,[51] while the older version, requiring broad tuning, forced a large number of stations to operate on the same narrow band, where they so interfered with one another as to be ineffective.[52] They were also conspicuous; the Wilson spark set, for example, requiring a sixty-yard aerial twelve feet high for a 4,000-yard range. One of the few wartime communications developments to appear after 1915, continuous wave provided a 6,000-yard range with a thirty-foot antenna requiring only two or three feet of aerial,[53] allowing its use far closer to the front line. First British Army, of which the Canadian Corps was a part, started teaching signallers how to use the new sets, which were reserved for use by field and heavy artillery units, on 1 March, with 40 to 50 Canadians attending.[54] The Germans had nothing comparable, not having been able to develop vacuum technology to the point where it could be applied to field conditions.[55]

On 9 April 35,000 men left tunnels and trenches and made their way towards the crest of Vimy Ridge, their faces whipped with wind and sleet. The 1st Division had little difficulty reaching its objectives, scientific gunnery and sophisticated infantry tactics proving sufficient for the task. General success was reflected in the realm of communications as well, as battalions moved forward and established new headquarters, which relied mainly on telephones. If technology had not changed since the beginning of the war, the way in which it was applied showed greater sophistication, especially in cable laddering, which led Major-General Arthur Currie to report that visual signalling, wireless, and power buzzers were little used because of the telephone's reliability.[56]

The 2nd and 3rd Divisions were about as successful as the 1st. The 3rd Division's 8th Brigade, and probably others, had stored cable near the front so linesmen following

attacking troops could run two lines from each battalion headquarters directly to the final objective.[57] Assuming the assault went well, each brigade planned to set up an advanced report centre, with linesmen running cable up the middle of the brigade's area so battalions could tap into it. They could also send runners to the report centre instead of directing them to make their way back to headquarters, and the centre in turn could use wireless, telephone, power buzzer, pigeons, visual signalling, or its own runners to keep higher headquarters up-to-date.[58]

The 4th Division was an exception to the day's success and was unable to take its objectives. It also demonstrated that reliance on a single trunk line was risky; in the 11th Brigade's sector, communications failed completely and Brigadier Victor Odlum had to go forward himself to see what was going on.[59] There was not always time to ladder the lines as the battle continued for the next three days, and as D.E. Macintyre later wrote: "The trench telephones could be exasperating things at times, although signallers worked like heroes to maintain the lines under shell fire. When a line was hit, both ends would be flung far apart and a signaller would have to go and find the break and mend it. He could follow one end of the wire by letting it run through his hand as he walked, but the other end might be yards away, and he would have to locate and test it, and then make the repair, often as not in darkness."[60]

The main problem, as usual, lay forward of battalion headquarters, and at Vimy Ridge runners once again carried the burden of maintaining communications between companies and their battalions.[61] Contact patrols could at least keep track of the advance and send back information to Corps Headquarters over wireless or, for longer reports, message drops.[62] Thus Lieutenant-General Julian Byng was, ironically, better informed of the troops' progress than his division or brigade commanders. Prior to the attack, infantry on manoeuvres had practiced sending messages to aircraft,[63] the 28th Battalion instructing its forward companies to fire three white Very lights as they captured each objective so headquarters could follow their progress,[64] but there are no reports on whether the flares were ever fired or seen. In some formations platoons were instructed to show disks or panels, as well as flares, at predetermined intervals synchronized with contact patrols. Thus, with Zero-hour being the moment the attack began, the 7th Brigade ordered its troops to signal aircraft at Zero plus twenty-five, Zero plus sixty, Zero plus 130, and Zero plus 160 minutes.[65] The 1st Brigade, on a different part of the front, received orders to set flares at Zero plus fifty minutes, Zero plus 120, and so on.[66] The 28th Battalion had a schedule of contact patrols lasting ten hours.[67]

Aside from simply announcing their positions, advancing battalions also prepared for two-way communications with contact patrols, as aircraft could initiate a dialogue by flashing a code with a white light, or firing a flare.[68] Forward troops could then identify themselves by reflecting light off a sheet to generate a two-letter code in Morse. The 6th Brigade, for example, was identified by the letters "CF." Headquarters identified themselves with a circular ground sheet, a half circle for battalions and three-quarter circle for brigades. Simple letter codes indicated the unit's status or requested help. For example, "N" meant the unit was short of ammunition and "X" that it was held up by machine guns. Thus "CB" space "O" meant that the 2nd Brigade had encountered barbed wire and requested an artillery barrage.[69]

