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Catherine E. Allan, CD

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This book analyzes the relationships among the Canadian navy, the scientific community and the government which affected the Canadian naval equipment programme in the Battle of the Atlantic. It argues that institutional and individual shortcomings hamstrung a service whose operational effectiveness relied on keeping technologically ahead of the enemy. It is one of the first Canadian books to examine the dynamics of technology, bureaucracy and operations.

The opening chapters introduce the key organisations and describe the RCN's early operations, the successful collaboration which produced Canadian asdic and the first radar projects. The middle chapters focus on the disastrous attempts to develop centimetric radar and lead up to the equipment crisis of 1943 which climaxed with the replacement of the Chief of Naval Staff.

A major theme is the relationship between the Canadian navy and the Royal Navy. As the author correctly points out, the tiny prewar Canadian navy's budget dictated dependence upon the RN. He condemns Canadian senior staff for dependence on the Admiralty for 'policy' decisions -- a word never satisfactorily defined in its wartime context -- and the RN for its inability to provide equipment. It is not clear what the relationship ought to have been, but it was more complex than that described. Not all Canadian, or even RCN, officers were 'content' with this approach. Some, such as the director of signals and the naval engineer G.L. Stephens, sought solutions wherever they could, simultaneously investigating potential British, Canadian and American sources. The Canadian attitude ensured unity of doctrine and policy with the RN, and therefore minimal confusion when the two operated jointly. The RN often was insensitive to Canadian requirements, but was hard pressed to fulfil its own. Puzzlingly, the book describes the navy's switch to American equipment near war's end as indicative of the RCN's independence rather than a reflection of the realignment of Canadian political-social-economic relations and of American operational primacy in the Pacific theatre.

The navy's backwardness is partly ascribed to its officers' lack of understanding or interest in technology. The author states that the Chief of Naval Staff was not interested in radar. As evidence he offers a letter from a Canadian officer to the Admiralty describing the CNS's inability to perceive the potential of radar. In fact, the letter was an RN officer's report of his briefing to the Canadian CNS. It is the RN officer who emphasises radar's air force applications, and the Canadian who politely presses for naval expertise. The date of the letter is significant: in July 1939, the RN's appreciation of radar's possibilities had not gone much beyond aircraft detection and coastal and convoy navigation. Further, not all senior officers at NSHQ lacked technical qualifications. The Director of Plans, Commander Frank Houghton -- incorrectly identified as the Director of Naval Intelligence (p 26) -- was advanced Signals and staff qualified, and came to NSHQ in 1939 from a seagoing command. The appointment of Commander G.A. Worth as Director of Signals in March, 1942, is not evidence that unqualified officers filled senior posts as NSHQ (p 53). Worth was qualified Signals and had served in senior signals positions in the RCN and RN prior to 1931. He rejoined the RCN in 1939, serving as Staff Signals Officer in Halifax, where he initiated a number of technical proposals. The book's apportionment of blame to Worth is based on unsubstantiated allegations. Worth had his shortcomings, but he is not guilty as charged. Officers are not the book's only target: wartime radar operators are described unsympathetically as leftovers, poorly trained and incompetent.

Organisational shortcomings were another factor in the sad equation of failure. A good understanding of the internal workings of the Naval Service, NRC and their channels of communication with various government departments is essential to appreciate how operational requirements were translated through research and development, to manufacture and finally to installed equipment. Organisation charts would have clarified such links. More insight is required into the ineffective Operations directorate and its rapidly expanding responsibilities. The author recognises that the reorganised Naval Staff Branch of June, 1943, provided a much improved structure with which to prosecute the war. There are minor errors: DNI and DSD did not become part of the Staff until later. The events preceding revised Allied arrangements for operational control in the northwest Atlantic were broader ranging and more complex than the narrative suggests. Other decisions are recorded out of context: the version of Worth's successful divorce of the navy from the Radar Committee, for example, ignores the navy's decision to pursue an independent course on a number of technical and policy matters, following frustration with what were perceived as conflicting priorities with one or both of the other services.

