The Science of Defence: Security, Research, and the North in Cold War Canada

Matthew Shane Wiseman
Wilfrid Laurier University, wise5300@mylaurier.ca

Follow this and additional works at: http://scholars.wlu.ca/etd

Part of the Canadian History Commons, History of Science, Technology, and Medicine Commons, and the Military History Commons

Recommended Citation
http://scholars.wlu.ca/etd/1924

This Dissertation is brought to you for free and open access by Scholars Commons @ Laurier. It has been accepted for inclusion in Theses and Dissertations (Comprehensive) by an authorized administrator of Scholars Commons @ Laurier. For more information, please contact scholarscommons@wlu.ca.
The Science of Defence: Security, Research, and the North in Cold War Canada

by

Matthew Shane Wiseman

B.A. (Hons) and B.Ed., Lakehead University, 2009 and 2010
M.A., Lakehead University, 2011

DISSERTATION

Submitted to the Department of History
in partial fulfillment of the requirements for
Degree in Doctor of Philosophy in History

Wilfrid Laurier University
Waterloo, Ontario, Canada

© Matthew Shane Wiseman 2017
Abstract

This dissertation examines the development and implementation of federally funded scientific defence research in Canada during the earliest decades of the Cold War. With a particular focus on the creation and subsequent activities of the Defence Research Board (DRB), Canada’s first peacetime military science organization, the history covered here crosses political, social, and environmental themes pertinent to a detailed analysis of defence-related government activity in the Canadian North. Three contextual chapters on the history of federal defence research in Canada provide the foundation for a close study of defence research projects pursued and supported by the Canadian government. The dissertation focuses on northern Canada to explore and explain key developments in the history of tripartite defence relations between Canada, the United States, and the United Kingdom while also providing new perspectives on the impact of the Cold War in Canada.

To meet the impending challenges of the early postwar period, senior officials in the Canadian defence establishment decided to create the Defence Research Board and involve select scientists in discussions about policy for science and defence in North. The decision to include scientists in the policymaking process was a deliberate and functional approach that helped the Canadian government secure and strengthen its security partnership with the United Kingdom and the United States during the early Cold War. When senior officials championed science as a means to bolster Canada’s commitment to Western security, the Defence Research Board became the primary vehicle to achieve this policy aim. Select scientists obtained the political power to design, implement, and administer policies for the distribution and use of federal funds made available for scientific defence research. This was a calculated move by senior Canadian officials who wanted to further bilateral defence relations with the United States
while maintaining close ties to the United Kingdom. Including scientists in government allowed
the Canadian defence establishment to focus its limited resources on specific fields of research in
which Canada could leverage geography and “expertise” to fulfill its political agenda for postwar
security and defence in the North.
Acknowledgments

When I began research for this study, I had envisioned maintaining a full list of people to thank in my acknowledgments. I soon realized that the list of archivists, research associates, supervisors, colleagues, and friends required to complete a dissertation is simply far too great to acknowledge properly in full. A number of people made significant contributions to the study, and I would be remiss not to mention their names. My supervisor Kevin Spooner has been a sounding board for ideas since the project began. I shifted the focus of my study to the North early in the writing process and Dr. Spooner supported my decision without hesitation. His knowledge of the topic and the secondary literature is outdone only by his kindness and enthusiasm. He has guided me throughout my degree, and I am extremely thankful for his generosity and expert advice.

The finished dissertation also bears the mark of my excellent committee. I was fortunate to have Roger Sarty as a field instructor during my first year at Wilfrid Laurier University. He has edited my work on numerous occasions, given me free books from his personal library, and has been an extremely useful reference on the inner workings of the Canadian defence establishment. Ryan Touhey has also been associated with this research project since it began. His knowledge of Canadian international history and the Cold War has challenged me to refine my ideas, and I am thankful for his careful and insightful engagement with my work. Indeed, all members of my advisory committee kindly read through my dissertation and provided detailed feedback that improved the quality of the final study.

I also wish to extend my thanks to Lianne Leddy, Alistair Edgar, and Andrew Burtch. Lianne read through portions of the dissertation dealing with human research on Inuit in northern Canada, and her knowledge of Indigenous studies and the history of colonialism during the Cold
War proved most beneficial to my work. Alistair and Andrew were the examiners for my dissertation, and I greatly appreciate their attention to detail and willingness to critique my ideas.

Prior to arriving at Laurier, I was fortunate to complete a Master’s degree at Lakehead University under the supervision of Jane Nicholas. Jane continues to read my work on a regular basis and I wish to acknowledge her unwavering support, which has certainly helped me grow as a scholar. While completing my doctoral degree, I received a wealth of support through the Laurier Centre for Military, Strategic and Disarmament Studies (LCMSDS). Terry Copp offered me a research position at the Centre when I was a first-year PhD student, and the experience significantly enriched my entire degree. Terry and Marc Kilgour entrusted me with a collection of working documents that had belonged to the late George Lindsey, who was a key strategic analyst with the Department of National Defence during the Cold War. Lindsey’s papers gave me a fresh perspective on the role of science and technology in defence policy and international affairs, and the opportunity to delve deep into the working life of an influential Canadian defence analyst altered the trajectory of my studies. My dissertation topic is largely the result of my time reading the Lindsey papers, and I thank Terry and Marc for their confidence and trust. I also wish to thank the Lindsey family for inviting me into their Ottawa home and sharing with me stories and memories of their late husband and father.

Mark Humphries has been an excellent mentor and resource for me since he assumed the directorship of the LCMSDS from Terry in 2014. He is always available to discuss research, writing, or any aspect of the historical discipline, and I greatly appreciate his willingness to answer questions and provide advice. I was also able to meet and work with a number of colleagues and friends at the Centre, including Geoff Keelan and Kirk Goodlet, who both invited me to participate in an online experiment, Clio’s Current. I thoroughly enjoyed my experience
discussing history and co-writing with Geoff and Kirk, and I greatly appreciate their ongoing mentorship and support. I also wish to acknowledge Kellen Kurschinski, Caitlin McWilliams, Trevor Ford, Lyndsay Rosenthal, Matt Baker, Kyle Falcon, Kandace Bogaert, Alex Souchen, Brittany Dunn, Eliza Richardson, Eric Story, Katrina Pasierbeka, Alec Maavara, and all my other colleagues at the LCMSDS. Graduate life can be a long and arduous process, and I thank you all for your friendship and support.

Likewise, my peers in the Tri-University graduate program have been a tremendous support network. I enjoyed three wonderful years as Laurier’s representative for the Tri-University Graduate Students’ Association (TUGSA). My time as TUGSA co-president was enriched by working with Geoff Keelan, Marjorie Hopkins, Joe Buscemi, and Erin Schuurs. I also grew as a scholar by experiencing the ups and downs of graduate life alongside Ian Muller, Joshua Tavenor, Christopher Bowles, Russ Freure, Alice Glaze, and Anne Vermeyden. To my entire cohort, thank you kindly for sharing this experience. Thank you as well to Cindi Wieg, who provided administrative assistance and friendly conversation throughout my entire degree.

I owe a major debt of graduate to my family for supporting my graduate work and providing constant encouragement throughout the research and writing process. My parents Shane and Fay, siblings Jennifer and Mark, and brother-in-law Chris all gave me the time and space required to research and write the dissertation. My family took a deep interest in my work and provided reassurance when the project seemed overly daunting. The same can be said of Dorian Lane, who I was fortunate to meet at the mid-point of my degree. I am thankful for Dorian’s patience, generosity, and unwavering support. Without you all, this dissertation would not be complete.
Financial assistance covered most of the travel costs associated with the research conducted for this study. I wish to acknowledge the financial support of the Social Sciences and Humanities Research Council of Canada, the Department of History at Wilfrid Laurier University, the LCMSDS, and the Northern Research Fund program of the Churchill Northern Studies Centre. Portions of Chapters 4 and 5 are published respectively in *Canadian Military History*¹ and the *Journal of the Canadian Historical Association*,² and I want to thank the editors of each journal for allowing me to reuse my work here.

---


# Table of Contents

Abstract .......................................................................................................................... ii

Acknowledgements ........................................................................................................ iv

Table of Contents .......................................................................................................... viii

List of Tables ................................................................................................................... ix

List of Figures .................................................................................................................. x

Abbreviations .................................................................................................................. xi

Introduction ..................................................................................................................... 1

Chapter Outline .............................................................................................................. 43

Note on Terms and Definitions ....................................................................................... 48

Chapter 1 The ABC’s of Defence: Tripartite Relations and Canadian Research ............ 50

Chapter 2 Cold War Prelude: Science and Defence in Northern Canada ....................... 84

Chapter 3 Funding Defence Research and Development .............................................. 121

Chapter 4 Science and Human Performance in the North ............................................ 158

Chapter 5 Acclimatization Research on Inuit ............................................................... 186

Chapter 6 Changing Priorities and the Closure of Defence Research Northern Laboratory... 213

Conclusion ....................................................................................................................... 247

Appendix A ..................................................................................................................... 255

Appendix B ..................................................................................................................... 258

Bibliography ................................................................................................................... 259
List of Tables

Tables

A.T1 Effect on skin temperature and insulation index of immersion of right hand and forearm in 5° C waterbath | 258

A.T2 Average temperature during second half-hour of immersion of hand and forearm in 5° C waterbath | 258
List of Figures

Figures

1.1 Map showing Canada’s Treeline | 95

2.1 Map showing the Canadian Arctic Archipelago | 110

A.F1 “A patrol on the barrens” | 255

A.F2 Types of Arctic clothing tested during Sun Dog One | 255

A.F3 Defensive position during indoctrination training on exercise Sun Dog One | 256

