Technology and Growth: The RCN during the Battle of the Atlantic

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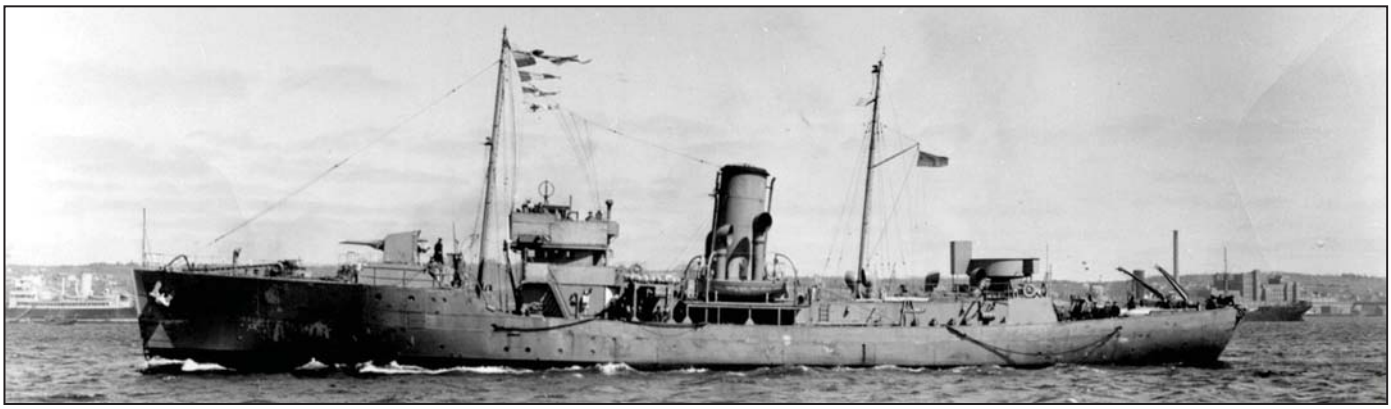

Credit: Royal Canadian Navy

*HMCS **Chambly**, the first Canadian corvette to sink a U-boat, is pictured in Halifax, summer 1941, as a perfect example of the first iteration of Canadian **Flower**-class corvettes with two masts and the forecastle deck ending just before the bridge.*

The Royal Canadian Navy (RCN) was a small force when the Second World War commenced in 1939. That it would grow and take on the role that it did in the Battle of the Atlantic was not expected by the few officers and sailors who manned the ships in 1939. The war-time maritime role that Canada played was significant, but it was a difficult role to play as technology changed and the navy tried to adapt. The rapid growth of the fleet contributed to problems of effectiveness as important improvements in technology were not being introduced because no one wanted to slow down production. This led to a crisis at the end of 1942, when RCN ships were removed from the important task of Mid-Ocean Escort Duty. The RCN ships were lagging behind the Royal Navy (RN) and US Navy in terms of radar, asdic and weapons technology.

This article will look at the development of the technology of the RCN fleet during the Second World War, how that differed from the Royal Navy, and how this related to the effectiveness of the RCN in the war effort.

The Problems of Expansion and Modernization

With the declaration of war in 1939, the RCN raced to increase the size of its escort fleet, instituting the rapid production of the *Flower*-class corvette. When the first program to build corvettes was implemented in 1940, it was quickly fulfilled. By late 1940, 64 *Flower*-class corvettes were on order in Canadian shipyards for the first shipbuilding program, with the bulk (52) being delivered in 1941.[1] The corvette design was based on a whaler that had been adapted for use by the RN when the need for inexpensive escorts became clear. They were built to civilian standards, emphasizing ease of construction.

