Canadian Military History

Volume 21 | Issue 3 Article 3

2015

“You Have Shut Up the Jerries” Canadian Counter-Battery Work in the Clearing of the Breskens Pocket, October–November 1944

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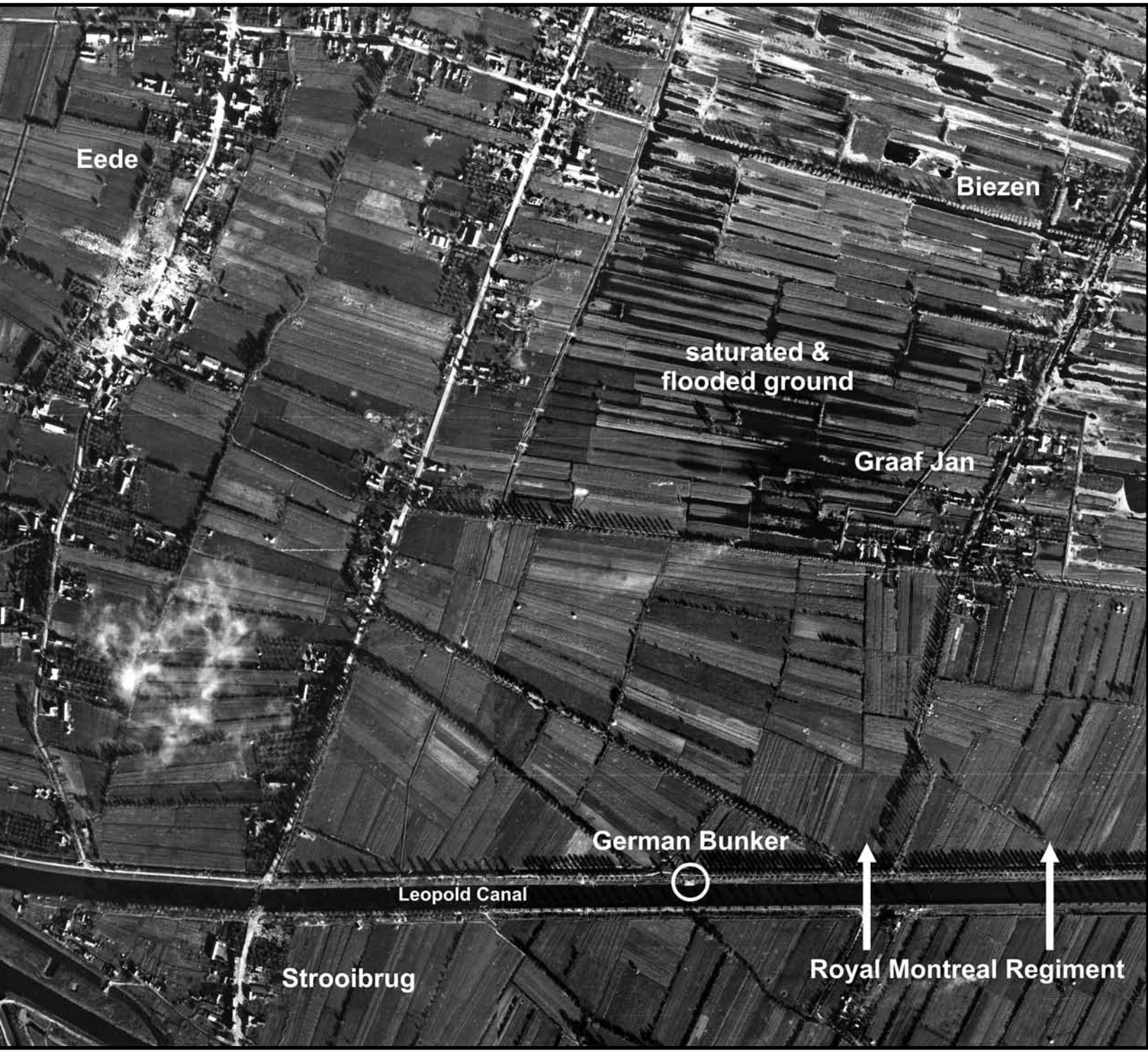
Abstract: This paper examines Canadian counter-battery work during Operation Switchback, the battle to clear the Breskens Pocket, from 6 October to 3 November 1944 during the Battle of the Scheldt. The Canadians achieved some success at isolating hostile batteries in the pocket, but predicted shooting was too inaccurate to permanently silence them. In the planning stage, the Canadians had little knowledge of the Germans' strength and dispositions behind their defences north of the Leopold Canal. Throughout the battle, those involved in locating hostile batteries strove to overcome challenges posed by the weather and terrain. Operational research conducted after the battle revealed that predicted fire dispersed shells over an excessively large area, mostly because of human error. Ultimately, the evidence challenges the idea that the Allies won the Second World War by the "brute force" use of their superior artillery and air assets rather than through skill and ingenuity.

On 4 September 1944 British troops, with the help of the Belgian resistance, captured the port of Antwerp intact. It was one of the largest and most important ports in Western Europe, but it lay at the end of the Scheldt Estuary whose 50-kilometre length was controlled by the Germans. It was essential that the port be opened to shipping as quickly as possible since the Allies were facing a logistical crisis. Most supplies still came over the original D-Day beaches and had to be trucked to the front, a distance of nearly 500 kilometres. The use of a large port was critical to the success of future operations.

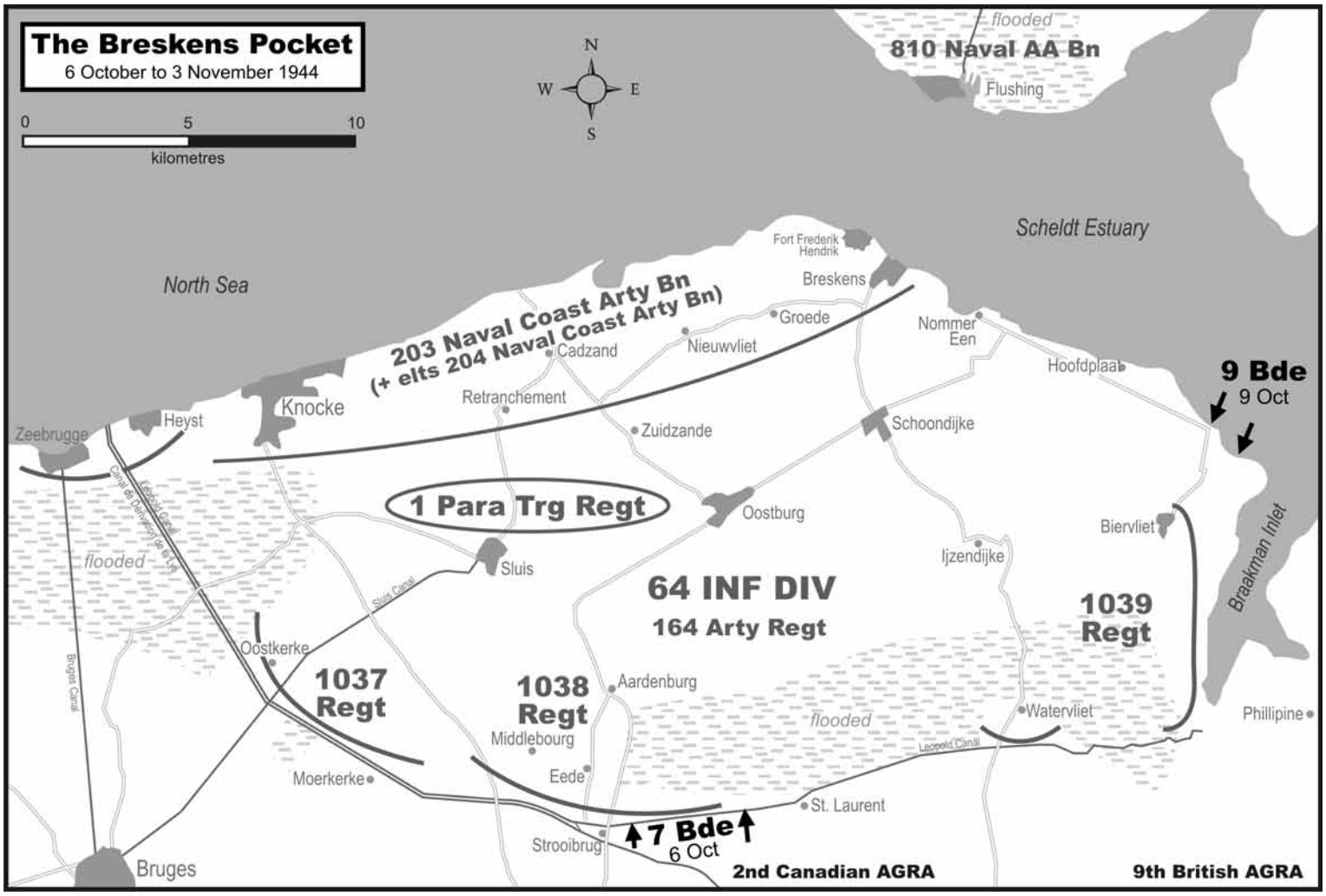
From 13 September, while the British prepared for a narrow armoured and airborne thrust through the Netherlands (Operation Market Garden), First Canadian Army's task was to clear the Scheldt Estuary. Operation Switchback was the battle to capture the "Breskens Pocket," a virtual island bordered by the Scheldt River, the Leopold Canal, the Braakman Inlet, and the North Sea. About 33 kilometres east to west and 18 kilometres north to south, the pocket was mostly below sea level. The terrain was not conducive to mobile warfare. The only high ground was found southeast of Knocke, as well as some sand dunes on the south shore of the Scheldt. Worse, a German flooding programme presented serious obstacles. In addition to an inundated section in the west, a wide flooded band in the south ran almost to the Braakman, leaving only an eight-kilometre stretch of traversable land along the Leopold. The flooded areas were under anywhere from several inches to four or five feet of water. The soil had turned to mud, making the area impassable to vehicles.[1]