A.F4 V-test apparatus for Mackworth’s tactile discrimination test | 256

A.F5 The V-test as pictured at Fort Churchill | 257

A.F6 “Snowhouse” construction at Fort Churchill as part of indoctrination training | 257
### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABC</td>
<td>American/British/Canadian</td>
</tr>
<tr>
<td>ACND</td>
<td>Advisory Committee on Northern Development (Canada)</td>
</tr>
<tr>
<td>AGARD</td>
<td>Advisory Group on Aeronautical Research and Development (NATO)</td>
</tr>
<tr>
<td>AINA</td>
<td>Arctic Institute of North America</td>
</tr>
<tr>
<td>CAF</td>
<td>Canadian Armed Forces</td>
</tr>
<tr>
<td>CIPA</td>
<td>Canadian Industrial Preparedness Association</td>
</tr>
<tr>
<td>CJIB</td>
<td>Canadian Joint Intelligence Bureau</td>
</tr>
<tr>
<td>CJIC</td>
<td>Canadian Joint Intelligence Committee</td>
</tr>
<tr>
<td>COPUOS</td>
<td>United Nations Committee on the Peaceful Uses of Outer Space</td>
</tr>
<tr>
<td>CWM</td>
<td>Canadian War Museum</td>
</tr>
<tr>
<td>DEA</td>
<td>Department of External Affairs (Canada)</td>
</tr>
<tr>
<td>DEW Line</td>
<td>Distant Early Warning Line</td>
</tr>
<tr>
<td>DHH</td>
<td>Directorate of History and Heritage (Canada)</td>
</tr>
<tr>
<td>DND</td>
<td>Department of National Defence (Canada)</td>
</tr>
<tr>
<td>DRB</td>
<td>Defence Research Board (Canada)</td>
</tr>
<tr>
<td>DRKL</td>
<td>Defence Research Kingston Laboratory (Canada, DRB)</td>
</tr>
<tr>
<td>DRML</td>
<td>Defence Research Medical Laboratory (Canada, DRB)</td>
</tr>
<tr>
<td>DRNL</td>
<td>Defence Research Northern Laboratory (Canada, DRB)</td>
</tr>
<tr>
<td>DRPC</td>
<td>Defence Research Policy Committee (UK, Ministry of Defence)</td>
</tr>
<tr>
<td>DRTE</td>
<td>Defence Research Telecommunications Establishment (Canada, DRB)</td>
</tr>
<tr>
<td>DSIR</td>
<td>Department of Scientific and Industrial Research (United Kingdom)</td>
</tr>
<tr>
<td>GNP</td>
<td>gross national product</td>
</tr>
<tr>
<td>HQ</td>
<td>Army Headquarters (Canada)</td>
</tr>
<tr>
<td>IAM</td>
<td>Institute of Aviation Medicine (Canada, RCAF)</td>
</tr>
<tr>
<td>IGY</td>
<td>International Geophysical Year</td>
</tr>
<tr>
<td>JIB</td>
<td>Joint Intelligence Bureau (Canada)</td>
</tr>
<tr>
<td>JIC</td>
<td>Joint Intelligence Committee (Canada)</td>
</tr>
<tr>
<td>JSES</td>
<td>Joint Experimental Testing Station (Canada)</td>
</tr>
<tr>
<td>LAC</td>
<td>Library and Archives Canada</td>
</tr>
<tr>
<td>LCMSDS</td>
<td>Laurier Centre for Military, Strategic and Disarmament Studies</td>
</tr>
<tr>
<td>MSF</td>
<td>Mobile Striking Force</td>
</tr>
<tr>
<td>NAE</td>
<td>National Aeronautical Establishment (Canada)</td>
</tr>
<tr>
<td>NARA</td>
<td>National Archives and Records Administration (United States)</td>
</tr>
<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration (United States)</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>NATO</td>
<td>North Atlantic Treaty Organization</td>
</tr>
<tr>
<td>NFB</td>
<td>National Film Board of Canada</td>
</tr>
<tr>
<td>NORAD</td>
<td>North American Air/Aerospace Defense Command</td>
</tr>
<tr>
<td>NRC</td>
<td>National Research Council (Canada)</td>
</tr>
<tr>
<td>OR</td>
<td>operational research</td>
</tr>
<tr>
<td>ORG</td>
<td>Operational Research Group (Canada, DRB)</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>research and development</td>
</tr>
<tr>
<td>RAF</td>
<td>Royal Air Force (United Kingdom)</td>
</tr>
<tr>
<td>RCAF</td>
<td>Royal Canadian Air Force</td>
</tr>
<tr>
<td>RCMP</td>
<td>Royal Canadian Mounted Police</td>
</tr>
<tr>
<td>SAC</td>
<td>Strategic Air Command</td>
</tr>
<tr>
<td>SES</td>
<td>Suffield Experimental Station (Canada, DRB)</td>
</tr>
<tr>
<td>SORO</td>
<td>Special Operations Research Office (United States Army)</td>
</tr>
<tr>
<td>SP</td>
<td>Severny Polus (North Pole)</td>
</tr>
<tr>
<td>TTCP</td>
<td>The Technical Cooperation Program</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
<tr>
<td>US</td>
<td>United States of America</td>
</tr>
<tr>
<td>USAF</td>
<td>United States Air Force</td>
</tr>
<tr>
<td>USSR</td>
<td>Union of Soviet Socialist Republics</td>
</tr>
</tbody>
</table>
Introduction

In 1948, the Defence Research Board (DRB), Canada’s first peacetime military science organization, cooperated with the Army Directorate of Military Training to sponsor the production of an Arctic training film titled *Going North*.1 Produced by the National Film Board (NFB), *Going North* depicts geography, climate, and winter living conditions of the Canadian Arctic and sub-Arctic through the experience of five soldiers training in northern Canada. Originally produced as the first in a series of winter training films, officials sponsored the production of *Going North* to introduce and educate soldiers and civil servants about living and performing military duties in the Canadian North. Presented in the film as “the least known area of Canada,” the Arctic represents a harsh space to be tamed by science, exploited for resources, and defended by specially trained men. The film portrays military kit as well as living and transport techniques developed by modern science and engineering, and the narrative emphasizes the importance of research and development (R&D) to the northward expansion of Canada’s southern population.

When considered against the backdrop of postwar security policy, *Going North* is a microcosm of Canada’s early experience with Cold War Arctic science. The DRB conceived the film under the assumption that civilian applications would follow naturally from military research. Its production depended on the cooperation of defence officials, scientists, military personnel, and executives of the NFB. The film seems to have been screened only for government and military personnel, but details on the security classification of the film remain unclear. In the end, *Going North* was the first and only release in what was supposed to be a

---

three-part series of Arctic training films. No others films appeared in the series and *Going North* became an entry on the index of the NFB archives.

This dissertation focuses on the circumstances and attitudes that gave rise to the science portrayed in *Going North*. Driven by the politics of national security and by a strong belief in the advantages of high technology, Canada’s Department of National Defence (DND) utilized science to assist the armed forces in the North and simultaneously bolster the Canadian contribution to Western security. During the early Cold War, the federal government invested large sums to attract academic scientists to defence research. By 1953, more than 100 academic staff members and nearly 300 graduate students from twenty Canadian universities had received annual research grants amounting to $500,000 from the Defence Research Board, a single branch of DND, established in 1947 to provide scientific and technical assistance to the Army, Navy, and Air Force. These numbers increased over the next twenty years and by the 1970s more than fifty universities across Canada had received DRB funding at a total annual expenditure of $3 million. When combined with the $4.5 million awarded annually for industrial research, each year the DRB allocated approximately $7.5 million of federal money to military R&D at the height of the Cold War.

The Defence Research Board implemented a wide program at eleven locations in Canada, each designed to investigate specific problems in support of the military and scientific needs of

---

2 Initially, the Canadian Army and the DRB considered releasing Arctic training films in three phases. *Going North* was a result of the first phase, which aimed to produce a film illustrating how to overcome the difficulties of Arctic climate and terrain. Although the film seems to have been the sole release of the proposed three-phase production plan, the NFB also produced *Vigil in the North* (1954), which also shows military training in northern Canada. On the three-phase production plan, see LAC, Record Group (RG) 24 F-1, vol. 3234, file DRBS 3-750-43-2, “Minutes of the 5/47 Meeting of the Arctic Research Advisory, 12 December 1947,” p. 5.


5 Ibid., 15-16.
Canada, the United States, and the United Kingdom. The northern-most facility was Defence Research Northern Laboratory (DRNL), located at Fort Churchill on the western shore of Hudson Bay in Manitoba’s northeast corner. Situated below the Arctic Circle, this location provided an ideal sub-Arctic environment to establish a research facility for northern science. Located on Canada’s tree line, the Churchill area enabled researchers to study the extremes of climate and terrain encountered in northern latitudes. The importance of northern environmental science emerged towards the end of the Second World War when Canada’s top military officials began to assess the strategic importance of the Arctic while planning for the postwar period.

DRNL, a multi-purpose research facility for year-round northern studies, was a key venue for the Canadian defence establishment during the early Cold War. What concerned North American defence officials the most was not a large-scale Arctic invasion, which seemed unlikely in the immediate postwar years. Instead, strategic analysts in Canada and the United States feared the possibility of bomber and rocket attacks on urban and industrial centres around the Great Lakes. Officials considered an air attack launched by expeditionary forces lodged on the fringes of the Canadian Arctic potentially more dangerous than an attack launched from the Soviet Union itself. Although the likelihood of an offensive incursion in the North was remote, Canada participated in cooperative measures with the United States and the United Kingdom that utilized science as a means to understand and overcome practical issues associated with northern military operations. The establishment of a permanent research laboratory at Fort Churchill, where the United States military had been stationed since 1942, gave the Canadian government an invested stake in matters considered important to the North Atlantic Alliance. Not only did the location offer a suitable northern laboratory unique to Canada’s geography and environment, but
the research facility also housed international scientists and contributed to an important network of scientific information exchange.