The RN quickly made alterations to lengthen the forecastle, raise the bow and enclose the bridge in an effort to improve the ships. However, in order not to slow production, the RCN did not make these changes even as the ships were under construction. This meant that the ships were equipped from the beginning with inferior equipment. And consequently, many Canadian-made corvettes

Credit: Royal Canadian Navy

*HMCS **Eyebright** is pictured here around 1943 as an example of a mid-war modified **Flower**-class corvette. In the modified ships, the forecastle deck was extended to midships, the mast was moved to aft of the bridge, and the lantern-shaped Type 271 radar was located between the mast and bridge.*

were already outclassed by ships built in Britain. Between 1940 and 1943, these first and second build program ships became increasingly outdated, compared to the sophisticated escorts of the RN.

The RCN rapidly fell behind in technology, becoming less effective as both the RN and German U-boats became more advanced.[2] This was because, despite the fact that hulls could be built rapidly, Canada had virtually no domestic maritime high technology industry and the British, and eventually the United States when it joined the war, were in short supply themselves.[3] Eventually Canadian industry was built up but it was not ready in time for the critical job of escort duty in the early years of the war. At the beginning, the Canadian shipyards could only build ships the size of corvettes, and only as the war progressed did the yards grow in size and experience, eventually building destroyers.

The largest difference between the RN and RCN corvettes was their weapons and sensors. The RN anticipated that the corvette would be an ocean escort and made continual improvements, while focusing the ship for anti-submarine warfare (ASW). However, the first 54 RCN ships had both anti-submarine warfare (ASW) weapons and minesweeping gear on the stern, not the bow, which reduced their ocean-going capabilities. The Canadian view was that these ships were 'jack-of-all-trades' vessels, operating inshore where the threat had been in the last war. This reflected a major difference in perceptions between Canada and Britain on what the threat was, and what the focus of maritime operations should be to address it.

The Canadian government resisted making changes to the design at first, and even as the needs became clear, six more of the original design were built without minesweeping and anti-submarine gear. Then 10 'Revised' ships, which featured changes the RN had adopted, were included in the second build program in 1940-1941.[4] Finally, 27 'Increased Endurance' (IE) escorts were delivered in late 1943.

The problems of modernization and repair had an impact on the function of the RCN escorts. When it became time to modernize to the IE standard, a new electrical system had to be installed. All the large yards were already busy with new construction. Only smaller yards could slowly do this work, and with the anticipation of newer ships joining the fleet, Naval Service Headquarters (NSHQ) put modernization lower in priority than construction.[5] Only 20% of RCN corvettes were modernized to the same level as all the RN corvettes by October 1943.[6]

The *Castle*-class was the next iteration of corvette. Possessing the structural changes from the 'Revised Increased

Credit: Imperial War Museum, A24759

*HMCS **Tillsonburg**, a **Castle**-class corvette, is seen on 15 July 1944, in Greenock, Scotland. Incorporating many of the midwar modifications to the **Flowers**, the **Castles** were around 15 metres longer than their predecessors and were much more seaworthy. Note the more robust lattice mast, allowing the ships to locate the Type 271 radar at a higher elevation and likely improving its range.*

Endurance' ships, 12 were acquired by the RCN, none of which were constructed in Canada.[7] Delivered near the end of 1943, these ships featured the equipment that RCN corvettes were missing, including: forward-throwing depth charge launchers; Type 147B asdic; and Type 272 radar, an improved version of the Type 271.[8] Interestingly, due to the fact that the RCN was now receiving the improved corvettes and frigates, modernization of the rest of the fleet slowed, leading to the large disparity in equipment between ships within Canadian escort groups.[9]

In an effort to become more effective, the RCN sought to acquire frigates. The frigate was designed to fix the shortcomings of the corvettes. Larger, faster and with a longer range, they were equipped with the latest radar, asdic and weapons. Unfortunately for the struggling RCN in 1942, the frigates it ordered had lower construction priority than those being built in Canada for the RN and USN. Even when the RCN asked to take some frigates that were advanced in construction, the Canadian government denied the request as the USN and RN ships being constructed were a source of money and expertise the Canadian government felt it could not afford to lose.[10] Therefore, the majority of the *River*-class was delivered to the RCN between 1943 and 1944, long after the crisis period for the RCN in late 1942.[11] Ultimately, 70 *River*-class frigates were built in Canada for the RCN, RN and USN.[12] However, instead of ordering the more technologically-advanced second generation *Loch*-class, the RCN decided not to wait and took over *River*-class frigates that the RN was having trouble manning, cancelling its *Loch*-class building program.[13] In May of 1943, a number of British *River*-class destroyers were given to the RCN. These destroyers had just returned from refit with all up-to-date equipment,[14] and were useful for the RCN war effort.