Histories of the battle have usually offered a brief chronology of events without providing much detail into the Canadians' preparations or the battle's aftermath. For decades, the definitive account of Canadian operations in Northwest Europe has been C.P. Stacey's official army history *The Victory Campaign*. In his treatment of the Scheldt battle, Stacey emphasized strategic issues, and, in particular, criticized Montgomery's failure to give the opening of Antwerp sufficient attention.[2] Subsequent studies of the Battle of the Scheldt tended to focus on Operation Infatuate, the capture of Walcheren Island on the north shore of the Scheldt Estuary. In the three decades following the war, the historiography of the clearing of the Breskens Pocket hardly went beyond Stacey's official history.[3]

Stacey credited the Canadians' victory, at least in part, to their generous artillery support and the infantry's ability to call in concentrations of fire quickly and readily.[4] This view is consistent with John Ellis' observation in his book *Brute Force* that the Allies had an overwhelming advantage over Germany and Japan in economic capacity, which translated into numerical superiority in artillery, armour, aircraft and ships. Yet according to Ellis, instead of using



This air photo was taken on 6 October 1944, the first day of the 7th Canadian Infantry Brigade attack across the Leopold Canal. It shows the sector assaulted by the Royal Montreal Regiment and the Regina Rifles. The effects of Canadian defensive artillery fire is evident, especially in Eede. The flooded ground north of the canal which affected movement is also visible. Laurier Centre for Military Strategic and Disarmament Studies Air Photo Collection 196/3047 & 3049



Map drawn by Mike Bechthold ©2012

these assets to achieve a quick and decisive victory, commanders of the Western Allies, anxious to avoid heavy loss of life, "seemed unable to impose their will upon the enemy except by slowly and persistently battering him to death with a blunt instrument."[5] This "brute force" thesis was largely based on generalizations and oversimplifications, not a detailed analysis of operational documents. Stacey's contention that the Canadians owed their victory at the Scheldt to the infantry's ability to request immediate artillery fire on prearranged targets was not seriously contested until the appearance of Terry Copp's *Montgomery's Scientists*. This edited collection, which reproduced a series of operational research reports written during the war, showed that Canadian shells were dispersed over large areas, which indicated that predicted artillery fire was not nearly as accurate as previously thought.[6]

This article examines the application of predicted fire techniques – counter-battery (CB) work – during Operation Switchback. It builds on Copp's books and challenges Ellis' thesis in *Brute Force*. The clearing of the Breskens Pocket was not a return to the voluminous barrages of the First World War. Switchback was an example of the Allies' use of artillery in a precise and economical fashion. The artillery plan for the operation was not designed to blanket the enemy with fire, but to engage specific targets when needed. The Allies' employment of sophisticated CB techniques, and the creation of an efficient communications system necessary for these techniques, suggests that artillery in Switchback was anything but a "blunt instrument." The methods used to identify and locate hostile batteries were effective, as long as atmospheric conditions and the terrain cooperated. That was very rarely the case during the battle. While the Canadians were mostly successful in identifying and locating hostile batteries in the Breskens Pocket, predicted fire was seldom accurate enough to permanently destroy them. Nevertheless, the fire was close enough that it often suppressed the enemy batteries during crucial periods in the battle.

The Plan for Operation Switchback

The plan for Operation Switchback made CB work difficult. While the plan was ambitious, imaginative and allowed for large-

scale artillery support, intelligence greatly underestimated the German strength in the Breskens Pocket, and the terrain offered little hope of gathering further intelligence through observation. Because the plan demanded surprise, it eliminated any preliminary counter-bombardment. With limited knowledge of the German gun positions, the Canadian counter-battery staff and associated units faced a challenging task.

Directing the battle was Lieutenant-General G.G. Simonds, who was temporarily in command of First Canadian Army while Lieutenant-General H.D.G. Crerar was in the United Kingdom undergoing medical treatment. In the meantime, Major-General Charles Foulkes took Simonds' place commanding II Canadian Corps. On 2 October Foulkes filed his outline for Operation Switchback, which was largely based on an earlier version devised by Simonds.[7] The objective was twofold: to capture the Breskens Pocket and clear the German coast artillery dominating the Scheldt, and to provide suitable areas for Allied artillery positions to support follow-on operations against the strongly-held Walcheren Island. The task of clearing the pocket fell to 3rd Canadian Infantry Division under Major-General D.C. Spry.

The innovative operation used two spearheads to take advantage of German weaknesses. First, on 6 October, Brigadier J.G. Spragge's 7th Canadian Infantry Brigade would attack a dry section of the German defensive line north of Leopold Canal where it diverged from the Canal de Dérivation de la Lys. The 7th Brigade would be followed later by Brigadier K.G. Blackader's 8th Canadian Infantry Brigade. The second phase of the plan called for Brigadier J.M. Rockingham's 9th Canadian Infantry Brigade to cross the Braakman in amphibious Landing Vehicles, Tracked (LVTs, or "Buffaloes"), and land in a relatively undefended area near Hoofdplaat on 8 October. This would force the Germans to fight on two fronts and cut their escape routes at Breskens and Hoofdplaat. Once the two bridgeheads were linked, the Canadians would advance westward to the coastal town of Knocke to clear the rest of the pocket.[8]

For a one-division operation, the plan for Operation Switchback provided very generous artillery support. The artillery formations allotted to the operation included 2nd Canadian Army Group, Royal Artillery (AGRA) (two heavy and four medium regiments) on the left and 9th British AGRA (one super heavy, two heavy, and four medium regiments) on the right, plus the field artillery from 3rd and 4th Canadian Divisions. Throughout the operation, the medium regiments, totalling 128 guns, would conduct most of the CB fire while the field regiments would provide direct support of the attacking infantry.[9]

The element of surprise was critical for the success of Operation Switchback. Simonds' plan called for a "silent" policy for the days before the attack; there was to be no preliminary CB fire or even any registration shoots.[10] The only bombardment allowed prior to the attack was from 4th Division's field guns, which were to continue harassing fire to the east of 7th Brigade's crossing point as a diversion until H-Hour, set for 0530 hours on 6 October. A one-hour bombardment was to begin at H minus 120 minutes. From H minus 55 to H minus 25 minutes, a short CB programme would engage fixed batteries. Finally, another bombardment programme would run until H plus 150 minutes, after which the infantry would call in fire as needed. At H-Hour, the CB policy would be "active" – as soon as a hostile battery opened fire, it was to be engaged immediately. For the whole day, the counter-battery officer (CBO) had priority call on all heavy guns and two medium regiments. Twenty rounds per field gun, 50 per medium gun, and 50 per heavy gun were allocated to CB tasks.[11]

Because there would be no preliminary bombardment aside from the timed programme, it was imperative to use observation to locate enemy artillery, mortars and machine guns. The 4th Division was

Anglo-Canadian Artillery Assets, Operation Switchback, 6 October 1944

Formation	Field Guns	Medium Guns		Heavy Guns		Super Heavy Guns		Total
	25-pdr	4.5-inch	5.5-inch	7.2-inch	155mm	8-inch	240 mm	
3 Cdn Inf Div	72							**72**
4 Cdn Armd Div	72							**72**
2 Cdn AGRA		16	48	16	8			**88**
9 AGRA			64	16	12	1	2	**95**
Total	**144**	**16**	**112**	**32**	**20**	**1**	**2**	**327**

Source: WD, HQ 2 Cdn AGRA, October 1944: app. 1, RCA 2 Cdn Corps Op Instr No. 8, 5 October 1944, p.1.