By 14 April the ridge was in Canadian hands, on 28 April the Corps attacked at Arleux, and on 3 May at Fresnoy, the attacks following a similar pattern. Visual signalling was limited by smoke or ground mist while telephones worked as long as the lines remained intact. Laddering was a great help, and the cable to one battalion was cut 37 times before communications ceased. Runners were the system's backbone, on at least one occasion getting artillery to stop shelling its own troops.[70] On the whole, however, communications still left something to be desired. Power buzzers were of dubious value, not only because they required almost perfectly flat ground but due to the weight of the accumulators that powered them, and

Repairing wire in a communication trench, February 1918.
NAC PA 2444

the fact that they tended to leak acid on the unfortunate soldiers that carried them. Sources of interference were legion: disused railway tracks, pipe lines, buried cables or other metallic objects could interfere with transmissions, as could telephones. Further, power buzzers did not eliminate cable entirely, and the transmission station required a base line of 150 to 200 yards of wire, rendering it vulnerable to shell fire.[71] Wireless sets suffered from a similar problem, their weight aggravated by the need to set up conspicuous aerials; and they were powered by accumulators that needed recharging, a logistical problem not entirely solved in the days after Vimy, as the process could only be done at Corps headquarters, and an already complicated and strained transportation network could not always deliver fresh accumulators to forward stations.[72] Pigeons were uncertain, though runners were reliable. Currie suggested that "It would seem advisable to concentrate on telephonic, visual and runner communication, wireless being used as a subsidiary means of communication."[73]

The Canadian Corps would never give up its reliance on a wide variety of signalling techniques, for it was impossible to predict which would be most useful in any upcoming battle.

For example, on 15 August the Canadian Corps assaulted and captured Hill 70, and here wireless played an important role, as the Canadians relied on their gunners to break up the inevitable German counter-attacks. Signallers could send back quick corrections to an artillery exchange, which then passed them on to the battery concerned by telephone.[74] The counter-battery guns could rely on even quicker communications through a direct wireless link with forward ground observers,[75] but infantry battalions continued to rely on the new technology only in emergencies, rather than integrate it into an already complex and diverse system.[76]

Though Edmund Blunden later wrote that wireless was apt to squeal nonsense of its own,[77] some were still intrigued by its

possibilities, even in the mud of Passchendaele, where the Canadian Corps joined the battle on 18 October. Four stations would provide communications between Forward Observation Officers and their heavy artillery batteries. Each wireless party consisted of seven men, who had to carry all their equipment, on one occasion through four and a half miles of mud. Teams worked in 48 hour shifts, under shell fire that forced them to leave their shelter to repair aerials. Relief parties brought in rations and water, fresh batteries, wire for the aerials, vacuum tubes, and at times new wireless sets, which quickly wore out under front-line conditions. One team needed seven sets in 12 days.[78]

Among proponents of wireless communication was the "gadget king," A.G.L. McNaughton who, according to Dr. John S. Moir, "In the thick of the fighting . . . handed a message to signals personnel located in a pillbox. The message was to be sent both by wireless and by carrier pigeon in order to test the speed of these services. Five minutes were required to send it by wireless, less time than it took to get the bird into the air, a definite augure (sic) for the future."[79] When a final assault on 10 November brought Third Ypres, or the Battle of Passchendaele, to an end, work on wireless continued. Though there had been problems during the battle itself, staff officers and commanders came to consider the wireless as part of the Corps' general communications system.[80] Again according to John Moir, the Canadians "were more hospitable to fresh departures in signalling than the Imperial troops,"[81] and toyed with the idea of using wireless extensively to supplement field telephones in the next offensive.[82] In February, 1918, equipment became sufficientlly available to allow divisons to allocate sets to their brigades, while battery-charging was decentralized from corps to division. On 15 June the Canadian Corps opened a wireless school, for using the device was complex, involving actual operation—sending and receiving messages—as well as setting up, maintaining, and repairing the set; thus only men who were already trained in Morse keying and ciphers were accepted as there was too little time to run a full course.[83]

With one campaign over it was time to prepare for the next, for Passchendaele had done little more than extend the British salient arount Ypres and the Germans as yet showed no signs of cracking. As aircraft came to play a more prominent role in operations the British armies sought ways to improve communications between airmen and the infantry or artillery units they supported. Radio telephony was still not available, while flares were not entirely satisfactory as the Germans could use their own to confuse messages and some colours were simply difficult to see.[84] By March 1918 the Canadian Corps was conducting exercises in which aircraft flew over the trenches daily so brigades and battalions could improve their proficiency with Lucas lamps and Popham panels, the latter being strips of cloth similar to Venetian blinds which could be used to flash messages if lighting conditions were appropriate.[85]