The most advanced class of destroyer to enter service with the RCN during the Second World War was that of the British-built *Tribal*-class. Heavily armed with four quick firing guns and heavy torpedoes, the ships were also well equipped with radar and asdic. However, as they were designed for surface combat, they were relegated to the RN Home Fleet, and not used as escorts.[15] Due to Canada

Credit: Library and Archives Canada

***Flower**-class corvette HMCS **Weyburn**, circa 1942. Illustrating the somewhat ad hoc approach to corvette modernization, **Weyburn** is shown here with the triangular Canadian-developed SW1C radar at the top of the mast and wider bridge wings, yet lacking some of the newer modifications such as an extended forecastle.*

being so closely tied to Britain, the British Admiralty could still issue orders for the RCN. The RCN wanted destroyers to create its ideal balanced fleet, but the RN was short on manpower, meaning the solution was Canadian-crewed ships to accomplish British tasks. Regardless, they arrived too late to participate in the convoy battles of 1942, when the RCN escort groups needed well-equipped destroyers. The Canadian government instituted a program to build *Tribals* in Canada but they entered service in September of 1945, too late to be used as escorts in the war.

The continued lack of up-to-date equipment, combined with NSHQ vacillating over which course to follow and the inability of the shipyards to modernize the corvettes quickly led to the decreasing effectiveness of the Canadian escort groups in protecting convoys and sinking U-boats. This prompted the RCN to be pulled out of the Mid-Ocean Escort Force at the end of 1942 until the summer of 1943 in order for it to re-equip, retrain and re-organize. It was during this period that the allies finally began gaining the upper hand in the Atlantic and by the time the Canadian groups returned, the situation had stabilized.

NSHQ continued to resist modernization of its corvettes, knowing that modern escorts were going to be available in the near future. As such, Canadian escort groups for the remainder of the war remained a motley assembly of highly advanced *River*- and *Castle*-class escorts, mixed in with *Flower*-class escorts which still had the ineffective radar and obsolete Type 123D asdic.

Radar

With the commencement of hostilities in 1939, the RN began equipping its escorts with radar. In addition to the structural updates, the RN also ensured every ship had a gyrocompass, which provided a stable directional reference. In contrast, even at the end of 1942, the RCN only approved gyrocompasses to be fitted on new construction; no provisions were made for fitting out the ships that were in combat.[16]

But it was radar that would prove to be the key for protecting convoys and sinking U-boats. The preferred method of attack for German submarines at this point was the nighttime surface attack. On the surface, the U-boat would use its superior surface speed in order to move into firing position. Remaining on the surface during the daylight hours would leave the boat vulnerable to being spotted, therefore, night attacks were the only option to maximize the advantages of the U-boats. To counter this, the allies began outfitting ships with increasingly powerful versions of radar. The first versions of radar had microwave beams that were in the metre length; satisfactory for detecting large surface vessels, but inadequate to detect submarines that were on the surface.

Starting in 1941, the RCN and the National Research Council began the research and construction of a 1.5 metre wave radar. An upgrade to the Type 286, the Surface Warning, First Canadian – or SW1C for short – was capable of sweeping side to side instead of just being fixed

forward, as the previous version was.[17] In testing against a surfaced Dutch submarine, the radar performed very well but was sensitive to shock and required constant maintenance. Furthermore, its wavelength reduced its ability to provide a sharp image, something needed to identify a submarine in the clutter of waves on the ocean. Fitting was slow, and only a quarter of the Canadian escort fleet was equipped by the end of 1941. By the end of the winter in 1942 all of the ocean escorts of the RCN had radar, either the Type 286 or SW1C. The SW1C was updated, with improvements, to the SW2C and SW3C variants.