Library and Archives Canada PA 112364

A 5.5-inch gun of the Royal Canadian Artillery in action south of Vaucelles, France, 23 July 1944. This medium gun was the standard artillery piece used for counter-battery fire during Operation Switchback.

tasked with establishing observation posts along the whole Leopold front.[12] Nos.660 and 661 Air Observation Post (AOP) squadrons, Royal Air Force (RAF) were available for observation, with individual flights assigned to specified zones of responsibility.[13]

Counter-Battery Work in 1944

The 2nd Counter Battery Officer's Staff was vital in the priority task of engaging hostile batteries. The CB staff sought to provide information about the location, strength, arcs of fire and behaviour of the enemy artillery and to use that information to silence, or at least suppress, hostile batteries.[14] Some of the techniques to emerge from the First World War for locating hostile batteries continued to be used during the Second, including flash spotting, air observation, sound ranging, espionage, and intelligence from locals and prisoners.[15]

The British had adjusted artillery organization and field communications early in the Second World War to apply scientific methods in identifying and locating enemy batteries. The CBO was attached to corps headquarters and responsible to the commander, corps Royal Artillery (CCRA). His role was to compile and disseminate intelligence summaries of hostile batteries to divisional headquarters and artillery units. The CBO was not a commander, but an adviser to the CCRA on CB policy and communications requirements.[16] During Switchback, the CBO of II Canadian Corps was Lieutenant-Colonel J.H.D. Ross. He had his own staff of about 30 men, including staff officers and their clerks, and a number of batmen, drivers and orderlies.[17] Acting CBOs (ACBOs), usually captains, were assigned to each division and were responsible for the technical work, such as analyzing shell craters and shell fragments, examining photographs, ordering bombardments for divisional frontages, and contributing material for intelligence summaries and hostile battery lists. A special ACBO (Air) was responsible for liaison with the Army Photographic Interpretation Section and assisted the Air Liaison Officer in briefing pilots for artillery reconnaissance.[18] CB intelligence summaries contained a review of CB operations and newly identified hostile batteries. These were normally filed and distributed at least weekly,[19] but Ross and his staff did so almost daily during active operations. These summaries are essential for understanding CB work during the Battle of the Scheldt.

The bulk of CB intelligence came from the corps' survey regiment, in this case 2nd Survey Regiment, RCA. It consisted of two batteries, each composed of an observation troop for flash spotting, a sound ranging troop, and a survey troop. This structure was well-suited to work under corps or to be assigned temporarily to divisions.[20]

The British and Canadians entrusted much of their CB work to sound ranging. The purpose of sound ranging was to locate hostile batteries where visual methods could not by tracing the sound made by

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a firing gun or an exploding shell. The technique took advantage of the relatively slow speed of sound, 1107.6 feet per second in still air at 50 degrees Fahrenheit and 50 percent relative humidity. Recorders could measure to within 1/300 of a second, during which sound travels just over a metre.[21] The principle on which sound ranging rested assumed that if sound travels at the same velocity in all directions, it will travel at the same speed between its source and any two points that are equidistant from it (i.e. if the source is actually midway between the two points). But if the source – the firing gun – happened to be closer to one point, then the sound would reach it sooner than the other point. Thus, using microphones at a set distance apart, surveyors could determine the location of the enemy gun by calculating the discrepancy between the times at which the same sound reached two different points. In 1944, surveyors used five or six microphones spaced 1,000 or 2,000 metres apart in a straight line or a concave curve in front of enemy territory to create the sound ranging base.[22] This technique was the most common method used in the Breskens Pocket to identify active German batteries.

Of course, sound ranging was never straightforward because atmospheric conditions greatly affect the transmission of sound waves. While humidity has little influence on sound, temperature does: for every degree Fahrenheit above 50, sound travels one foot per second faster, and the opposite for every degree below 50. More importantly, wind has a significant effect on the speed of sound, as sound waves travel faster downwind of the source. Moreover, when the wind travels faster along the ground than it does higher in the atmosphere, it tends to direct sound upwards, making sound increasingly inaudible on the ground as it travels away from its source.[23] Terrain is also important as audibility can be poor in valleys. Heavy bombardments made it difficult to isolate discharges from particular batteries.[24] In ideal conditions, the probable error in locating a hostile battery at a range of 1,000 yards by sound ranging alone was at least 100 yards with 1944 methods.[25]

Nevertheless, sound ranging had several advantages over other CB techniques. It was quick and could provide more information on the type of hostile battery than any other survey method. It required only a single shot to identify and locate a hostile battery, and it had a particular advantage over visual methods such as flash spotting whose effectiveness was limited by modern flashless propellants and concealment measures.[26]

The lack of natural observation points produced by the flat terrain of western Belgium and the Netherlands certainly favoured the defence and made CB work for Switchback challenging. Until a tall structure could be captured, the Canadians

A 5.5-inch gun firing in support of the Canadians.

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A German pillbox mounting a 105 mm gun in an armoured turret. This position was not destroyed by counter-battery fire and remained in action until captured by the Canadian Scottish and North Nova Scotia Highlanders near the end of the battle.

had no "vantage points from which artillery officers could observe and direct the fire of the guns."[27] A further problem was that the German batteries had been rather inactive in late September when 4th Division had held the area south of the Leopold Canal, and few hostile batteries had been identified and located before 3rd Division's arrival.[28] By 5 October, 2nd Survey Regiment managed to establish two sound ranging and two flash spotting observation posts, the latter upon towers built by engineers. This preliminary CB work achieved some immediate results: on 5 October alone, the Canadians identified 29 active hostile batteries. All but three, however, were "unfixed," which meant that their positions were not known with sufficient accuracy to warrant bombardment without further investigation.[29] The CB staff and the survey regiment would have to work quickly to fix the rest of the German batteries as soon as possible during the early days of the battle.

German Dispositions in the Breskens Pocket

Although the Canadians had a clear idea of the German defences and the nature of the terrain immediately across the Leopold Canal, the plan for Switchback suffered from insufficient knowledge of enemy strength and dispositions in the pocket. In September, intelligence predicted and then confirmed that the Germans might take advantage of the Canadians' inability to use tanks in the area by holding the south bank of the West Scheldt for as long as possible. They had no intention of falling back from the Leopold, determined to keep their own guns on the south bank of the West Scheldt to hold the approaches to Antwerp.[30]

By about 20 September 1944, 100,000 men of the German Fifteenth Army and thousands of vehicles and artillery pieces had been evacuated across the West Scheldt, leaving 64th Infantry Division and some attached units to defend "Scheldt Fortress South."[31] While Allied intelligence of 64th Division's forward positions was very good, there was no reliable information on its reserves or its total strength in men or equipment. According to Copp, Ultra (intelligence derived from decrypted German signals) "provided little assistance when it came to questions of enemy strengths and dispositions, so much depended on photo reconnaissance and patrol reports."[32] On 5 October, the day before the attack, II Canadian Corps' counter-battery staff had catalogued some 68 medium and

heavy artillery pieces in the pocket.[33] Very little was known of the Germans' coastal artillery positions, and in any case most of the German artillery was thought to be in the second line of defence just behind the Leopold.[34] The garrison's strength in men was estimated at no higher than 7,000 men, only 2,000 of which were thought to be infantry. "There have been no indications that the enemy has undisclosed reserves of any considerable strength in layback positions behind his present line," according to an intelligence summary from 7 October.[35] The 64th Division was comprised of the 1037th, 1038th and 1039th Grenadier Regiments. In the days preceding the attack, intelligence placed 1039th Regiment on the enemy's left flank, 1038th in the centre of the line, and 1037th furthest to the west. The central and eastern sectors of 64th Division's front were believed to be reinforced with 500 men of 129th Anti-Aircraft Regiment, equipped with 88 mm guns.[36]

German Artillery Assets, Operation Switchback, 30 September 1944

Weapon Type	Calibre	Quantity	Total
Mortar	8.1 cm	38	39
	12 cm	1	
Antiaircraft	20 mm	8	65
	Quadruple 20 mm	8	
	French 25 mm	6	
	37 mm	15	
	Twin 37 mm	3	
	40 mm	2	
	88 mm	23	
Antitank	3.7 cm	9	13
	5.7 cm	6	
Gun	7.5 cm	31	37
	Czech 83.5 mm	5	
	15 cm	1	
Howitzer	Czech 80 mm	1	48
	10.5 cm	20	
	15 cm	21	
	Soviet (calibre unknown)	6	
Total	**202**		

Source: A.G. Steiger, AHQ Report No.69, 30 July 1954, par. 205 and note.