Aircraft of a different sort were the subject of several experiments conducted by the Canadian Corps in May and June 1918. Forward of brigade headquarters, which could keep in touch with its flanks and higher formations with telephone or wireless, the most widely-used and effective means of communication remained the runner, who carried hand- or type-written messages through enemy and friendly fire in order to keep commanders appraised of the situation so they could allocate reserves or artillery support accordingly. If it were possible to replace these men with some other means, they could be retained at the front. Further, there might be some way to get messages back much faster than in the hands of a man who often had to take cover, or might become wounded or killed. A possible solution was to use rockets carrying messages as payload, though the first tests were discouraging, as they were not sufficiently accurate and it took so much time to locate them that runners would have been quicker.[86] By June 1918 there was some improvement, the rocket proving capable of carrying a message up to 2,200 yards, but even then the impact of landing, though not affecting the message itself, made it extremely difficult to open the nose cone. Officers of the 7th Canadian Infantry Brigade, who conducted the tests,

concluded that such rockets would be very useful in the hands of trained men,[87] but there was little time to instruct soldiers in their use, and very few of the devices were carried on the battlefields of the last Hundred Days.

On 21 March 1918 the Germans launched one of the most successful offensives of the war, against the British Fifth Army, some distance south of the Canadian Corps' positions. In April they launched another series of attacks against Second Army, this time north of the Canadian front. Given that their sector was relatively quiet the Canadians had the leisure to learn from what was happening elsewhere and train their battalions accordingly, and in early May the 11th Brigade issued instructions to its signalling sections to practice independently and with infantry units. Runners, flags, telephones, Popham panels, and Lucas lamps were the mainstays of Canadian communications, the panels and lamps used to send messages to aircraft.[88] The latter could communicate with artillery batteries and infantry headquarters with the same tried-but-true methods, wireless and message drops respectively.[89] Cooperation between aircraft and ground units had certainly become more complex by 1918. The 1915 manual on air/ground cooperation ran to twenty-seven pages including appendices,[90] while the December 1917 manual on artillery cooperation alone was seventy-four pages long.[91] Aircraft still carried transmitters only; for though years of experiment, mostly in the United States, had produced radio telephones that functioned well in demonstrations they could not be depended on in action,[92] undoubtedly because technicians trained to repair and maintain them were lacking.

The war was about to enter a different phase, where headquarters had to move often in spite of their heavy reliance on the telephone, pushing signallers almost to the breaking point to keep messages moving. On 18 July a French counter-offensive near the Marne brought the last of the German campaigns to a halt, and on 8 August the Allies launched a major offensive near Amiens, the Canadian Corps advancing seven miles on the first day and thirteen miles by the time the campaign ended on the 20th. In one of the first such operations, wireless operators went to Flanders, north of the actual front chosen for the offensive, set up their sets, and maintained a steady flow of dummy traffic to deceive the Germans as to where the offensive would begin.[93] The number of sets and men trained to use them had multiplied dramatically since Passchendaele; each infantry or artillery brigade, as well as the Field Survey Section, and the Canadian Independent Force of machine guns and armoured cars, was provided with wireless, while other sets maintained contact with the French on the right and the Australians on the left.[94]

The tendency to multiply methods of communication, so much in evidence at Vimy Ridge, continued.[95] Telephones, visual signalling, pigeons, message-carrying rockets, power buzzers, wireless, runners, and contact patrols were all available in 1918,[96] though brigades were limited to visual signalling, runners, and mounted orderlies.[97] William Ogilvie, then with the 21st Battery, received orders to act as mounted liaison. "There being no telephone wires laid I was to be the only link between our command party, who were following close on the heels of the advancing infantry, and our guns, now being left far to the rear."[98] A Civil War cavalryman would not have felt out of place. The first day of the offensive at Amiens the 5th Battalion reported that the signals section followed the advancing infantry closely and established its first station soon after the attack, then set up a second station when the advance continued ninety minutes later. On neither occasion, however, could they contact brigade headquarters with lamps. After another few hours the infantry's success forced them to set up another station, but again they could not contact the brigade.[99] A forward observer moving with the 14th Battalion had different luck; he saw the unit held up by machine guns in a wood and reported that "I had perfect communications and perfect observation, but was unable to use Artillery as the Infantry were steadily encircling [the wood]."[100] The copse was captured in a flanking assault.