However, the RCN radar systems retained the core problems of long-wave radar systems.[18] As well, fitting Canadian escorts with the improved Type 271 radar took much longer than expected, hampering the RCN at a critical time. Designed and tested concurrently with SW1C, the Type 271 was a major upgrade. It had a 10 centimetre wave length which greatly increased its image sharpness. It could detect surfaced U-boats and periscopes in moderate conditions. Covering 360 degrees, escorts could now detect U-boats as they prepared to attack. The RN quickly refitted its escorts with these updates, but the RCN was slower. Thus, while the RCN was just beginning to equip its escorts with the SW1C in January 1942, the RN had already refitted 78 escorts with the Type 271.

Canadian efforts to acquire the centimetric system were challenged by misunderstandings and bad timing. After being informed of the benefits of this type of radar in the summer of 1941, the NSHQ and National Research Council worked to develop a Canadian version, asking the RN for a set to copy. Unfortunately, the set was not delivered until January 1942, after development of the Canadian short-wave set – RX/C – had begun, leading to delays as Canadian scientists worked from scratch. NSHQ hoped to receive sets from the United States but the US Navy radar became increasingly difficult to procure following the US entry into the war. In any case, RCN ocean escorts did not start receiving advanced radars until early 1943.

As late as June 1944, some Canadian escorts still had not received effective radars. Canadian corvettes supporting the Normandy landings were in many cases equipped with the finicky RX/C and SW2C. Even by the war's end the escorts from the first program were not fully equipped with Type 271 radars.

High Frequency Direction Finding

By the summer of 1941 all RN escort destroyers and many of the rescue ships were equipped with High Frequency Direction Finding (HF/DF) sets, allowing the triangulation and attack of U-boats.[19] In summer of 1942 the ships in Canadian escort groups still lacked HF/DF, and efforts were made to fit the escorts with sets. Apparently, however, NSHQ lacked understanding of the system, leading to a lack of urgency in fitting the escorts.[20] And so, Canadian escorts continued to operate without the important tactical information provided by HF/DF until the spring of 1943.[21] Creative efforts were made to make up for this deficiency, including using illumination shells to try to illuminate suspected U-boats. However, this tactic was dangerous for the convoy, and quickly fell out of use. Even with their inventive tactics, the lack of HF/DF in Canadian escort groups was a serious problem. As the December 1942 convoy ONS 154 learned when the convoy sailed without HF/DF, it could not pre-empt any attacks, only react. Combined with ineffective radar and disorganized command, the convoy lost one-third of its merchant ships and precipitated the withdrawal of Canadian escort groups from the Mid-Ocean Escort Force. Fortunately NSHQ realized the value of HF/DF, and by war's end all destroyers were fitted with it.[22]

Asdic and Anti-Submarine Warfare

In the early stages of the war – until the summer of 1942 – depth charges were the sole method of attacking a submerged submarine. Due to the need for the charges to

Credit: Royal Canadian Navy

*Acquired prewar, the C-class destroyer HMCS **Restigouche** (this ship and others acquired from the Royal Navy in this period were named **River**-class despite being different actual classes in material terms) eventually received a wide number of technical improvements. In this circa 1944 photo, a High-Frequency/Direction-Finding (HF/DF) antenna can be seen on top of the main (aft) mast.*

explode very close to the target – within 20 feet – depth charge attacks had a low rate of success.[23] Furthermore, the ship had to run directly over the submarine, losing asdic contact at a critical moment.