The German position in the Breskens Pocket was stronger than the Allies realized. Generalmajor Knut Eberding's 64th Division had been selected to hold Scheldt Fortress South because, of all the divisions in Fifteenth Army, it was the strongest in equipment and skilled men, especially compared to those divisions that had seen action in Normandy. It had a full complement of artillery, including 203rd Naval Coast Artillery Battalion and elements of the 204th, as well as ample ammunition and supplies.[37] On Walcheren, in positions that could fire into the Breskens Pocket, was the 810th Naval Anti-Aircraft Battalion at Flushing and, elsewhere on the island, the 202nd Naval Coast Artillery Battalion. Historical narratives written during and shortly after the war placed the German strength in the pocket on 6 October 1944 as high as 15,000 men.[38] From German sources, the actual number of German troops left in the Breskens Pocket was about 11,000 following the exodus of most of Fifteenth Army across the Scheldt. Excluding anti-aircraft and anti-tank guns, the garrison had anywhere from 65 to 73 guns of 75 mm or larger.[39] This was a substantially stronger force than the Canadians estimated.

The Attack

Artillery activity during the battle can be divided into three distinct phases. The first, from 6 to 14 October, saw extremely heavy bombardment from both sides while the Canadian infantry made little progress. During the period from 15 to 20 October, the slow infantry progress continued but the German guns were very quiet. This limited the CB work that could contribute to the Canadian advance. CB intelligence gathering, particularly by visual techniques, was again compromised by poor weather in the last stage of the battle, from 21 October to 3 November.

During the first days of Operation Switchback the Canadian infantry struggled to establish a bridgehead on the north side of the Leopold Canal. The fire plan opened at 0330 hours on 6 October, two hours before the infantry assault. The programme went according to plan, except at about 0420 hours when heavy German shells hit the headquarters of 13th Field Regiment near Zeebrugge, "which provided an early reveille for many people and turned one vehicle into a reasonable replica of a sieve."[40] Such occurrences were quite rare throughout the operation; the Germans never mounted concerted CB efforts and preferred instead to shell the infantry bridgeheads. Canadian artillery units seldom

reported enemy shells landing in their lines. During the short CB programme before the attack, the Allies engaged 29 fixed batteries at a ratio of 14 guns per hostile battery.[41]

At 0530 hours, the infantry of Spragge's 7th Canadian Infantry Brigade attacked across the Leopold supported by flame-throwing "Wasp" armoured vehicles. On the right, 1st Battalion, Canadian Scottish Regiment secured a small bridgehead at Oosthoek and Moershoofd, while the Regina Rifle Regiment (with the Royal Montreal Regiment replacing its "B" Company on the left) struggled to establish a foothold across from Moerhuizen.[42] Resistance was stiff: there were simply more troops opposite the canal than expected, including substantial reserves. A company of 1st Parachute Replacement and Training Regiment had come from Sluis to reinforce 1038th Grenadier Regiment's sector.[43] As the morning progressed, there was also much more German shelling than expected. The war diarist of 23rd Field Regiment (Self-Propelled), RCA wrote, "apparently the Germans have a lot more stuff over there than we had thought. He has concealed his strength very cleverly."[44] It was already becoming apparent that the Canadians had underestimated the German defences.

Lieutenant-Colonel Ross considered the pre-zero hour CB programme a success because the German guns had remained quiet for the early morning. However, he made it clear in his intelligence summary for 6 October that determining the effectiveness of CB fire during an operation was almost impossible; most of the hostile batteries identified had just been holes in the ground from which German guns fired. Limited visibility meant that the AOP squadrons could identify only some of the enemy's gun positions. Hence, by the afternoon, German guns were able to fire on the attacking infantry with impunity. At the very least, with so much enemy shelling, the CB staff had more information with which to locate German batteries: on the first day of the operation, twelve new batteries were fixed, mostly by AOP, and five additional batteries were identified by sound ranging.[45]

The Canadians held onto their tenuous bridgeheads in the face of continued strong resistance. On 7 October, most of the enemy shelling came from field and medium guns located close to the Germans' forward defences at the Leopold. That day the CB staff identified 17 hostile batteries

Shells land in Breskens, 22 October 1944.

Library and Archives Canada PA 138437

by sound ranging, and another six by flash spotting. All batteries that had been fixed were engaged as soon as they fired, and sometimes the Canadians tried to engage an unfixed battery "for lack of a better target." The 3rd Medium Regiment, RCA and 3rd Super Heavy Regiment, RA each engaged one battery near Cadzand to the west and were reportedly successful.[46] The next day, 8 October, saw only light, but continuous, enemy shelling. Thus far, artillery support seemed to be effective. Headquarters, 2nd Canadian AGRA commended 4th Medium Regiment, RCA in a message stating that the "Infantry is well pleased with Harassing Fire – very good. You have shut up the Jerries. The Infantry can rest a bit now."[47] The message was premature, however, as enemy fire intensified in the evening. The survey regiment identified 13 active German batteries on 8 October, the majority by sound ranging. Much of the enemy fire came from the Cadzand area.[48] That evening, from its position at Maldegem, 3rd Medium Regiment engaged a battery of four 9-inch guns on the south shore of the Scheldt from 2030 hours to midnight.[49] The 7th Medium Regiment, RCA also engaged and silenced two hostile batteries using air observation, but was then ordered to proceed north of Antwerp the next day to support 2nd Canadian Infantry Division.[50]

The pressure on the 7th Brigade bridgeheads was supposed to have been eased by 9th Brigade's assault from Terneuzen scheduled to begin at 0130 hours on 8 October, but at the last minute that attack had to be delayed by 24 hours. The 9th Brigade troops were transported in LVTs, and approached, out of sight of the enemy, in the Ghent–Terneuzen Canal. The vehicles could not climb up at the damaged locks at Terneuzen, however, and engineers had to construct ramps.[51] The men on the Leopold front had to withstand the full force of German counterattacks for another day. In the early hours of 9 October, with no preliminary counter-bombardment, the North Nova Scotia Highlanders landed at Green Beach east of Hoofdplaat and the Highland Light Infantry of Canada landed at Amber Beach immediately to the south. The infantry met no German resistance. The reserve battalion, the Stormont, Dundas and Glengarry Highlanders, landed later in the morning. Ross sent a detachment along with the brigade to coordinate CB work on the new front. By 0900 hours, the Canadians had created a bridgehead some 1,500 yards deep pushing westward beyond the main dykes. Alarmed, the Germans responded with intense artillery fire from the heavy guns at Breskens and Flushing, "a visitation which made movement by our vehicles a somewhat precarious duty."[52]

On the morning of 9 October, while Rockingham's 9th Brigade was busy consolidating its bridgehead near Hoofdplaat, Ross met with Brigadier E.R. Suttie (Commander, 2nd Canadian AGRA), both of whom were headquartered at Eelvelde, near Maldegem. Ross needed to discuss some problems with counter-bombardment. Enemy artillery activity on the Leopold had increased dramatically overnight, and the Canadian countermeasures were not having much effect. Only 25 rounds had been allotted to medium and heavy guns per day for CB tasks, which was only enough to engage hostile batteries known to be active and not enough to destroy them outright or to suppress positions that were only suspect. Suttie discussed the matter with Brigadier A.B. Matthews (CCRA, II Canadian Corps), also at Eelvelde, and later that morning Ross received word that the ammunition allotment to CB tasks had been increased to 50 and 35 rounds for medium and heavy guns per day, respectively.[53]

Even though the Canadians increased their ammunition expenditure, it was becoming clear by the 10th that their countermeasures were frustratingly ineffective. Ross noted that the Canadians had achieved at least some success the day before as the German forward batteries either were temporarily silenced or were never heard from again.[54] But the Germans had already begun to bring their reserves forward, as three companies of 1st Parachute Replacement and Training Regiment had relieved 1038th Grenadier Regiment by the previous night.[55] More German batteries were active than ever. Furthermore, the coastal batteries, including two batteries at Cadzand that were causing the most trouble, could not be engaged as effectively because the 5.5- and 4.5-inch gun-howitzers had maximum ranges of about 15,840 and 19,360 yards, respectively. The greater the distance from the target, the more diffuse the Canadian concentrations became. The Canadian weapons were no match for the German 150 mm coastal guns firing from Walcheren, which could hurl shells some 24,000 to 26,800 yards.[56] Thus there was very little the Canadians could do about the coastal batteries until the front line moved forward.