The Arctic sciences in Cold War Canada were not restricted to Fort Churchill. DRNL served as a base of operations for scientists and military personnel engaged in various defence-related studies, both in and outside Canada. Researchers often travelled through Churchill to gain access to more remote locations in the Canadian North, and funding provided by the Defence Research Board led to the creation of university laboratories in southern Canada that were designed to simulate the effects of a northern environment. A postwar interest in the defence and development of the Canadian North coalesced into a unique relationship among government departments, military personnel, civilian scientists, and industrial partners. In this effort, the DRB pursued science as a means to address and pronounce Canada’s commitment to North American defence and Western security.

The dissertation aims to investigate and understand the impact of the Cold War Arctic sciences in Canada and on Canadian international relations between 1947 and 1963. I use the Defence Research Board, and in particular the role and influence of its Defence Research Northern Laboratory, as a lens through which to explore and interpret my subject. I argue that Canada’s top military and defence officials considered science important to the development and implementation of policies for defence in northern Canada during the early Cold War, and that the creation and subsequent activities of the Defence Research Board allowed Canada to reaffirm and strengthen its international position within the Western security alliance.

To be clear, Canada did not have a science policy during the early Cold War. In fact, the Government of Canada first officially considered a national science policy in November 1967.
when the Senate decided to establish a Special Committee on Science Policy. The committee’s hearings began in March 1968 and ended in June 1969, leading to a four-volume report on the development of a national science policy for Canada. Within a year of the first volume appearing in 1970, the activities of the newly-formed Ministry of State for Science and Technology marked the beginnings of Canada’s first federal policy for science.

Prior to the establishment of an official science policy, the Canadian government utilized various bureaucratic structures to govern the conduct of science. During the period under investigation in the dissertation, the federal government spread responsibilities for the North across various departments, agencies, and among select individuals. Administration in the North influenced the development and implementation of scientific activities related to defence, particularly in the eastern region around Hudson Bay. In the absence of a regional government, scientific research in the Northwest Territories was the responsibility of the federal departments that undertook the research. For the Defence Research Board, this meant scientists had the power to create, implement, and administer scientific research projects. The DRB developed internal levels of bureaucracy to ensure quality and efficiency of work, but the structures put in place allowed scientists to pass judgement on their own ideas.

The dissertation deals exclusively with defence research to avoid any confusion with policies developed to govern general scientific activities in the Canadian North. On 1 April 1947,

---

6 It should be noted that the Canadian government created the Science Secretariat in 1964 and the Science Council in 1966. In 1968, the Science Council published an assessment of government science; see Science Council of Canada, *Towards a National Science Policy* (Ottawa: Queen’s Printer, 1968).


an amendment to the Department of National Defence Act (R.S.C. 1927, c. 136) provided for the establishment of the Defence Research Board.\(^\text{10}\) In addition to the Chiefs of Staff of the three services, the President of the National Research Council, and the Deputy Minister of National Defence, the initial Board included prominent academic scientists from a number of Canadian institutions: Charles Best of the University of Toronto; Paul Gagnon of Laval University; J.H.L. Johnstone of Dalhousie University; Otto Maass of McGill University; and Gordon Shrum of the University of British Columbia.\(^\text{11}\) Under the guidance of this Board, the Canadian government established defence research as a “fourth arm” of the services.\(^\text{12}\)

The bureaucratic structure of the Defence Research Board is vital to understanding the role and influence of defence research in Canada during the early Cold War. Upon establishment of the DRB, the administration and governance of Canadian defence research became the responsibility of the individuals appointed to serve on the various committees and panels created to support the organization as a whole. Minister of National Defence Brooke Claxton described the impetus for, and importance of, defence research in his 1947 policy statement:

> The advisory committees [of the DRB] will serve to make available to the armed forces the best scientific advice that is available in government, university and industrial research laboratories. These committees will also help to keep the whole scientific community of the country in touch with the problems of defence to facilitate rapid mobilization in time of need.\(^\text{13}\)

With regard to the Canadian North, the Defence Research Board established an interdepartmental Arctic Research Advisory Committee with Hugh Keenleyside, the Deputy


\(^{11}\) Colonel R.D. Harnkess of the Northern Electric Company was also among the appointed members.

\(^{12}\) Claxton, *Canada’s Defence*.

\(^{13}\) Ibid.
Minister of Mines and Resources, as Chairman. The committee helped coordinate the scientific efforts of government departments in the North and identified areas that required further research. A collective recognition of the need for a coordinated effort emerged out of the DRB’s Arctic deliberations, which produced a recommendation to Cabinet that resulted in the creation of the Advisory Committee on Northern Development (ACND) in January 1948. The ACND considered and advised on policy matters concerning civilian and defence activities in the North, but the allocation of resources and personnel required a flexible government approach to ensure proper and adequate administration.\textsuperscript{14}

The period 1947 to 1963 represents an intriguing period to study the development of Canadian policies for science and the North during the early Cold War. Scholars have used the term “Whole of Government” to explain the federal approach to northern policy and planning during this period.\textsuperscript{15} The Advisory Committee on Northern Development was relatively inactive following a series of initial meetings in 1948-49, until it emerged rejuvenated in 1953 because of a change in the priorities of Louis St. Laurent’s Liberal government. Before then, administration in the North was collaborative and co-dependent. Yet, even during the mid-1950s when the ACND was most actively involved in the development and advisement of northern policy, administration in the North remained inadvertently flexible. Although key personalities such as Keenleyside observed the need for a consistent and growing government presence in the North, the harsh climate of Canada’s northlands posed continuous problems for effective administration. To overcome the practical issues of administration and governance in the North, members of the ACND championed science as a means to protect and promote federal priorities with regards to

\textsuperscript{14} Ibid.

\textsuperscript{15} See, for instance, P. Whitney Lackenbauer and Daniel Heidt, \textit{The Advisory Committee on Northern Development: Context and Meeting Minutes, 1948-66}, Documents on Canadian Arctic Sovereignty and Security (DCASS) Number 4 (Calgary: Centre for Military and Strategic Studies, University of Calgary, 2015), viii.
social, economic, and military development. In turn, the Defence Research Board became the primary vessel for government science in the North.

Prior to the Royal Commission on Government Organization of 1960-63, scientific research projects supported by the Defence Research Board were not subject to external review. In other words, the DRB was fully responsible for the administration and governance of the defence research activities carried out under its patronage. While the top-down Board, committee, and panel structure enabled the Defence Research Board to review projects on a semi-annual and annual basis, scientists who received a financial grant from the DRB had full autonomy to carry out the defence research project. Once a grant application received approval from the DRB, the lead scientist on the application became solely responsible for the project. Officials with the DRB did not administer, govern, or otherwise oversee defence research projects supported by the organization. This would have been impractical considering the large volume of grants distributed by the Defence Research Board. But practicality aside, the DRB distributed grants with the expectation that the grant-receiving scientist was the person most suited to carry out and monitor the defence research project in accordance with the wider policies of the Defence Research Board. In short, scientists who received financial support from the DRB, because of the power granted to the DRB under the National Defence Act, had considerable authority to conduct a range of scientific activities under the umbrella of defence research.

This dissertation explores the growth of defence research in Canada, the emergence of the Defence Research Board, the funding structure of the organization, and then uses the context of the early Cold War to examine the impact of scientific defence research conducted in the Canadian North. The circumstances covered here provide insight into the influence of scientific
ideas, the power of federal priorities, and the function of government administration in Canada during a significant period in world affairs.

By examining the interplay between economics, technology, military, and politics this dissertation accepts the premise that Canada’s postwar defence policy was shaped by societal factors and the nature of the Cold War within which science, defence, and diplomacy were practiced. Analysis of this sort yields original findings about Canadian Cold War priorities concerning security and science in the North. Defence research offered a means to address two crucial anxieties about the Canadian North during the early Cold War. The first relates to long-standing government concerns over territorial control in the North, and specifically the role of science and technology in asserting that control. To be precise, the scientific focus of the Defence Research Board placed its research establishments at the centre of a broader political agenda to secure and strengthen Canadian sovereignty and security in the North.

Defence Research Northern Laboratory was particularly useful in establishing cognitive and territorial claims over the North. This was especially important during the immediate postwar period, as senior officials in the Canadian government responded to American wartime activity in the North. Approximately 43,000 military personnel and civilians from the United States worked in northern Canada constructing airfields, military bases, supply roads, and weather stations during the Second World War. The looming threat of a possible Soviet attack over the Pole exacerbated uncertainty in Ottawa over American activity in the North after the war. Knowing that the United States was prepared to defend its interests in the North with or without Canada, officials in Ottawa had to craft policies for the postwar period that would protect and promote Canadian autonomy in the North. As Hugh Keenleyside remarked in 1949,

Canada had “not gained independence from London in order to relinquish it to Washington.” He shared Mackenzie King’s concern that Canada might be separating from Britain only to be absorbed by the United States. As documented in the dissertation, the history of defence research in northern Canada suggests science was useful to address Canadian anxieties over territorial sovereignty in the North during the first two decades of the postwar period.