Due to a lack of high technology manufacturing, Canadian-built corvettes did not have the equipment needed to plot depth charge attacks accurately. Asdic was the means to detect and attack submerged submarines. The asdic sets were measuring instruments that sent out an acoustic pulse and then measured distances based on the time for the echo of the pulse to return – i.e., the predecessor of active sonar. Sound waves reflected off a submarine, and these waves were picked up by hydrophones, giving a range and bearing. Drawbacks of early systems were their limited range and inability to determine depth, meaning that depth settings for the depth charges had to be guessed.[24]

The asdic sets on Canadian corvettes were the obsolete Type 123A, which the RN considered inadequate for service on anything except auxiliaries.[25] In August of 1942, the decision was made to update to the latest Type 145, a system which could determine depth and was linked to forward-throwing weapons. Unfortunately, updating required a replacement of the entire electrical system, which began in early 1943.[26] The efforts to make the change were confused by NSHQ's decision to upgrade incrementally, first to the Type 127DV then to the Type 144Q/145, the best available. By the end of the war, few first program escorts were equipped with the latest asdic.

The ASW techniques evolved rapidly in the war – a deadly game of rapid action and reaction to offence and defence as the war progressed. In the summer of 1942 the RN began employing 'Hedgehog,' a system which allowed the firing of 24 small bombs forward of the ship, and in which asdic contact could be maintained throughout the attack.[27] The weapon was also gyro-stabilized, allowing accuracy in rough seas. Importantly, the bombs were contact fused, meaning only a direct hit would explode and misses would not obscure asdic conditions. These features gave the weapon a success rate of anywhere between two to six times better than depth charges.[28]

Unfortunately for the first and second Canadian build program escorts, the fact that the *Flower*-class had not been modernized made fitting Hedgehog difficult. The Type 123A or Type 123D asdic fitted to the corvettes was not capable of controlling the weapon, and the forecastle was too small.[29] Furthermore, NSHQ was unsure of Hedgehog's effectiveness, and the RN had trouble convincing escorts to use the weapon until early 1943.[30] The development of a forward-throwing anti-submarine mortar called 'Squid' also made NSHQ reluctant to fit Hedgehog, as it looked like an improvement was on the way. Unlike Hedgehog, Squid fired three large depth charges the depth of which was set by the Type 145 or 147B asdic.[31] Unfortunately, Squid was too heavy for the *Flower*-class, and was not fitted. However, RCN *Castle*- and *River*-class escorts featured these weapons.

Credit: Library and Archives Canada

R. Cosburn and Lieutenant F.A. Beck (right) monitor the asdic set on the bridge of HMCS ***Battleford****, a* ***Flower****-class corvette, in Sydney, Nova Scotia, November 1941.*

Credit: Lt Gerald T. Richardson; Library and Archives Canada PA-115026

Sailors load a Hedgehog anti-submarine mortar on the Increased Endurance ***Flower****-class corvette HMCS* ***North Bay*** *in November 1943.*

In September 1943, the Kriegsmarine began employing the 'T-5' acoustic homing torpedo. Called the German Naval Acoustic Torpedo (GNAT) by the allies, it was acoustic homing with a magnetic firing pistol.[32] To counter this threat, towed noise-makers made of loose metal pipes inside a frame were developed. The metal pipes would rattle, creating noise to drown out the sound of the ship itself, attracting the torpedo away from the escort. The British developed 'Foxer' which was comprised of two sets of pipes. The RCN developed Canadian Anti-Acoustic Torpedo (CAT) gear, comprised of only one set. Easier to use, it was also more durable.[33] While not a perfect solution, when combined with tactical changes, the GNAT ended up being less of a threat than originally feared.[34] What is notable is that, unlike the otherwise slow adoption of technology, the RCN developed a decoy system very quickly. Not only did the RCN develop its own gear but it continued to employ it when confronted by the RN, which thought its system was better.[35] Unfortunately, both the systems had some faults – for example, the noise-maker was so loud that it would drown out the escort's own asdic so it had to be turned off during searches in order for asdic to work.[36]