From 10 October, the Germans shifted their artillery efforts to repelling 9th Brigade's assault, which gave 7th Brigade some respite. The incessant German counterattacks on the Braakman front translated into constant requests for defensive fire, which helped to halt attacks. However, batteries around Breskens and Flushing relentlessly pummelled 9th Brigade. The Canadians were very busy with CB fire throughout the day, firing 33 predicted concentrations, some at a ratio of 20 guns per target. The several attempts throughout

the day at silencing hostile battery YT near Breskens were unsuccessful because the medium guns southwest of Terneuzen were firing at near their maximum range.[57] As 7th Brigade continued to fight forward from the Leopold Canal, Major-General Spry decided to reinforce success by reassigning 8th Brigade, which was originally supposed to assist with the Leopold attack, to bolster 9th Brigade. The bulk of the Canadian artillery assets involved in Switchback were also transferred to the northeast.[58] German artillery on the Leopold front remained "virtually silent" on the 11th, while the German coastal batteries continued to shell the Braakman front.[59]

The fighting on 9th Brigade's front became increasingly vicious. Brigadier Rockingham remarked on 12 October that the German artillery was very effective, against which the Canadians had little protection in the flat polder country.[60] By this time, it was clear to the Canadians that the fighting in the Breskens Pocket was as intense as that during the early days of the Normandy Campaign. German activity, especially shelling and mortaring, was reduced along the Leopold, as only about 100 enemy shells were reported to land in that bridgehead on the 12th, much less than during the first days of the battle. But the Braakman bridgehead experienced no less than 12 counterattacks from 11 to 12 October as well as intense artillery bombardment from positions near Breskens, Cadzand, Flushing and South Beveland.[61] The 12th was a day of very intense counter-bombardment, with 52 CB shoots. The 3rd Medium Regiment fired an impressive 20 CB and 22 harassing fire tasks, at 99 rounds per gun. On the same day the RAF conducted a major bombing mission, with the heavy bombers attacking Breskens and medium bombers attacking Cadzand.[62] Given the increased German attention to the Braakman bridgehead, 9th Brigade had succeeded in taking pressure from 7th Brigade.

The first week of Operation Switchback had seen important setbacks and unpleasant surprises. Progress on the Leopold bridgehead was slower than planners had anticipated, but 9th Brigade's landing, even though a day late, was a great success.

During the second week, shelling from both sides steadily declined because of limited visibility in the autumn weather. Consequently, CB work and counter-bombardment were less intensive than before. Some progress was finally made on the Leopold front, as engineers finished constructing bridges at Strooibrug for tanks.[63] Intelligence at last acknowledged that the Germans had many more troops in the Breskens Pocket than it had first estimated. The Canadians had only been in contact with the forward troops of Eberding's 64th Infantry Division in that sector of the front before the operation, which obscured the division's reserves. Intelligence confirmed from 12 to 13 October that the entire 3rd Battalion, 1st Parachute Replacement and Training Regiment and Battlegroup Krause were in the pocket.[64] Overall, the 13th was a bad day for CB work. The skies were clear enough for fighter-bombers to attack German guns and two houses that were believed to be ammunition dumps in front of the Queen's Own Rifles of Canada.[65] But the cool temperature and wind made it difficult to identify active hostile batteries with sound ranging. The infantry called only for moderate artillery support, a total of 14 predicted shoots for the day.[66]

By 14 October, the Canadians fighting north of the Leopold against the ferocious German defence had managed to secure a foothold in the southern edge of Eede, a kilometre from where they had crossed. The bridgehead was large enough for 3rd Division to move its remaining field artillery on that front to new gun areas on the opposite side of the canal.[67] The two bridgeheads became linked, and the entire eastern portion of the pocket was in Canadian hands.[68] After severe losses, most German units were down to a third of their original strength; they had also started to withdraw forces from 4th Division's front to the east. As far as artillery was concerned, intelligence estimated that the Germans still had 50 field, 30 medium, seven heavy and 30 heavy anti-aircraft guns, as well as 35 other unidentified artillery pieces for a total of 152 guns of all types in the Breskens Pocket. This was the largest number of German guns holding the approaches to Antwerp, but there were formidable artillery forces in the adjacent areas as well, 76 artillery pieces on Walcheren and 55 in South Beveland.[69]

The strong, concrete-protected coastal artillery positions at Breskens and the Flushing batteries were notorious for shelling the Canadians, especially on 9th Brigade's line of advance along the south shore of the West Scheldt. The AOP aircraft patrolled the area regularly, which made the German firing stop for a short time, but did nothing to damage the guns or inflict casualties on the crews.[70] Photographs of Breskens and Flushing, which had been heavily bombed by the RAF over the previous days, suggested that at least half of the batteries were destroyed. Three positions at Flushing had also been demolished. CB work suggested that the Germans had redeployed their guns, as most of the firing over the previous two days had come from positions that had not previously been located whereas known positions had been silent for some time.[71] The Canadians' newly consolidated major bridgehead and the Germans' reallocation of their

A 25-pounder gun and crew in the Scheldt, October 1944.

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guns meant that the battle was entering a new phase.

A Brief Respite

The period from 15 to 20 October, following an initial period of intense bombardment from both sides, was relatively quiet for the artillery. German shelling was so light and visibility was so poor on the 15th that Ross' staff received very little information from 2nd Survey Regiment on active hostile batteries. Even the coastal batteries fired infrequently on 16 October, and the Canadians therefore conducted very few counter-bombardments.[72] An intelligence summary from II Canadian Corps noted on 7th Brigade's frontage that while German muzzle flashes were visible on 16 October, sometimes no shells landed in Canadian lines. Brigadier N.E. Rodger (Chief of Staff, II Canadian Corps) believed this to be an attempt to confuse the Canadian flash spotters.[73] That the Germans made the effort to mount such a deceptive tactic suggests that Canadian CB work had made a difference.

On the morning of the 17th, although the German coastal batteries continued to fire, artillery and mortar fire inside the Breskens Pocket "slackened off." The Canadians conducted only ten CB shoots throughout the day, most of which were coordinated by the AOP squadrons.[74] On 18 October, while the guns at Flushing continued to harass 9th Brigade, German shelling was at its lowest level since the commencement of Switchback. More important, 2nd Survey Regiment's "A" Troop was finally able to establish a flash spotting base to observe Flushing and pinpoint the locations of the German batteries there.[75]

Meanwhile, the infantry had made such impressive gains pushing the Germans westward that 9th AGRA could move its guns across the Leopold.[76] On the 19th, the bad weather made AOP shoots impossible, and predicted shoots engaged only four hostile batteries.[77] At midnight on 19/20 October, the Germans withdrew to the line Breskens–Schoondijke–Oostburg–Sluis, a semicircle that curved to the North Sea. Behind it were all the guns they could move.[78]

On 20 October, Spry contrived a plan to break the new German line. He ordered the 7th Brigade, which had just been relieved by the British 157th Infantry Brigade, to pass through 9th Brigade and clear the enemy northeast of Cadzand. At the same time, 8th Brigade was to take

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Lieutenant-Colonel D.G. Crofton of the Canadian Scottish Regiment examines the wreckage of a German 155 mm gun near Breskens, 28 October 1944. German beach defences are visible in the background.

Oostburg, Sluis and Cadzand, then clear what remained of the pocket between the Leopold and the coast.[79] The coastal batteries only lightly shelled the Canadians. Intelligence from a reliable source reported that the Germans manned their guns at 0500 hours daily. To take advantage of this opportunity to eliminate some crews while they were still in the open, a counter-bombardment programme fired against five hostile batteries, in addition to three predicted shoots.[80]

Endgame 21 October–3 November

In the last period of the battle, between 21 October and 3 November, artillery activity in the Breskens Pocket escalated as the infantry captured more and more ground, but the late October weather soon began to impede CB work and air support. After the lengthy period of minimal German artillery activity, operations became more intense on 21 October as the German situation in the Breskens Pocket became desperate. On that day, 9th Brigade launched attacks on Breskens and Schoondijke.[81] The attack toward Breskens was met with heavy shelling, primarily from Flushing. But coordinating CB fire was difficult because the movement of so many Allied guns to new positions closer to the front presented communications problems. Enemy artillery, especially from the Flushing batteries, was heavy. However, Allied air support was also very active. Heavy and medium bombers retaliated against Flushing and Cadzand, respectively, and hostile battery ZQ in Breskens was attacked from the air five times. Despite its volume, the aerial bombardment had mixed results, as batteries in those cities were still identified as active afterward.[82] There was only light shelling overnight until Batteries Flushing North, Flushing West, Flushing East and Dishoek on Walcheren opened fire on Canadian forces south of Breskens the next morning and again in the afternoon. Shells landed in the lines of 8th and 9th Brigades. The Germans also still had active artillery in Cadzand, which was difficult to locate with any certainty because of poor visibility in the miserable weather and the

dearth of observation points in the unrelievedly flat country. The weather made AOP useless for several days, so counter-bombardment was limited to predicted fire from 22 to 25 October.[83]