Science also addressed the real concerns or anxieties over Soviet activity in the Arctic. The requirements of postwar defence in the North extended beyond Canada’s limited defence budget. Adequate defence in the North depended on access to the resources and capabilities of the United States. Fort Churchill and Defence Research Northern Laboratory gave Canadian officials a tangible asset that represented Canada’s physical, financial, and scientific contribution to Western security in the North. This was not only important from the practical standpoint of security; competition mattered as well. The Arctic was an ideal stage to demonstrate scientific prowess, and both the United States and the Soviet Union invested heavily in Arctic science as a means to show dominance over nature. A close study of the history of the DRB and its connection to the North reveals that the competitive aspects of the Cold War affected Canadian defence policy. The marriage of scientific and military affiliations in the North represented Canada’s firm commitment to Western democratic values, and Canadian officials accepted the idea that support for modern science and engineering was essential to ensure Western superiority in the postwar period.

Official / Internal Publications on the Defence Research Board

As a member of the North Atlantic Alliance, Canada’s Cold War defence posture was highly scientific and technical. Tripartite defence relations with Britain and the United States depended

---

17 Keenleyside, quoted in Grant, Sovereignty or Security?, 191.
on coordination among various research initiatives and establishments, many of which were located on Canadian soil. While a few studies have broached this field, historical scholarship on Canada during the early Cold War has yet to examine the relationship of science and technology to national security and defence. The first historical overview of the DRB appeared in 1958 when Donald Goodspeed published *A History of the Defence Research Board of Canada*. Goodspeed’s account covers the formative years of the DRB and provides important details for understanding the institutional history of the organization. The book is thorough in its coverage of the events and discussions that led to the creation of the DRB and its affiliated research establishments, including the Defence Research Northern Laboratory. Goodspeed’s perspective is analytically narrow, however. He wrote the book while he was a Captain in the Historical Section of the Canadian Army in 1956-57, and this early publication date did not permit the contributions of DRB experts to be placed in the broader context of Canada’s Cold War experience. In fairness, Goodspeed’s book covers well the origins and evolution of the DRB in the early Cold War years and thus remains extremely valuable to the history of Canada’s postwar science and technology policy covered in this dissertation.

In addition to Goodspeed’s official history, there have been several informal internal histories of the Defence Research Board authored or co-authored by its employees. In the case

---

of the Defence Research Northern Laboratory, former superintendent Archie Pennie compiled an excellent account of individual reminiscences by employees who had lived and worked at Fort Churchill. The first-hand perspectives offer unmatched insight of particular importance to this dissertation, for which it was possible to gather only limited oral history material. Internally published reports are also valuable to the historical record, such as an annotated bibliography of DRNL projects compiled for the Defence Scientific Information Service by G.K. Davies in 1965. Moreover, the DRB produced a small number of short publications that provide historical background information as well as brief overviews of the research projects considered by the organization to have made important contributions to Canadian scientific development.

That many publications about the Defence Research Board derive from the desire of former employees to record the history of defence research in Canada is indicative of a community of like-minded individuals. Defence scientists often speak highly of their colleagues in written records. This is evident in a 1994 book titled Perspectives in Science and Technology, which is a collection of articles originally presented two years prior to publication at a symposium in honour of the DRB’s founding Chairman, Omond Solandt, who is described by the editors of the book as a “physician, soldier, scientist, and above all, innovator … whose

21 Unfortunately, many of the persons with direct knowledge of and experience with the Defence Research Northern Laboratory are deceased. I was unable to interview former employees of DRNL, although I did speak with citizens of the town of Churchill and former employees of Fort Churchill, the military base where DRNL was located. To supplement this material, I used interviews originally conducted for an oral history project initiated by the Canadian War Museum, which, fortunately for this dissertation, included an interview of Archie Pennie conducted prior to his death. See Canadian War Museum (CWM) Archives: Sound Recordings 31D 10 Pennie, “Interview with Flight Lieutenant Archie Pennie [sound recordings]: CWM Oral History Project,” Ottawa, Ontario, Canada: Canadian War Museum, 16 January 2009.
record was outstanding in organizing and managing the practical application of science to problems in war and peace.”

The collection features first-person accounts written by some of the scientists and engineers who not only experienced Canadian research and development during the Second World War but who also contributed significantly to the growth and utility of collective Allied science in the early postwar period. The first-hand experiences and perspectives of the contributing authors highlights the pace and intensity of technological growth in both Europe and Canada at a time when non-military expertise became increasingly important to developments in international security.

The collection provides direct insight into the influential role Solandt played as a pioneer in the field of operations research and as a visionary in Canadian science. Amongst the twenty speakers whose papers comprise the collection, George Lindsey, a prominent defence analyst for the DRB, contributed an essay titled “The Management of Science in the Defence Research Board.” Solandt’s ability to cultivate constructive links between scientists and the bodies or groups whose activities their research supported impressed Lindsey the most. In the concluding remarks of the collection, Lindsey and fellow editors Cecil Law and David Grenville reflect on Solandt’s determination. In their estimation, Solandt resisted “the pressures of bureaucracy to submit to the management of scientific personnel to the procedures applied to the administrative civil service, which were not well adapted to the problem of identifying and quickly employing unusual individuals with special qualifications.”

---

25 Ibid., 239.
26 Ibid.
**Historical Secondary Sources on the DRB**

While the Defence Research Board has received little direct attention, several Canadian-focused scholars have published histories that reference some of the activities of the organization.

Stephen Bocking’s work has broached the topic of the DRB’s contribution to the field of aerial geography, and he has written generally on the intersection of government science and colonial authority in northern Canada. Andrew Godefroy’s research covers the history of Canada’s space-related activities, which includes detailed analysis of the DRB’s Alouette satellite program and the Churchill Rocket Range. Edward Jones-Imhotep is a well-published author on electronics research and the crosscurrents of technology and nature pertaining to Canadian science in the Cold War. Both John Vardalas and Scott Campbell have written on the DRB’s financial research connection to computing, while Vera Pavri-Garcia’s research examines intergovernmental cooperation and exchange between the Defence Research Board and the Department of Communications in the 1960s. Most recently, Jason Ridler wrote a biography of

---


Omond Solandt for his doctoral thesis that he later published as a full-length book.\textsuperscript{31} Ridler covers Solandt’s involvement in defence research during the Second World War and with the establishment of the DRB.

Although these scholars deal in part with some of the research activities or individuals of the Defence Research Board, only one recent history discusses the organization as a primary focus. In 2012, Jonathan Turner defended his doctoral dissertation, which provides an institutional history of the DRB between 1947 and 1974.\textsuperscript{32} Turner’s study focuses primarily on the management structures of the DRB within the Department of National Defence. He also examines the impact of intergovernmental politics on the creation and implementation of policies for defence research in Canada. As the first scholarly examination covering the whole of DRB’s history, his work is an institutional survey study similar to Goodspeed’s official history. The details covered by Turner are impressive. His research is comprehensive in scope and provides a sufficient historical foundation from which to explore the history of the Defence Research Board in relation to scientific, technical, military, political, and international developments concerning Canada and the early Cold War.

The current body of scholarship available on defence research in Canada leaves many unanswered questions about the specialized activities of the Defence Research Board. While Goodspeed and Turner cover a wide range of important topics in their work, survey histories require supplementary analyses based on specific and closely defined research questions. In addition to Godefroy’s work on space research, only one publication has examined the wider


impact of DRB activity on Canada. In *Pathogens for War*, historian Donald Avery discusses Canadian involvement in biological science and germ warfare research during and after the Second World War. Much of the book concentrates on research conducted at the DRB’s Suffield Experimental Station (SES), situated near Medicine Hat, Alberta on land acquired by the Government of Canada during the war. Avery provides a thorough overview of SES and his work shows the value of delving deep into the history of a single research establishment of the DRB.

Inspired by the opportunity to explore uncharted territory of Canada’s early Cold War history, this dissertation examines the DRB’s interest and scientific activity in the Canadian North. The research focuses almost exclusively on the Defence Research Northern Laboratory and the various sciences facilitated by Fort Churchill. The literature relevant to this topic derives from three separate but interconnected fields: Cold War science, Canadian international history, and the Canadian North.

**Cold War Science**

While Canadian histories that focus on Cold War science are scarce, Canada’s historical literature is a rich field that includes important and relevant studies on government science and technology. Prior to his work on the Suffield Experimental Station, Donald Avery published an important book titled *The Science of War* in 1998, which describes the emergence and evolution of the Canadian contribution to Allied military technology during the Second World War. A year before Avery’s book appeared, George Lindsey published an edited collection titled *No Day
Long Enough in which he and the contributing authors described their personal experiences with wartime research and development. Many of the authors had joined the Defence Research Board after the war, and the collection of articles is a valuable resource on the direction of Canada’s federal scientific defence effort during the early postwar years. The dissertation utilizes this scholarship in the first two chapters, which explore the history of defence research in Canada and militarization in the North during and after the Second World War. Context of the pre-Cold War period is necessary to fully appreciate and understand why senior military and defence officials in the Canadian government pursued and supported northern defence research as a means to bolster Canada’s position within the Western security alliance.

Several older sources remain highly valuable to the historical study of Canada’s early Cold War defence research. Robert Bothwell has produced two works on the history of atomic energy in Canada, Nucleus and Eldorado. Together with the works of Wilfrid Eggleston (National Research in Canada) and Mel Thistle (The Inner Ring) on the National Research Council, the institutional history of federal science in Canada during the interwar years and the Second World War is well covered. Eggleston also wrote Scientists at War, a study that focuses on influential figures, wartime science, and the direction of government priorities.