Conclusion

The Battle of the Atlantic was the first real combat in which the Royal Canadian Navy participated. The difficulty in acquiring and building effective ASW equipment was a persistent problem in the RCN, reducing its effectiveness in defending convoys early in the war. Despite the difficulties the RCN had in securing and adopting modern equipment, it ultimately became a potent fighting force, destroying 33 U-boats during the course of the war.[37] That the RCN had this success while also having to contend with rapidly changing technology and a massive expansion of the fleet is remarkable. The growth from six destroyers to 278 warships strained Canadian industry, but it survived.[38] That the fleet did not uniformly have the most up-to-date technology caused problems during the war, but ultimately through cooperation with the RN and USN, the Battle of the Atlantic was won and that was a major factor in winning the war as a whole.

Notes

* This article is the opinion of the author, and not the opinion of the Royal Canadian Navy or the Department of National Defence.

1. James S. Pritchard, *A Bridge of Ships: Canadian Shipbuilding During the Second World War* (Montreal, QC: McGill-Queen's University Press, 2011), p. 293.
2. Roger Sarty, *Canada and the Battle of the Atlantic* (Montreal: Art Global, 1999), p. 119.
3. Pritchard. *A Bridge of Ships*, p. 229.
4. *Ibid*., p. 8.
5. Sarty, *Canada and the Battle of the Atlantic*, p. 140.
6. *Ibid*., p. 141.
7. Pritchard, *A Bridge of Ships*, p. 298.
8. Marc Milner, *The U-Boat Hunters: The Royal Canadian Navy and the Offensive against Germany's Submarines* (Toronto: University of Toronto Press, 1994), p. 88.
9. *Ibid*., p. 100.
10. *Ibid*., p. 16.
11. *Ibid*., p. 270.
12. Pritchard, *A Bridge of Ships*, p. 9.
13. Milner, *The U-Boat Hunters*, pp. 87-88.
14. Marc Milner, *North Atlantic Run: The Royal Canadian Navy and the Battle for the Convoys* (Annapolis, Maryland: Naval Institute Press, 1985), p. 219; Sarty, *Canada and the Battle of the Atlantic*, p. 135.
15. W.A.B. Douglas, et al., *A Blue Water Navy: The Official Operational History of the Royal Canadian Navy in the Second World War, 1943-1945*, Vol. II, Part 2 (Toronto: Dundurn Press, 2007), pp. 150, 223.
16. Milner. *North Atlantic Run*, p. 153.
17. Michael L. Hadley, *U-Boats Against Canada: German Submarines in Canadian Waters* (Montréal, QC: McGill-Queen's University Press, 1985), p. 31.
18. W.A.B. Douglas, et al., *No Higher Purpose: The Official Operational History of the Royal Canadian Navy in the Second World War, 1939-1943*, Vol. II, Part 1 (Toronto: Dundurn Press, 2004), p. 306.
19. Milner, *North Atlantic Run*, pp. 112-113.
20. *Ibid*., p. 123.
21. *Ibid*., p. 265.
22. Milner, *The U-Boat Hunters*, p. 15.
23. Hadley, *U-Boats Against Canada*, p. 12.
24. *Ibid*., pp. 11-12.
25. Milner, *North Atlantic Run*, pp. 34-37.
26. *Ibid*., p. 153; Douglas, et al., *A Blue Water Navy*, p. 73.
27. Hadley, *U-Boats Against Canada*, p. 204.
28. Milner, *The U-Boat Hunters*, p. 44.
29. Douglas, et al., *A Blue Water Navy*, p. 46.
30. Milner, *North Atlantic Run*, p. 266.
31. Milner, *The U-Boat Hunters*, p. 88.
32. *Ibid*., p. 62.
33. *Ibid*., pp. 72-73.
34. *Ibid*., p. 76.
35. *Ibid*., p. 75.
36. Hadley, *U-Boats Against Canada*, p. 204.
37. "The Battle of the Atlantic, 1939 to 1945," Canada.ca, 24 May 2018, available at www.canada.ca/en/navy/services/history/naval-service-1910-2010/battle-atlantic-1939-1945.html.
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