Bad visibility continued into the 26th, though there was much more shelling than in previous days, especially at Schoondijke. On the left, after slow progress, 8th Brigade captured Oostburg.[84] The men of Battery Nieuwe Sluis evacuated their gun positions and thereafter fought as infantry.[85] Counter-bombardment was again limited to 18 predicted shoots.[86] The weather slightly improved the next day, 27 October, which allowed for sound ranging to identify five new unfixed batteries. However, 202nd Naval Coast Artillery Battalion's batteries at Domburg, Zouteland and Dishoek on Walcheren were too distant to be located accurately.[87]

The German shelling on the 28th was the heaviest it had been for a long time. The Canadians concluded that the Germans had been conserving their ammunition until they realized that there was nothing to be gained by hoarding it any longer.[88] The last German artillery unit left in the pocket, 203rd Naval Coast Artillery Battalion, fought on at Cadzand with two 150 mm howitzers and a troop of gunners converted to infantry.[89] The next day, its commander reported dwindling supplies of 150 mm rounds and that his unit was down to nine officers and 243 other ranks. Though the situation was hopeless, the battalion was promised a shipment of ammunition that night and was told that "the bridgehead was to be defended to the last cartridge."[90] As far as Ross was concerned, CB work for Operation Switchback was practically complete since most of the known German batteries in the Breskens Pocket had been overrun. Ross' attention shifted to softening German positions on Walcheren in preparation for the impending attack. Ten of the remaining batteries were attacked by heavy bombers and fighter-bombers, but with limited success as some of them survived and were still active later in the day.[91]

At 1800 hours on 31 October, the Germans' 203rd Naval Coast Artillery Battalion reported that its strength was down to six officers and 86 other ranks. It had no operational guns left.[92] The job was almost over and 3rd Division no longer needed the immense artillery support it had been allotted at the beginning of the operation. The attention of First Canadian Army, and indeed much of 21st Army Group, was on the new task at hand: the capture of Walcheren Island (Operation Infatuate). The week before, 9th AGRA had been moved to support 52nd (Lowland) and 2nd Canadian Infantry Divisions on South Beveland.[93] On 31 October, 2nd Canadian AGRA and 61st and 110th Field Regiments, RA were reallocated to coastal positions to support Infatuate, leaving 3rd Division with only its own field artillery.[94] From 1 November, while the Canadian artillery moved into its new positions to support the assault on Walcheren, the infantry mopped up the remainder of the pocket. Knokke, Heist-aan-Zee and Sluis were all cleared. On 3 November, with no German strongpoints remaining in the Breskens Pocket, Operation Switchback was complete.[95]

The clearing of the Breskens Pocket had been a dreadful experience for all of the forces involved. The duel between Allied and German artillery had been intense. While the German guns were set on obliterating the attacking Canadian infantry, the Canadian guns aimed to suppress and silence its opposite numbers. In the end, it was a decisive victory for the Allies and a source of pride for the Canadians. CB work was an integral part of that victory, but the efforts of Lieutenant-Colonel Ross and 2nd Survey Regiment were at the mercy of the unfavourable weather. After the first week of Switchback, identifying and accurately locating hostile batteries was difficult. Clouds and rain hindered air support and wind interfered with sound. Fortunately, the periods during which CB work was least productive were also those in which the German artillery was least active. In other words, CB work was effective when it was needed the most.

Aftermath and Analysis

The clearing of the Breskens Pocket provided important lessons regarding CB fire. The large volume of shells devoted to CB tasks made it seem that counter-bombardment during Operation Switchback was overwhelmingly effective. However, operational research revealed that hostile batteries were only being temporarily silenced. The experience of clearing the Breskens Pocket made it clear that while the Canadians may have been adept at locating hostile batteries, counter-bombardment through predicted shooting was much less accurate than expected.

How effective had CB methods been? A study conducted by 3rd Division after the battle stated that "difficulties of operation of Flash Spotting and Sound Ranging in polder country" made CB information "unreliable," though the final report did not elaborate.[96] Certainly, the terrain of the pocket and the worsening autumn weather had presented challenges to CB work, especially during the final phase. But Ross had extolled the effectiveness of sound ranging throughout the operation. Sound ranging undeniably had advantages over flash spotting and aerial photography because it was less affected by poor visibility caused by the weather.

However, 2nd CBO Staff's intelligence summaries are slightly

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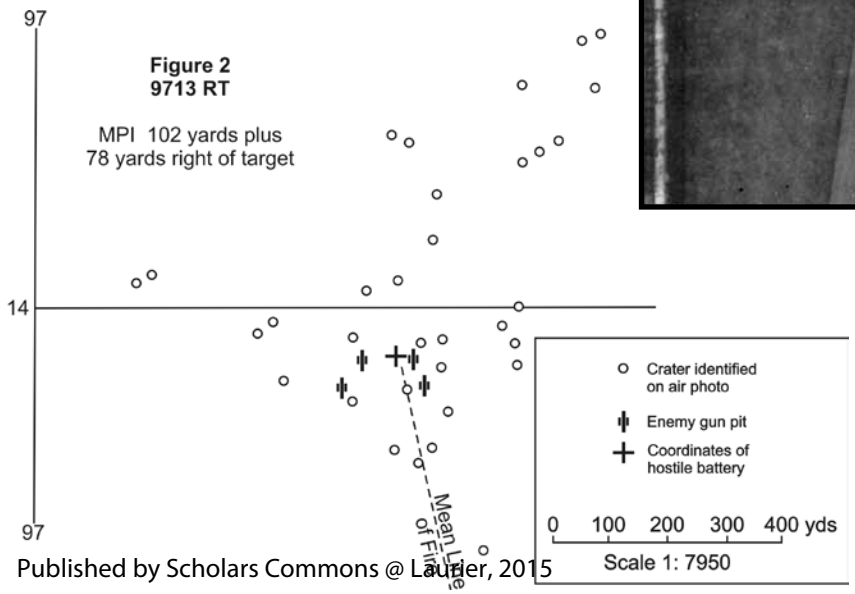
A prepared, but unoccupied, German gun position outside the village of Retranchement was identified on Canadian defence overprint maps as early as 10 September 1944. The position was considered active on the eve of Operation Switchback and targeted by the predicted fire of 10 troops of 5.5-inch and 7.2-inch guns which fired 112 rounds at the target. An operational research report later determined that only 11 shells fell near the German battery. Aerial reconnaissance photos taken on 21 October show the position (above and closeup right). The large craters which straddle the position were left by an attack by medium bombers. The smaller craters left by the artillery are more difficult to discern on the air photo.



Left: This figure shows a plot of the artillery shells directed at the German battery. It was found that the mean point of impact (MPI) was 102 yards past and 78 yards to the right of the target. Only 11 shells of 112 fired fell with a 100 yard box centred on the target.

Report No.24, "Accuracy of Predicted Shooting," in Terry Copp, ed., *Montgomery's Scientists: Operational Research in Northwest Europe, 1944–1945* (Waterloo, ON: LCMSDS, 2000), pp.311-23.

misleading with respect to the value of sound ranging. A careful statistical analysis of the hostile battery lists and CB intelligence summaries indicates that although sound ranging was the most frequently successful method of identifying active German batteries, by itself it rarely provided enough information to fix a battery. Of 197 fixed batteries listed in the counter-battery documents from 5 October to 4 November, 74.6 percent appeared as "fixed" for the first time as a result of aerial photography, not sound ranging. A further 2.5 percent were fixed by AOP. Sound ranging accounted for only 5.1 percent of batteries listed as "fixed" for the first time.[97] In other words, while sound ranging could identify and roughly locate a hostile battery, aerial photography was required in order to gain enough information about it before it could be engaged. Conversely, aerial photography could only be used when the weather permitted. Therefore, in the Breskens Pocket, no single counter-battery technique could pinpoint hostile batteries by itself.

How accurate was the Canadian CB fire during the battle? One method was through operational research which had already revealed some very important lessons about artillery by the time of Switchback. There were already some serious doubts in 1944 as to the accuracy of artillery fire. The 3rd Medium Regiment, RCA participated in a simulation in April 1944 to test methods of measuring the accuracy of artillery fire and determine the causes of inaccuracies. The experiment involved firing on three dummy targets, codenamed Mars, Jupiter and Saturn, and measuring the discrepancies between each shell crater and the targets. The study produced some interesting results. The mean point of impact of the 48 rounds fired at Jupiter was one degree 33 minutes to the right and 27 yards long of the target. Similarly, the mean point of impact for the bombardment on Saturn was 36 minutes to the right and 228 yards short of the target. Only one dummy gun at Saturn was hit in the entire experiment, and that hit was by a single shell fragment. In other words, on average, shells not only missed Jupiter and Saturn, they did so by a wide margin in both bearing and range. Worst of all, an error at the command post meant that a quarter of the rounds directed at Mars landed over 1,000 yards past the target. Unfortunately, the report was not completed until after the Battle of the Scheldt. The study yielded no general conclusions as it was meant to be supplemented by future experiments.[98] Nevertheless, it showed that the slightest errors could produce wildly inaccurate results in a bombardment.