Scientia Canadensis: Canadian Journal of the History of Science, Technology and Medicine has released two special issues of particular relevance to the field. The first appeared in

---

35 George Lindsey, ed., No Day Long Enough: Canadian Science in World War II (Toronto: Canadian Institute of Strategic Studies, 1997).
38 Wilfrid Eggleston, Scientists at War (London: Oxford University Press, 1950). Incidentally, Eggleston’s title has recently reappeared on the cover of an American study about the ethics of weapons research during the Cold War; see Sarah Bridger, Scientists at War: The Ethics of Cold War Weapons Research (Cambridge, MA: Harvard University Press, 2015).

Outside of Canadian literature, there is a wealth of historical scholarship on Cold War science in Britain and the United States. By questioning the impact of government on science, scholars in the United States continue to debate the so-called “Forman thesis,” which maintains national security concerns distorted the natural or true path of the physical sciences in the Second World War and Cold War. The production of knowledge remains a key issue in this debate, but American scholarship also tackles issues concerning the production of technology. Authors such as Seymour Melman have sought to determine if the demands of the national security state enhanced or inhibited processes of research and development. Chapter 3 of the dissertation asks similar questions of the Defence Research Board. While the United States expended greater financial and physical resources on R&D than Canada during the early Cold War, representatives of the Department of National Defence openly voiced concerns for Western security in order to attract civilian scientists to defence research. A critical appraisal of the DRB’s funding structure suggests defence research supported and grew fundamental scientific research in Canada. Whereas military patronage may have impeded or altered the trajectory of the social and physical sciences in the United States, Canada’s approach to defence research was one of openness rather

39 Yves Gingras and Richard A. Jarrell, Building Canadian Science: The Role of the National Research Council (Ottawa: Canadian Science and Technology Historical Association, 1991).
than direction. The Defence Research Board supported fundamental research in the hope that a wide and diverse approach to science might produce results with a military applicability. Only after rearmament for the Korean War (1950-53) did Canada’s postwar approach to defence research change, and the DRB increased its support of scientific projects directly applicable to military activity.

Although scholars of Canada should be careful in their use of such themes as the “military-industrial-academic complex,” it seems imprudent not to learn from the analytical developments that have yielded deep insights for American Cold War scholarship.43 The term military-industrial complex has sparked scholarship and debate since President Dwight D. Eisenhower warned of the perils of militarization—secrecy, corruption, state power, and coercion—in his farewell address of early 1961.44 Deeply critical of the influence of defence on economy, the original concept has since been applied to a myriad of studies concerning the role of government in society. The term broadened to include “academic” when historians of science began to investigate the deep financial linkages between state and university affiliations in the United States during the Cold War.45 While critics charged the military with creating a “warfare state,” recent scholarship has re-examined the military-industrial-academic complex to explain the importance of military patronage to the growth of scientific research in the United States. Mark Solovey, for instance, has replaced the word “complex” with “nexus” to explain how

45 See, for instance, Stuart W. Leslie, The Cold War and American Science: The Military-Industrial-Academic Complex at MIT and Stanford (New York: Columbia University Press, 1993). The broadening of American Cold War scholarship resulted from interdisciplinary studies of the period that introduced historians to new forms of analysis. For a brief yet sophisticated exploration of this development, see David A. Hounshell, “Epilogue: Rethinking the Cold War; Rethinking Science and Technology in the Cold War; Rethinking the Social Study of Science and Technology,” Social Studies of Science 31, no. 2 (2001): 289-297.
government support of academic research led to a greater visibility and influence of the social sciences in national affairs.46

Understanding the complex relationship between military and scientific authorities in the United States allows us to further understand the role, structure, and influence of defence research in Canada. Indeed, scholarship on science and technology in the Cold War United States is analytically broad. The literature is comprised of institutional histories that explain the origins of such government establishments as the Department of Defense’s Advanced Research Projects Agency, but also a range of sociocultural studies that situate government science within broader Cold War contexts.47 Some of the most relevant works on American military research include Donald MacKenzie’s *Inventing Accuracy*, Stuart Leslie’s *The Cold War and American Science*, and Paul Edwards’ *The Closed World*.48 While these books were some of the first to address the military-industrial-academic complex as a major Cold War theme, the topic continues to inspire historical scholarship. This is evident in Solovey’s recent work on the militarization of the social sciences that produced an edited collection titled *Cold War Social Science* and a monograph titled *Shaky Foundations*; both provide wider context for understanding the function of defence research in the early postwar period.49 Furthermore, Joy Rohde’s *Armed with Expertise* and Audra Wolfe’s *Competing with the Soviets* represent two recently published and important


syntheses on science, technology, and the United States government.\textsuperscript{50} Both books engage deeply with the Cold War connection between military, industry and the academy.

In relation to a history of the Defence Research Board, these studies on the military patronage of science in the United States tell us much about the influence of the American national security state in Canada during the early Cold War. In the first decade after the Second World War, the United States military funded more research than any other federal agency.\textsuperscript{51} A significant amount of military R\&D occurred in university laboratories and industrial research institutes sponsored by the Pentagon. But as Rohde contends in her historical assessment of Pentagon-sponsored social research, “Americans embraced, challenged, and adapted to political and intellectual militarization.”\textsuperscript{52} While some social scientists embraced military-related research as a means to protect and promote the goals of the national security state, others voiced concerns over the increasing militarization of American democracy. Rohde traces this debate as it played out in the Special Operations Research Office (SORO), a multidisciplinary research institute created by the United States Army in 1956.

Although Canada’s Defence Research Board emerged nine years prior to SORO, important questions arise when comparing the research initiatives of both organizations. SORO dealt exclusively with political matters, whereas the DRB sponsored defence research in a variety of scientific fields and did not insist on research closely aligning with defence priorities. In this respect, the DRB was not a significant force for the militarization of science. Nevertheless, despite their differences, SORO and the DRB both occupied a unique space between academia and government. Indeed, the creation and subsequent activities of the Defence

\textsuperscript{50} Audra J. Wolfe, \textit{Competing with the Soviets: Science, Technology, and the State in Cold War America} (Baltimore, MD: Johns Hopkins University Press, 2012); Rohde, \textit{Armed with Expertise}.

\textsuperscript{51} Rohde, \textit{Armed with Expertise}, 5.

\textsuperscript{52} Ibid., 6.
Research Board partly reflect Canada’s response to American militarization and the influence of postwar Western security ideology. This is particularly apparent in the history of Canada’s Arctic-related defence research during the early Cold War, where the DRB sponsored research in the North to bolster Canada’s scientific contribution to the tripartite security alliance. Ultimately, while the military-industrial-academic complex does not apply directly to Canada, the concept is useful to assess the history of Canadian defence research during the Cold War. Unlike the American Pentagon, Canada’s defence establishment was not the primary patron of academic research in this period. Yet the Defence Research Board was one of only two federal funding agencies (the other was the National Research Council) to support academic research, which means political priorities for defence and security did influence the academic sciences in Canada. The Arctic is particularly important because it represents an area of Cold War research that demonstrates the union of military and scientific affiliations in Canada, a relationship facilitated largely by the funding structure and organizational mandate of the Defence Research Board.

British literature on the postwar militarization of science is also useful to the Canadian context. Of the more relevant studies is David Edgerton’s Warfare State. Although not concerned with analyzing the strategic importance of the Polar Regions to western security in the early Cold War, Edgerton’s thematic approach to the Department of Scientific and Industrial Research marries the American military-industrial-academic complex with postwar defence history in the United Kingdom. His work builds on older scholarship such as Ronald Clark’s The Rise of the Boffins, which chronicles the contribution of science to British national security in wartime.

---

Historiography on Cold War defence research in the United States and the United Kingdom is particularly relevant to the dissertation because of the relative youth of the field in Canada, but also due to the nature of the Western security alliance and the history of scientific information exchange among all three tripartite partners in the early postwar period. The Defence Research Board opened liaison offices in Washington and London, and as documented in the dissertation, officials with the DRB shaped Canadian priorities for defence research in response to the diverse yet specific research and development projects undertaken outside of Canada. To secure the benefits of a security partnership with both the United States and the United Kingdom, the DRB had a mandate to avoid duplication of effort and pursue only research areas where Canada could make a unique contribution to the tripartite collective. For reasons of geography, terrain, climate, and population senior officials in Ottawa leveraged the Canadian North and the federal government strengthened Canada’s primary security partnership during the early Cold War. Understanding the history of defence research in the two countries most closely allied with Canada thus helps to explain the perception by top Canadian officials of the role of science in supporting the national interest for defence and security, both at home and abroad.

**Canadian International History and the Cold War**

The literature on the history of Canadian foreign policy in the post-1945 period is substantial, and a number of particular studies in this area helpfully shaped the dissertation. Charles Stacey’s *Arms, Men and Governments* and Jon McLin’s *Canada’s Changing Defense Policy, 1957-1963* are two canonical texts that are still valuable in understanding the strategic circumstances encountered by the Canadian state and military in the immediate postwar period, even though...
McLin concentrates on the Diefenbaker years. For broad examinations of the Cold War and Canadian foreign relations, Robert Bothwell’s *The Big Chill* and *Alliance and Illusion* provide good syntheses of Canadian foreign policy in this era, and Greg Donaghy’s *Canada and the Early Cold War, 1943-1957* focuses on key, relevant years. Historians such as Isabel Campbell (*Unlikely Diplomats*) and Ryan Touhey (*Conflicting Visions*) have also contributed to our understanding of Canada’s Cold War role internationally, with specific studies that address the role played by Canada and Canadians in particular regions, Europe and Asia respectively. Campbell’s work is especially valuable to Chapter 6 of the dissertation, which examines the increasingly international role played by scientists of the Defence Research Board during and after the Korean War. Other seminal works by Denis Stairs (*The Diplomacy of Constraint*) and Denis Smith (*Diplomacy of Fear*) remain valuable for their detailed analysis of Canadian diplomacy in the early postwar period.