The book sometimes fails to consider the foundations of key relationships such as the partnership of sailor and scientist. In order to reap the full benefit of technology, particularly of research, the sailor must first understand the operational or tactical problem that he wants solved. Only then can he state his requirement -- in operational terms -- to the scientist. The organisation of defence science could also have been examined more objectively. That defence science was organised differently among the Allies is important to note, but C.J. Mackenzie's decision to centralise Canadian research and development on NRC should not be condemned simply because it was

different. Mackenzie's decision ought to be evaluated using more useful criteria. The litany of Mackenzie's shortcomings requires substantiation, given his reputation.

The book correctly identifies poor channels of communication between operational groups at sea and senior staffs as factors in the equipment crisis. It is also true that seagoing officers were sometimes unable to translate their frustration into accurate identification of a problem. The book does not resolve the difference, for example, between what the RN thought the Canadian problem was -- training and tactics -- and what Canadian officers thought the problem was: equipment. It does not recognise a natural tendency among officers to blame equipment, not themselves, for operational shortcomings. The conflict between seagoing groups and NSHQ over fitting deserves further exploration: seagoing officers were anxious to acquire new equipment from any source, while NSHQ was concerned about uniform installation. Both approaches were valid.

According to the author, the government's economic policies and industrial strategies also contributed to the navy's failure. No doubt they did, but it is unfair to present Ernie Forbes' centrist view as fact. The issue is not that clear cut. It can be argued that the selection of maritime shipyards for maintenance work and Great Lakes shipyards for small ship construction was at the least a fortuitous allocation of tasks, given the heavy demand for maintenance and alterations placed on east coast shipyards. His description of the Canadian shipbuilding and repair industry does, however, accurately depict its inadequacies. The portrait of those sectors of the Canadian industrial base which suffered from a 'branch plant' syndrome reveals the obstacles an advanced naval project would face. A fuller explanation of the American priority system would have been useful. The author implies that acquiring material was a simple matter of having a high priority rating; but getting the rating was a major undertaking, and Canadian liaison officers in Washington faced a daunting bureaucratic maze.

The book does more than find fault. Successful projects such as Canadian asdic and CAT gear have their place, as do acoustic and bathythermic research in general. Unfortunately, NRC-NSHQ collaboration in ionospheric research is not mentioned. This partnership, which began at the naval research facility in Chelsea, Quebec, in 1942 eventually contributed significantly to Allied meteorological data. The equipment was RN, and as usual, delivery was late, but an NRC-developed experimental set provided practice and valuable insight. It might have been useful to analyse such programmes to understand more fully why they succeeded when other projects such as RXC failed so abysmally.

It is a pity that a book about technology uses secondary sources to support technical claims, for example Admiralty results on 286 radar trials (p 36). Operation of the FH3 direction finder is described incorrectly, and the range given for ground waves over water demonstrates a misunderstanding of high frequency radio wave behaviour (p 80). There are also errors of emphasis or interpretation, some important, some not. Henderson and Heakes (p 18) did not advise on strategy, but provided technical input on radar applications. Wolf pack tactics were not 'perfected' by late summer 1940 (p 23).

General McNaughton is alternately condemned as a mere political appointment when he is selected to head NRC (p 14) and lauded for his accomplishments (p 26). The shortsightedness of Canadian naval staffs was not the only reason that corvette modernisation was poorly handled. Worth never said that the FH4 high frequency direction finder was unreliable (p 124); he warned that supply from the Admiralty would be unreliable.

For all its flaws, this is an important book. It tackles the issue of why the Canadian navy was not served by technological advantages available to its allies. Those who cite *The Great Naval Battle of Ottawa* must exercise caution. A number of conclusions are not well substantiated or are based on errors of fact, and the tactical and scientific frames of reference are incomplete. The author examines the key issues, but selectively. He points his finger at individuals and institutions rather than examining why they failed given the pressures of war. Setting priorities correctly is always easier with hindsight.

Catherine E. Allan

Major Catherine Allan, CD, is an historian with the Directorate of History at National Defence Headquarters, Ottawa.