By autumn 1944, concentrations were getting larger and units were using ammunition from different production lots as well as uncalibrated guns, and it was suspected that predicted shooting was inaccurate. The question of accuracy was crucial. No.2 Operational Research Section (ORS) could do little work in autumn of 1944, in part because the fighting was a continuous struggle with few large set-piece battles. However, Major J.G. Wallace, one of the artillery experts in No.2 ORS, did manage to conduct an important examination of the accuracy of predicted fire in which he focused on CB fire. There were few suitable battlefields on which to base the study. The Breskens Pocket was the logical choice because "little if any firing had taken place beforehand, and where the distribution of shells could be examined soon after firing, without any danger of its being confused by subsequent fighting."[99]

The inherent problem with counter-bombardment was ascertaining its effectiveness while a battle was still in progress. If an enemy battery ceased to fire, was it because friendly artillery had successfully destroyed it, or had the enemy simply moved its guns to another location? Or had the battery run out of shells? Visual confirmation that a hostile battery had been destroyed was often needed to consider it permanently silenced. Thus, operational research conducted after a battle was the only way to assess the effectiveness of counter-bombardment.

Wallace's examination of the accuracy of CB fire in the Breskens Pocket was nothing short of groundbreaking. No.2 ORS examined aerial photographs of five hostile batteries engaged on 6 October. Hostile battery history sheets confirmed that the pre-zero counter-bombardment programme was the first time each of these batteries had been fired upon. They had not been engaged again between H-Hour and the time at which the photographs were taken or affected by the engagement of any other battery.[100] The study found that shells had fallen over a large area, typically 1,000 yards square. Only about 4.4 percent of shells landed within 100 yards square of the target, meaning it would take over 2,000 shots to cause 100 of them to fall into an area of 100 yards square. Wallace attributed this dispersion to errors in sight testing and command post work. Meteorological work, survey and calibration only accounted for minor errors in the fall of shot.[101]

A report compiled after the war, using data from Operations Wellhit (Boulogne), Switchback and Veritable (Rhineland), confirmed Wallace's conclusions. Only 5 percent of shells could be expected to land within 100 yards square of a hostile battery. Though CB fire could still have a neutralizing effect on the enemy, even a heavy bombardment could produce only temporary results.[102] Operational research seriously challenged the Allies' perception of the accuracy of artillery, not just during Switchback, but predicted fire in general. Either more shells would

be required or measures would have to be taken to improve the accuracy of each shell in future operations.

In the end, the inaccuracy of artillery compromised the effectiveness of counter-bombardment during Operation Switchback. Artillery fire undoubtedly hurt the Germans' morale and impeded their movements, but certainly the experience in the Breskens Pocket showed that it was too inaccurate to destroy a hostile battery or neutralize it for very long. Despite the disappointing performance of artillery in terms of accuracy during the battle, operational research helped commanders understand why errors were so prevalent and gave clues as to how they could be remedied. Operational research alone could not achieve victory: it was up to gifted field commanders to use its lessons to the Allies' advantage to bring a speedy and welcome end to the Second World War.

Conclusion

Prior to Operation Switchback, the Canadians had little intelligence concerning German strength, dispositions or locations of hostile batteries beyond the forward defences. This was a serious handicap for counter-battery efforts. Because the German batteries were relatively silent before the battle, the Canadians had only fixed a small number. Once the battle was underway, the CB organization had to contend with poor visibility from the worsening autumn weather, a lengthy period of German inactivity and the lack of natural observation posts on the flat terrain.

The battle exemplified the weaknesses of specific counter-battery techniques. Careful analysis shows that sound ranging was not precise enough to accurately locate German guns. Regardless of how well sound ranging worked in identifying an active German battery, aerial photography was almost always needed to engage it. Unfortunately, photo-reconnaissance aircraft could only operate in good weather and sound ranging was most effective in clear, calm weather. Yet in the all too rare occurrences of favourable conditions, the two methods produced invaluable information on the location, size and behaviour of German batteries. That the Canadians had known so little about the German reserves and coastal positions before the battle made the success of CB work an even greater achievement. In the end, the Allied counter-battery methods proved to be invaluable during Switchback.

As Major Wallace discovered in his study of the battlefield, counter-bombardment by predicted shooting suffered from severe limitations. The primary culprits for the wide dispersion of shells were errors at the command post and in sight testing, not calibration or meteorology. Survey mistakes were responsible only for marginal errors. Given the limitations of CB work during quiet periods and in poor weather, as well as the inaccuracy of predicted shooting, artillery accounted for a less substantial role in the Canadian victory at the Scheldt than historians have previously realized.

The Canadian struggle for the Breskens Pocket was not an exercise in "brute force." Despite the large number of artillery units devoted to Switchback, planners had never meant to use artillery as a "blunt instrument." Instead, artillery was employed as flexibly as possible for attacks on precise targets. The diligence of Lieutenant-Colonel J.H.D. Ross and 2nd Survey Regiment, RCA shows that the Allies used highly developed methods to enable the artillery to silence German guns with the most intelligent and economical application of firepower. Such methods do not resemble the clumsy tactics presented in John Ellis' "brute force" thesis.

Notes

Special thanks to Professor Geoffrey Hayes (University of Waterloo), who supervised this project. Portions of this article were presented at the 22nd Military History Colloquium, Laurier Centre for Military Strategic and Disarmament Studies (LCMSDS), Waterloo, ON, 5–7 May 2011.

1. War Diary (WD), General Staff (GS), HQ, 3rd Canadian Infantry Division, October 1944, Appendix 5, Lieutenant-Colonel J.D. Mingay (General Staff Officer, 3rd Canadian Infantry Division), 3rd Canadian Infantry Division Intelligence Summary (ISUM) No.45, 2 October 1944, p.1; Library and Archives Canada (LAC), Record Group (RG) 24, vol.10,907, file 235C3.013 (D3): Major J.R. Martin (Historical Officer, 3rd Canadian Infantry Division), "Battle Narrative, Operation 'Switchback,'" 25 Jan 1945, para.2.
2. C.P. Stacey, *Official History of the Canadian Army in the Second World War*, vol.3, *The Victory Campaign: The Operations in North-West Europe, 1944–1945* (Ottawa: Queen's Printer, 1960), pp.358–361, 386–389, 425.
3. See R.W. Thompson, *The Eighty-Five Days: The Story of the Battle of the Scheldt* (London: Hutchinson, 1957); L.F. Ellis, *Victory in the West*, vol.2, *The Defeat of Germany* (London: HMSO, 1968), chaps.4–5.; and J.L. Moulton, *Battle for Antwerp: The Liberation of the City and the Opening of the Scheldt, 1944* (New York: Hippocrene Books, 1978).
4. Stacey, *The Victory Campaign*, p.400.
5. John Ellis, *Brute Force: Allied Strategy and Tactics in the Second World War* (New York: Viking, 1990), pp.xvii–xix. Ellis paid slight attention to the actual Scheldt fighting, but he concurred with Stacey's contention that the Canadians were sluggish because Montgomery had misallocated so many resources to the Ruhr enterprise (p.406).
6. Terry Copp, ed., *Montgomery's Scientists: Operational Research in Northwest Europe, 1944–1945* (Waterloo, ON: LCMSDS, 2000), pp.26, 49. See also Terry Copp, *Cinderella Army: The Canadians in Northwest Europe, 1944–1945* (Toronto: University of Toronto Press, 2006), pp.290–291.
7. C.P. Stacey, "Canadian Participation in the Operations in North-West Europe, 1944, Part VI: Canadian Operations, 1 October–8 November: The Clearing of the Scheldt Estuary," Canadian Military Headquarters (CMHQ) Report No.188, 7 April 1948, Directorate of History

and Heritage, Department of National Defence (DHH), para.104.