These works provide a strong contextual base for the thesis of this dissertation, especially when considering the value of science to the North Atlantic Alliance during the early postwar period. Canada made important military and material contributions to the Allied victory in the Second World War, and Canadian diplomat Hume Wrong devised the principle of functionalism, which stated that Canada’s position and voice should reflect its contributions to international

---


security. This principle is key to understanding the history of defence research in the Canadian North during the early Cold War. As a political “middle power,” Canada had little choice but to rely on its Western partners to secure Canadian interests after the Second World War. The concept of a middle power emerged after the war as a way of explaining Canada’s international role or status in relation to other countries. “Canadians were of greater consequence than the Panamanians but could not take on the obligations of the Americans, or even the French,” John Holmes wrote upon reflection in 1984. Holmes was referring specifically to Canada’s postwar foreign policy, and to the pragmatic approach of senior Canadian diplomats who utilized international institutions—the United Nations, the Commonwealth, and the North Atlantic Treaty Organization (NATO)—to increase Canada’s “voice” and wield a level of influence in international affairs.

My use of the term middle power has more to do with Canada’s position relative to the United States and Britain, where Canadian defence policy included a scientific element to define and emphasize Canada’s useful and unique contribution to Western security. Aware of the centrality and importance of science to national defence in both the US and the UK, officials in the Department of National Defence created the Defence Research Board to strengthen Canada’s commitment to Western security. The primary mandate of the DRB was to provide scientific and technical assistance to the Canadian armed forces, but this could only be achieved through direct

---


61 For a more recent and detailed account of Canada’s role as a middle power in international forum, see Adam Chapnick, *The Middle Power Project: Canada and the Founding of the United Nations* (Vancouver: University of British Columbia Press, 2006).
cooperation with similar agencies in the US and the UK. In order to gain access to American and British resources and expertise, the DRB pursued defence research only in fields where Canada could make a unique contribution. The decision to invest heavily in Arctic defence research was a deliberate and functional approach, designed to leverage Canadian science, geography and environment. Canada not only improved its position in the Western security alliance, but also bolstered its national security while maintaining territorial sovereignty in the North.

The notion of security and sovereignty in the North is the focus of a large body of scholarship on continental air defence, which provides insight into the development of bilateral security relations between Canada and the United States during the early Cold War. Joseph Jockel’s two books on Canada’s involvement in North American Air/Aerospace Defence (NORAD) are a clear starting point, but Andrew Richter (Avoiding Armageddon), Sean Maloney (Learning to Love the Bomb), James Fergusson (Canada and Ballistic Missile Defence), and Randall Wakelam (Cold War Fighters) have also published on the topic. Although the core of this dissertation predates the technological threat posed to North America by ballistic missiles, the history of continental air defence includes detailed and relevant examination of the bomber threat and the role of radar in the defence of the Canadian North.

One of the original and more important contributions here is what the dissertation adds to our knowledge of Canadian defence relations in the postwar period. While a considerable

---

volume of works is available on bilateral security relations between Canada and the United States, much less discusses the changing relationship between Canada and the United Kingdom in the years following the Second World War. In the deliberations that led to the establishment of the Defence Research Board, senior officials in the Canadian government carefully considered pragmatic approaches to maintain close defence relations with the United Kingdom while increasing bilateral ties with the United States. Scientific information exchange and liaison was central to the entire process, and the dissertation documents the resolve of Canadian officials who utilized science as a means to define Canada’s security interests during the early Cold War.

The dissertation also benefits from a number of important studies that explore the impact of the Cold War in Canada. Scholars such as Tarah Brookfield (Cold War Comforts), Andrew Burtch (Give Me Shelter), and Robert Teigrob (Warming Up to the Cold War) have contributed recent works that provide added context to some of the social and cultural themes first introduced by Reg Whitaker and Gary Marcuse in their watershed book Cold War Canada. Sociocultural analyses are particularly important here to assess the role and function of the Canadian government in the North. Scientists funded by the Defence Research Board often interacted with members of the Royal Canadian Mounted Police (RCMP) and representatives from other government departments when they travelled north to conduct research. Interdepartmental relations reveal the DRB’s connection to Canada’s national security state. During the Cold War, for instance, the RCMP selectively screened foreign scientists who applied for grant monies from the DRB. Moreover, some of the specific Arctic defence research projects

---

(documented in chapters 4 and 5) supported by the DRB impacted military personnel and civilians in the North. Other scholars such as Kurt Jensen (Cautious Beginnings) and most recently David Zimmerman (Maritime Command Pacific) have traced the varied impact of the Cold War in Canada through in-depth examination of intelligence and maritime security. While rooted in a Canadian context, the diversity of subjects covered by these authors shows the complexity of circumstances imposed on Canada because of the new international climate resulting from the Cold War.

**The Canadian North**

Historical scholarship on the Canadian North is a growing field comprised of political, social, cultural, economic and environmental studies. Works most relevant to this dissertation include those concerned with policy development, government administration, and scientific and military activity. The starting point for this research is a 1966 collection titled The Arctic Frontier, which resulted from a three-year collaboration between the Arctic Institute of North America and the Canadian Institute of International Affairs. Edited by Ronald Macdonald and introduced by John Holmes, the collection discusses government administration, sovereignty, strategy, and international scientific relations in Canada, the United States and the Soviet Union. Moira Dunbar and Robert Sutherland, two of the foremost individuals tied to the Defence Research Board, both contributed articles that offer insight into their work. Dunbar’s contributions are particularly relevant in Chapter 2, which provides a geopolitical history of the Canadian North that explains the importance of defence research to decisions in Ottawa concerning sovereignty.

---


and security in the North. She studied sea ice for the Defence Research Board, and her work on Arctic geography was important to developing Canadian strategy for the early postwar period. Sutherland also made an important contribution to Canadian defence and security, although his area of expertise was in operational research. Along with individuals such as George Lindsey, an aerospace physicist and strategic analyst for the DRB, Sutherland’s work in operational research influenced Canadian strategy during the development and implementation of the North American air defence network.

Two years after the publication of The Arctic Frontier, the Department of Energy, Mines and Resources published a two-volume collection titled Science and the Hudson Bay to mark the centenary celebrations of Canada that had taken place the year prior. Over fifty authors contributed to the collection, including two of the more prolific Arctic commentators, Graham Rowley and Margaret Carroll. Rowley first traveled to the Eastern Canadian Arctic as an archaeologist in 1936. After serving in the Canadian Army during the war, he became secretary and coordinator of the Advisory Committee on Northern Development and later scientific adviser to the Department of Indian Affairs and Northern Development. Carroll was a member of the Department of National Defence and wrote about the history of Canadian military activity in the North. Her contribution to the collection, “Defence Forces Operations in Hudson Bay,” is relevant here for its thorough coverage of northern Manitoba and the Churchill area. She explains the history of joint Canada-United States military projects in the North during the

Second World War, and contextualizes Defence Research Northern Laboratory within a detailed discussion of postwar military activity in the Hudson Bay area.

Outside of major collaborations, one of the first contributors to the historiography of the Canadian North was Morris Zaslow. As a pioneer of northern studies, he produced two seminal books for the *Canadian Centenary Series*. The latter of his two books, *The Northern Expansion of Canada, 1914-1967*, provides an historical overview of northern industrialization through an examination of economic, social and political development in the Yukon and Northwest Territories. Although dated, Zaslow’s work remains relevant. His contribution to northern historiography is clear by the degree to which subsequent scholars have expanded on or challenged his work.

A second generation of northern scholars emerged in the tradition of Zaslow and made significant contributions to the field throughout the 1980s and 1990s. Among them were Bruce Trigger (*Natives and Newcomers*), J.R. Miller (*Skyscrapers Hide the Heavens*) and Kerry Abel (*Drum Songs*). These scholars introduced ethno-historical and oral history analyses to research and write about Indigenous peoples, which brought attention to the importance of individual agency and voice with regard to Canadian history. Although they did not focus on the North as a primary area of study, their works had a significant influence on the field. The issue of Indigenous peoples’ agency and voice is especially relevant in Chapter 5, which explores the involvement of Inuit in a series of experiments designed to study cold-tolerance in the human body.

---


body. The Defence Research Board funded the research project with the intent to apply the findings to military and service work in the North.

As studies that examined the historical treatment of Indigenous people in Canada’s North began to engage with sensitive debates that had long surrounded Indigenous-state relations in the public, historians such as Kenneth Coates, who had lived in the North, wrote and published academic literature in support of Indigenous rights. Collaborations such as The Modern North and Northern Visions, the former published more than a decade prior to the latter, show the evolution of the field over a relatively short period. As Canadians became increasingly aware of the contemporary situation of Indigenous peoples in the North, scholarship reflected the need to better place the North within Canadian history. Issues of geography, climate, human adaptation, and Indigenous-state relations coalesced and now histories of northern Canada broach a variety of topics that include and extend beyond assimilative narratives.