Maintaining links between the troops and their headquarters was much more difficult than in previous battles not only because battalions moved faster than before but thanks to new Canadian tactics that called for the infantry, with tank support, to move directly to their objectives and bypass strong points. The 4th Tank Battalion, a British unit supporting the 1st Division's assault, reported that runners could not keep up with the advance, but "The Motor Cycle proved to be very useful in keeping up communication and might be more fully employed on similar occasions."[101] After the battle the 10th Battalion suggested each battalion headquarters have a motorcycle for the communications section, for if roads were suitable it would provide far better liaison with brigade headquarters.[102] When the 14th Battalion reached its objectives, it had to commandeer two horses to contact the units on its flanks.[103] Commanders still hoped to impose some semblance of order on the battlefield, and the 3rd Brigade's final report on Amiens included the admonition that, "It is of the most vital importance during operations that Brigade be kept informed at frequent intervals of the progress of the battle, and the successive points gained by each Unit during the advance."[104]

Thanks to wireless, commanders had indeed regained some modicum of control over their formations, but only at higher levels. In much the same way that contact patrols had given Corps Headquarters a better view of the battlefield than was available to division and brigade commanders, the new wireless organization allowed communications between brigades, divisions, and the corps itself, but no lower. Corps sets had to move often to keep in touch with its divisions, which were always moving out of range in the course of the attack, and in the final days of the Amiens offensive wireless networks came under pressure as troops advanced deeper into enemy territory and divisional headquarters found it impossible to lay enough cable to set up telephone systems. Information for counter-battery work came through wireless, with one station at Heavy Artillery Headquarters and three others near the line, but again, as infantry advanced, communications were sometimes interrupted as the forward observers had to pack up their sets and move to a new location. Thus the main lesson learned at Amiens was that units needed two sets each, so one could continue operating while the other moved. A further lesson concerned training, as the number of wireless sets operating in a limited area offered many an opportunity for unintentional jamming, which could only be eliminated by ensuring all operators were thoroughly trained.[105]

Amiens was the first of several battles that slowly moved the Allied front towards the German border, wearing down armies who were already short of material and food after four years of the Royal Navy's blockade. In these offensives, signallers faced a major challenge just keeping up with the infantry, but after Amiens often managed to reestablish telephone links following an attack. To give just one example, the 10th Brigade reported after pushing through the Drocourt-Quéant line in early September: "Under very difficult conditions telephonic communications were maintained, almost continually, within the Battalion, throughout the operation. Too much importance cannot be laid on the necessity of an abundant supply of wire for lines. We had no occasion to use pigeons, but should this contingency have arisen, we would have been very short."[106] In fact, at the end of the war the British Army still operated 150 pigeon lofts on the Western and Italian Fronts, an indication of their perceived importance.[107] At Drocourt-Quéant the 3rd Brigade recounted that visual signalling was too dangerous as German machine gunners on the flanks were able to see and fire upon the signallers handling the lamps, so the formation had to rely on pigeons and runners.[108] Will Bird later wrote that "It was often a joke in the platoons that runners knew more about what was going on than anyone else,"[109] even in 1918.

In the Canadian Corps' last set-piece attack of the war, at Valenciennes on 1 and 2 November, there was no time to lay cable and all messages from brigade to higher headquarters were sent through wireless

stations.[110] Communications between aircraft and troops on the ground, however, had not improved; infantry carried a new system for signalling contact patrols, a white cloth with a metal disk sewn on the inside flap of the respirator which troops waved when called for. The RAF found the devices very useful in determining the infantry's positions,[111] but all-in-all air-ground communications techniques in the last Hundred Days were essentially the same as those of 1917, and remained so until the Armistice was declared on 11 November.

The First World War saw the development and application of aircraft, submarines, and tanks as effective weapons of industrial warfare, while tactics underwent drastic change as fire and movement replaced wave attacks, and artillery, through scientific gunnery, proved ever more capable of supporting infantry battalions as they struggled to survive in one of the most hostile environments our species has ever devised. In the realm of communications, however, the revolutionary developments of previous decades, especially the telephone and wireless telegraph, were only partially applied to solving the information problems of the modern battlefield. As a tactical tool the telegraph had already been supplanted by the telephone before the war began, and the latter would dominate communications organizations on the ground until the war was long over, wireless proving to be an administrative problem even after it was so reduced in size as to allow troops to carry it, for training a wireless operator in Morse keying was far more difficult and time-consuming than teaching a signaller to talk on the 'phone. In the air wireless, available as early as 1914, underwent some technical improvement throughout the war, aimed at reducing its size. There were thus two divergent ways in which communications technology could develop; technically, the telephone changed little from 1914 to 1918, but laddered lines, deep buries, and sophisticated communications networks steadily improved its usefulness, while wireless had to undergo technological change—miniaturization—to fit into air-ground and land operations. Both were attempts to impose order on an essentially disorderly enterprise, and even in tandem they were only partially successful.

NOTES

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