8. WD, GS, HQ, 2 Cdn Corps, October 1944: Appendix 27, Major-General C. Foulkes (Acting General Officer Commanding 2 Cdn Corps), "Operation 'Switchback' Outline Plan," 2 October 1944, pp.1–2. At the time, the Canadians always mistakenly referred to the Braakman Inlet as the Savojaards Plaat, which really only applied to the shoal at the mouth of the inlet (Stacey, *The Victory Campaign*, p.365n). For a detailed study of air support for Operation Switchback, see Mike Bechthold, "Air Support in the Breskens Pocket: The Case of First Canadian Army and 84 Group Royal Air Force," *Canadian Military History* 3, no.2 (Autumn 1994), pp.53–62.
9. WD, HQ, 2 Cdn AGRA, October 1944, Appendix 1, Brigadier A.B. Matthews (CCRA, 2 Cdn Corps), RCA 2 Cdn Corps Operation Instruction (Op Instr) No.8, 5 October 1944, pp.1–3. 3rd AGRA (2 heavy regiments, less 2 batteries of 155 mm guns) had been tentatively allotted in Foulkes' plan, but was subsequently reallocated.
10. WD, GS, HQ, 2 Cdn Corps, October 1944, Appendix 27, Foulkes, pp.1, 3.
11. WD, HQ, 2 Cdn AGRA, October 1944, Appendix 1, "Notes on Planning," 29 September 1944, p.1 and Matthews, pp.2–4.
12. WD, GS, HQ, 2 Cdn Corps, October 1944, Appendix 27, Foulkes, Appendix A, p.2.
13. WD, HQ, 2 Cdn AGRA, October 1944, Appendix 1, Matthews, p.3.
14. United Kingdom, War Office, *Artillery Training*, vol.3, *Field Gunnery*, Pamphlet No.11, "Counter Battery Duties, 1944" (London: HMSO, 15 April 1944), para.2; Brigadier-General A.G.L. McNaughton, "Counter Battery Work," *Canadian Defence Quarterly* 3, no.4 (1926), p.380.
15. McNaughton, pp.382–383; Shelford Bidwell and Dominick Graham, *Fire-Power: The British Army Weapons and Theories of War, 1904–1945* (1982; repr., Barnsley, South Yorkshire: Pen & Sword, 2004), pp.109–111; G.W.L. Nicholson, *The Gunners of Canada: The History of the Royal Regiment of Canadian Artillery*, vol.1, *1534–1919* (Beauceville, QC: L'Éclaireur, 1978), pp.312–317.
16. McNaughton, pp.380–381; *Artillery Training*, vol. 3, 11/44, section 10.
17. *Artillery Training*, vol.3, 11/44, App.1.
18. Ibid., sections 11–12.
19. Ibid., paras.98, 180.
20. Ibid., section 15.
21. United Kingdom, War Office, *Artillery Training*, vol.6, *Survey*, Pamphlet No.5, "General Principles and Practice of Sound Ranging, 1944" (London: HMSO, 1 April 1944), paras.5, 9.
22. Ibid., paras.5–6. Each pair of adjacent microphones comprised a "sub-base."
23. Ibid., paras.18–21.
24. Ibid., sec.26.
25. Ibid., paras.115–116.
26. Ibid., paras.3, 107.
27. WD, GS, HQ, 2 Cdn Corps, October 1944, Appendix 2, Brigadier N.E. Rodger (Chief of Staff, 2 Cdn Corps), 2 Cdn Corps ISUM No.64, 7 October 1944, part 1. Quotation from Stacey, CMHQ Report No.188, para.121.
28. WD, GS, HQ, 3rd Canadian Infantry Division, November 1944, Appendix 19a, "Op Switchback – Study Period: Notes on Polder Fighting," 20 November 1944, part 1, para.15(a).
29. WD, 2 CBO Staff, RCA, October 1944, Appendix 5, Lieutenant-Colonel J.H.D. Ross (CBO, 2 Cdn Corps), 2 Cdn Corps CB ISUM No.17, 6 October 1944, 1; WD, 2 Svy Regt, RCA, 1–5 October 1944; *Artillery Training*, vol.3, 11/44, para.22(b).
30. WD, GS, HQ, 2 Cdn Corps, Sep 1944, Appendix 2, Rodger, 2 Cdn Corps ISUM No.53, 14 September 1944, part 1; and 2 Cdn Corps ISUM No.57, 22 September 1944, part 1, p.2.
31. For a detailed account of the German evacuation across the Scheldt, see S.J. de Groot, "Escape of the German Army across the Westerscheldt, September 1944," *Canadian Military History* 6, no.1 (Spring 1997), pp.109–117.
32. Copp, *Cinderella Army*, p.89.
33. Calculated from WD, 2 CBO Staff, RCA, October 1944, Appendix 5, Ross, 2 Cdn Corps CB Hostile Battery (HB) List No.16, 5 October 1944, pp.2–3 and amdt.
34. WD, GS, HQ, 3rd Canadian Infantry Division, October 1944, Appendix 5, Mingay, 3rd Canadian Infantry Division ISUM No.45, p.3.
35. WD, GS, HQ, 2 Cdn Corps, October 1944, Appendix 2, Rodger, 2 Cdn Corps ISUM No.64, part 1; Canadian War Museum (CWM) 20000005-001: 21 A Gp, "Clearing of the Scheldt Estuary," n.d., para.11.
36. WD, GS, HQ, 2 Cdn Corps, October 1944, Appendix 2, Rodger, 2 Cdn Corps ISUM No.63, 5 October 1944, part 1, p. 2 and Appendix D. The Germans expressed their artillery calibres in centimetres, not in millimetres as in Anglo-American armies. For consistency, all calibres are expressed here in millimetres.
37. A.G. Steiger, "The Campaign in North-West Europe: Information from German Sources, Part III, German Defence Operations in the Sphere of First Canadian Army (23 Aug–8 Nov 44)," Army Headquarters Report No.69, 30 July 1954, DHH, para.203; Denis Whitaker and Shelagh Whitaker, *Tug of War: The Allied Victory that Opened Antwerp*, 2nd ed. (Toronto: Stoddart, 2000), p.271. The 64th Infantry Division remained under LXVII Corps until 14 October, when it was placed directly under Fifteenth Army's command (Steiger, para.218).
38. See, for example, LAC, RG 24, vol.10,907, file 235C3.013 (D3): Martin, para.15, and Stacey, CMHQ Report No.188, para.112.
39. Steiger, para.205 and note.
40. WD, 13 Field Regiment, RCA, 6 October 1944.
41. WD, 2 CBO Staff, RCA, October 1944, Appendix 5, Ross, 2 Cdn Corps CB ISUM No.18, 7 October 1944.
42. Stacey, *The Victory Campaign*, pp.393–395.
43. WD, GS, HQ, 2 Cdn Corps, October 1944, Appendix 2, Rodger, 2 Cdn Corps ISUM No.64, part 1.
44. WD, 23 Field Regiment (SP), RCA, 6 October 1944.
45. WD, 2 CBO Staff, RCA, October 1944, Appendix 5, Ross, 2 Cdn Corps CB ISUM No.18.
46. Ibid., Appendix 5, Ross, 2 Cdn Corps CB ISUM No.19, 8 October 1944. Includes quotation.
47. Quoted in WD, 4 Medium Regiment, RCA, 8 October 1944.
48. WD, 2 CBO Staff, RCA, October 1944, Appendix 5, Ross, 2 Cdn Corps CB ISUM No.20, 9 October 1944.
49. WD, 3 Medium Regiment, RCA, 8 October 1944.
50. WD, 7 Medium Regiment, RCA, 8 October 1944.
51. CWM, 20000005-001: 21 A Gp, para.19.
52. WD, GS, HQ, 2 Cdn Corps, October 1944, Appendix 2, Rodger, 2 Cdn Corps ISUM No.65, part 1, p.1; WD, 2 CBO Staff, RCA, October 1944, Appendix 5, Ross, 2 Cdn Corps CB ISUM No.21, 1; Stacey, *The Victory Campaign*, pp.396–397. Quotation from Stacey, CMHQ Report No.188, para.140.
53. WD, 2 CBO Staff, RCA, 9 October 1944.
54. WD, 2 CBO Staff, RCA, October 1944, Appendix 5, Ross, 2 Cdn Corps CB ISUM No.21, 10 October 1944, p.1.
55. WD, GS, HQ, 3rd Canadian Infantry Division, 9 October 1944; WD, GS, HQ 2 Cdn Corps, October 1944, Appendix 2, Rodger, 2 Cdn Corps ISUM No.65, 9 October 1944, part 1, p.1.
56. Nicholson, *The Gunners of Canada*, vol.2, p.362n and C.P. Stacey, *Official History of the Canadian Army in the Second World War*, vol. 1, *Six Years of War: The Army in Canada, Britain and the Pacific* (Ottawa: Queen's Printer, 1957), p.545.
57. WD, HQ, RCA 3rd Canadian Infantry Division, 10 October 1944; WD, 2 CBO Staff, RCA, October 1944, Appendix 5, Ross, 2 Cdn Corps ISUM No.22, 11 October 1944, p.1.
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