Of particular importance to this dissertation are works by Shelagh Grant and Whitney Lackenbauer. Grant has produced two excellent historical studies (Sovereignty or Security? and Polar Imperative) that provide comprehensive coverage of government activity and interest in the Canadian North. Based on thorough archival research, both works provide an ideal contextual base to support a study of the Cold War sciences in northern Canada. Lackenbauer has also made two important historical contributions to the field, Battle Grounds and The Canadian Rangers, which provide contextual information pertinent to this dissertation.

work illuminates relationships between government officials and Indigenous communities. With particular reference to military activity in the North, Lackenbauer’s research offers insight that builds on Grant’s extensive examination of Canadian sovereignty. In addition to his stand-alone publications, Lackenbauer is the series editor of a useful collection of Documents on Canadian Arctic Sovereignty and Security. He has also co-published on topics related to the militarization of the Canadian North.

Scholars Matthew Farish and Adam Lajeunesse have also published materials relevant to the study of Cold War science in the Canadian North. Although not focused on the Defence Research Board, Lajeunesse’s work provides valuable insight for this dissertation. His book *Lock, Stock, and Icebergs* provides a thorough history of Canada’s Arctic maritime sovereignty, which is important to a comprehensive understanding of Canadian defence policy in the early Cold War. Farish, on the other hand, is an historical geographer who researches knowledge production and militarization in the context of the Cold War American Arctic. He has written articles that explore the concept of “war on nature,” and his book *The Contours of America’s Cold War* documents the perception and use of geographical and environmental sciences by the United States government and military in the early postwar period. Farish’s book touches on

---


75 For instance, see P. Whitney Lackenbauer and Matthew Farish, “The Cold War on Canadian Soil: Militarizing a Northern Environment,” *Environmental History* 12, no. 4, Special Issue on Canada (October, 2007): 920-950.


some of the Arctic research activities of the DRB and his work provides important details on Canada-United States Cold War Arctic relations. His analysis of the Arctic Aeromedical Laboratory at Fairbanks, Alaska is particularly useful when comparing the history of Arctic defence research in the United States with the activities that occurred at Fort Churchill. Furthermore, his approach to historical geography is useful when examining the production of Arctic knowledge in Canada. He argues that the Arctic frontier was engineered by military and scientific affiliations in the United States.\footnote{Farish, \textit{The Contours of America’s Cold War}, 176.} This dissertation employs a similar argument to explain how and why the Defence Research Board leveraged Arctic knowledge and geography to secure and strengthen Canadian defence relations. During the early Cold War, senior military and defence officials conceptualized the Arctic as an ideal space for scientific exploitation. Only in this context was the Arctic a \textit{useful} tool for a political agenda.

**Primary Sources**

This dissertation relies heavily on primary sources to analyze the Defence Research Board and the development of Canada’s Cold War Arctic policy. Government documents, newspaper clippings, scientific literature and oral interviews provide some evidence of wider societal responses to Canadian defence research and development in the period under examination. As a methodological approach, relying on primary evidence has both advantages and disadvantages. Public documents provide a lens through which to explore change and continuity in societal responses to the government’s defence research priorities, and are of particular importance to this study because the DRB deliberately used print media as a conduit to disseminate its scientific and technological “achievements,” both domestically and internationally. Arctic research

received considerable coverage in print media and much of the coverage resulted directly from public relations outreach by the DRB.

The dissertation is cautious in its use of newspaper material. Similar to other government institutions, National Defence had its own Directorate of Public Relations that controlled the release of defence-related research information originating from DND branches, including the DRB. The nature of newspaper publishing also shapes content in particular ways, and often reflects editorial rather than governmental priorities. Nonetheless, official DRB press releases and print media coverage of defence research activities provide, in addition to unique insight into the institutional makeup of Canada’s DND, an unmatched and useful primary record of Canadian science during the Cold War.

A history of the DRB must begin with an overview of its origins and establishment within the DND. The first scientists recruited to work for the DRB were Canadian veterans of the Second World War. Operational research (OR) analysts were among the first to systematically apply science to the study of war. A useful collection of documents pertaining to Canadian OR is available in the extensive archival records of the Department of National Defence at the Directorate of History and Heritage (DHH) in Ottawa. Of particular value to this study are the George Lindsey and Robert Sutherland fonds. Sutherland was Chief of the Operational Research and Analysis Establishment, a branch of the DRB that applied operational science to study vulnerabilities in Canadian defences during the 1950s and 1960s. In 1967, Lindsey replaced Sutherland. Lindsey was an aerospace physicist and Canadian veteran of the Second World War who worked in operational research during the war. DHH maintains declassified records related to both Sutherland and Lindsey, which provide a wealth of information pertaining to the Cold War defence activities of the DRB. Additionally, the Laurier Centre for Military, Strategic and
Disarmament Studies (LCMSDS) holds the George Lindsey fonds, a second archival collection of work-related documents that Lindsey wrote and collected during his thirty-five year career at DND and in retirement as a Senior Research Fellow with the Canadian Institute of Strategic Studies between 1987 and 2005.

In addition to documents held at DHH and LCMSDS, there are relevant records at Library and Archives Canada (LAC). All official DRB press releases issued by the Directorate of Public Relations can be found in RG 24 (Department of National Defence), vols. 10339 and 10340. Also located in RG 24 are DRB headquarters records, reports, Chairman’s records, and graphic material. Other associated files on the DRB at LAC can be found in RG 25 (External Affairs) and RG 85 (Northern Affairs). Additionally, *Documents on Canadian External Relations* provide important contextual information on Canadian defence policy for the period 1947 to 1963.

Beyond Ontario, there are several archival collections pertinent to this dissertation. The Personal and Confidential Series and the Prime Minister’s Office Series in the Diefenbaker papers, located at the Diefenbaker Canada Centre of the University of Saskatchewan in Saskatoon hold the records of John Spinks, an important scientist sponsored by the DRB. Spinks’ records include information on entomology pertinent to the North as well as general documents on the DRB’s extramural research programme. Records from university scientists funded by the DRB also derive from the archives of Queen’s University, the University of Toronto, and Dalhousie University.

The town of Churchill, Manitoba maintains a small archival collection in its Public Library. The records consist mainly of materials preserved by members of the Churchill Ladies Club, including now out-of-print town newspapers, public service announcements, town reports,
and photographs. Unfortunately for this dissertation, the oldest print newspaper in the Churchill Public Archives dates from 1959. Nonetheless, some of the available documents describe social and cultural aspects related to Fort Churchill and government activity on the shore of Hudson Bay around the Churchill area. In addition to this material, Lorraine Brandson, the Curator of the Itsanitaq (formerly Eskimo) Museum in Churchill, wrote a guide to the natural and cultural heritage of the region that provides a detailed chronological history of the town and some information on the local activities of the Defence Research Board.\textsuperscript{79}

As vital as the DRB was to tripartite defence activities and relations, it is important to examine records at archival institutions outside of Canada. Located at the National Archives and Records Administration (NARA) in College Park, Maryland are useful annual reports originally produced by the DRB and then sent from Ottawa to Washington, DC. The dissertation also uses relevant volumes of the \textit{Foreign Relations of the United States} series and declassified American documents available online through the National Security Archive of George Washington University.

\textbf{Historical Context on the DRB}

The Defence Research Board, responsible for scientific research and its application for defence purposes, emerged in 1947 as a division of the Department of National Defence. The DRB offered scientific advice to the Minister of National Defence as well as scientific and technical assistance to the Canadian Armed Forces. In addition to conducting scientific defence research at various research establishments throughout Canada, the DRB also had extensive involvement in international defence partnerships such as NATO.

Omond Solandt returned to Canada to become the first Chairman of the DRB upon its establishment in 1947. Solandt invited a number of scientists he had met during the war to enroll in various positions in the DRB. Primary research suggests the DRB recruitment process was an institutionalized government response to Cold War anxieties; defence researchers (scientists and engineers) helped National Defence pursue and manage what historians refer to as “big science.”

Historians use the term “big science” to describe changes in science that occurred in industrial nations during and after the Second World War. During this period, governments increasingly influenced scientific progress by funding large-scale projects. In Canada, research facilities established under the patronage and direction of the DRB served the defence scientific interests of Canada as some of the most modern establishments of their kind. Accordingly, the DRB represents an institutionalized embodiment of Canadian innovation and modernity in the early Cold War.

The recruitment process and scientific initiatives conducted by the DRB offer insight to clarify Cold War priorities in Canada at the intersection of science, politics and security. Determining the degree to which the DRB was representative of scientific priorities in the Canadian defence establishment is a challenging task, however. In 1957, C.A. Pope argued the DRB had become the “keystone of defence science in Canada,” which seems accurate considering the scope of the DRB’s activities. As a modern and sophisticated division of National Defence, the DRB conducted defence research in areas that included geophysics and the Arctic, maritime and space, electronics and telecommunications, medical and environmental protection, aeronautics, civil defence, operational research and guided missiles. This research

---

often garnered international recognition, as several of these scientific activities promised useful applications for civilian as well as national security interests.

The Defence Research Board was very much a national, or at least in geographic terms, a Canada-wide research organization. It was impractical to conduct research on such a wide scale in one Canadian location, so the DRB established multiple research facilities in various regions of the country. Although the various DRB establishments outside of the Canadian North are generally beyond the scope of this dissertation, scientific information exchange is a consistent feature in the primary source records of the Board. Headquarters activities occurred at DND Headquarters in Ottawa, and just east and west of the city respectively were the Defence Research Telecommunications Establishment and the Chemical Laboratories. The DRB’s other Ontario-based facilities included a biological research program conducted at the Defence Research Kingston Laboratory and a medical activities program conducted at the Defence Research Medical Laboratories in Downsview, Toronto. Downsview scientists investigated the physical capabilities of military men, and some of their work had direct ties to the DRB’s Arctic program.

The Defence Research Board operated establishments outside of the Province of Ontario, too. The DRB’s Naval Research Establishment had two locations, one at Dartmouth, Nova Scotia and another at Esquimalt, British Columbia. A weapons program existed at the Canadian Armament Research and Development Establishment in Valcartier and there was an animal disease protection facility in Grosse Ile on the St. Lawrence River near Québec City, Québec. Furthermore, at Suffield, located near Medicine Hat, Alberta, scientists conducted biological, chemical and flame warfare trials as part of an entomological program that resulted in the
development of offensive weapons techniques. These extensive activities took place concurrently with the program of Arctic research conducted at Fort Churchill and in the Canadian North.

The dissertation begins in 1947 with the establishment of the Defence Research Board and ends in 1963 at the conclusion of the Royal Commission on Government Organization. The introduction of ballistic missiles in the late 1950s drastically altered the geostrategic role of the Canadian North in considerations of North American continental defence. Prior to the launch of Sputnik in October 1957, when long-range bombers posed a primary threat, the Canadian defence establishment pursued a program of scientific research to aid the military in preparing for the potential defence of the Canadian North. While the DRB was concerned with the maritime and air defence of the North, this dissertation focuses on some of the scientific research projects meant to improve the land element of Canada’s northern defences. It is within this context that the DRB’s Arctic initiatives provide insight pertinent to a direct investigation of Canadian defence priorities during the first decade after the Second World War.

In assessing the significance of the Defence Research Board to both the Canadian government and wider public, economics must be considered. Between its inception in 1947 and its highpoint in the late 1950s, the annual budget of the DRB increased between $7 and $10 million each year from an initial operating cost of roughly $4 million. As defence research expenditures grew, the DRB regularly provided grant monies to employ researchers at universities throughout Canada. Operational costs also covered liaison offices in London and Washington, which in turn helped foster and expand Western tripartite defence relations in the early postwar period. Federal financial support of the DRB suggests the Canadian government

---

82 Godefroy, Defence and Discovery, 19. General information on Canada’s financial commitment to early postwar scientific and defence research may also be found in King, A. et al., Reviews of a National Science Policy: Canada (Paris: Organisation for Economic Co-Operation and Development, 1969).
valued defence research and made a strong commitment to apply science to its own strategic interests.

**Theoretical Framework**

Examining Canada’s experience with defence research in the North during the early Cold War is only possible because of the strong foundation of the existing historical scholarship. Historians have documented the policymaking process, debating extensively whether sovereignty or security was the primary driving force behind Canada’s federal policy for the North in the years following the Second World War. Historian Shelagh Grant posed this challenge by arguing that bilateral cooperation with the United States hindered and threatened Canadian sovereignty in the North.  

Her interpretation has been challenged by other scholars. David Bercuson and Elizabeth Elliot-Meisel, for instance, have stressed the benefits of bilateral cooperation when examining Canada’s early Cold War defence relations with the United States.  

At the other end of the spectrum, historian Jack Granatstein has claimed that the history of Canada’s northern policymaking process is marred by incoherence.  

“Regrettably,” Granatstein has observed, “the lack of concern for the North and the regular and almost automatic acquiescence in American requests since 1942 had eaten away some of Canada’s rights.” This argument runs contrary to the assessment of historians P. Whitney Lackenbauer and Peter Kikkert, who contend that the

---

83 Grant, *Sovereignty or Security?*
86 Ibid., 30.
development of Canadian policy for the North was cautious, pragmatic, and ultimately successful.\textsuperscript{87}

Historian Adam Lajeunesse has argued that “the truth of the matter lies somewhere between these competing schools of thought.”\textsuperscript{88} He concedes that senior officials effectively developed and executed a policy to quietly strengthen Canada’s claim in the North, but asserts that public articulation of the cautious bureaucratic approach failed. The public, in his estimation, was confused and dissatisfied with the apparently ambivalent federal approach toward the North. While this discontent helps explain the diverse and contentious nature of scholarship in the field, a close analysis of the activities of the Defence Research Board shows the value of science to the development of policies for defence in the North during the early Cold War.

Given the significance of the Defence Research Board to the development and implementation of Canada’s Cold War defence policy, scientific defence research received special attention in considerations and decisions about northern Canada. Science shaped federal priorities in Ottawa during the period under investigation here. The decision to involve scientists in policy discussions for science and defence in the North paid immediate dividends for the federal government. In the process of crafting and shaping effective northern policies to meet the evolving issues of the immediate postwar period, senior officials in the Canadian defence establishment championed science as a means to bolster Canada’s commitment to Western security. The primary vehicle to achieve this policy aim was the Defence Research Board, and the bureaucratic structures of the DRB enabled and supported range of environmental sciences


\textsuperscript{88} Lajeunesse, Lock, Stock, and Icebergs, 7.
pertinent to military operations in the North. This pragmatic approach of senior officials in National Defence strengthened Canadian claims in the North and secured beneficial arrangements with both the United States and the United Kingdom. Ultimately, the unique circumstances examined in this dissertation explain how and why the federal government employed scientific defence research to protect and promote national interests in the North during the early Cold War.
Chapter Outline

1) The ABC’s of Defence: Tripartite Relations and Canadian Research

This chapter explores the history of defence research in Canada and provides context for key developments that shaped the Canadian approach to northern defence research during the early Cold War. The North Atlantic partnership highly influenced Canada’s scientific and technological activity in this era, and the tripartite defence relationship with the United Kingdom and the United States played a key role in shaping Canadian Cold War Arctic policy. Interestingly, the history of defence research in Canada seems to contradict a school of thought deeply rooted in the historiography of Canadian Cold War foreign relations, which suggests the North American bilateral defence partnership gradually diminished the significance of the United Kingdom in Canadian defence policy. New findings presented in this chapter suggest DRB officials sought to secure for Canada the benefits of a strong and equal scientific relationship with both the United Kingdom and the United States. The Canadian Arctic represented an area in which Canada could make a unique contribution to Western security. Recognizing American and British interest in Arctic security, Canadian officials crafted a functional approach that saw Canada use science and the Arctic to its advantage. This research nuances the continentalist school of thought, or what Robert Teigrob has referred to as Canada’s “reorientation of national allegiances.”

2) Cold War Prelude: Science and Defence in Northern Canada

Moira Dunbar became one of the world’s better-known Arctic scientists while working for the Defence Research Board between 1947 and 1978. Along with Keith Greenaway, Dunbar made

---

1 Robert Teigrob, Warming Up to the Cold War: Canada and the United States' Coalition of the Willing, from Hiroshima to Korea (Toronto: University of Toronto Press, 2009), 5.
numerous flights over the Arctic to map Canada’s wide northern expanses. Through an analysis of the DRB’s mapping of the North, this chapter explores how officials with National Defence and External Affairs conceptualized the Arctic from a geostrategic perspective. In so doing, the information presented in this chapter brings to light new details on the strategic value of aerial photography to Canada’s Cold War Arctic defence in the era prior to the development of missile technology. When long-range nuclear bomb-carrying strategic bombers posed the primary threat to North America, Dunbar and Greenaway photographed and monitored large ice floes in the Canadian sector of the Arctic Ocean. This chapter documents high-level concerns in Canada over Soviet and American activity in waters north of Canada, and raises new questions about Canadian sovereignty and defence during the first decade of the postwar period. The information presented here is essential to understanding the scientific activities of the Defence Research Board in the Canadian North, because competition was an influential element of the Cold War. North American officials showed concern for Soviet scientific prowess in the Arctic during the early postwar period. In response, the Department of National Defence utilized the DRB to showcase Canada’s contribution to Western security. Leveraging science and geography gave the Canadian government a vested stake in discussions about North American defence in the Arctic while maintaining close relations with the United Kingdom.

3) Funding Defence Research and Development

This chapter explores institutional priorities of Canada’s postwar defence establishment through an examination of the Defence Research Board’s internal and extramural research programs. The large majority of DRB experts were university-educated males between twenty-five and forty-five years of age, which suggests the Defence Research Board was a highly privileged establishment. To lure scientific recruits, DRB awarded in excess of $40,000,000 between 1947
and 1970 to Canadian universities and research institutions. This was particularly important for Arctic research during the early postwar period when academic scientists in Canada had only limited access to financing for Arctic fieldwork. “The main exception to the lack of government support of university field scientists was the Defence Research Board,” wrote Trevor Lloyd, a preeminent Arctic traveler, geographer and commentator from McGill University. “The Board,” he continued, “maintained a systematic program of arctic fieldwork that took scores of university scientists and graduate students to the Arctic, thus marking a major contribution to the high standing that Canada enjoys in arctic research today [1978].” Using important questions first developed in Cold War literature concerning British and American science in the postwar period, this chapter explores how and why the DRB established links between defence, industry and the academy in Canada. Because Arctic science was imperative to postwar Canadian defence interests, the DRB became Canada’s primary patron of Arctic research. This chapter demonstrates the importance of Arctic research to the Canadian defence agenda by situating the DRB’s support of Arctic research within a financial history of Canada’s defence budget during the early Cold War.

4) Science and Human Performance in the North

For a six year period between 1947 and 1953, scientists supported by the Defence Research Board administered physiological and psychological experiments on Canadian soldiers conducting indoctrination training for Arctic warfare. Designed in an attempt to determine the ideal characteristics of cold-weather military personnel, a series of studies conducted in the

---


Canadian North by a leading British scientist resulted in physical and mental injury to two participating soldiers. Although the army immediately questioned its participation in further DRB testing because of these injuries, ethical considerations for human testing did not deeply penetrate the military or defence discourse concerning the involvement of soldiers in acclimatization research and indoctrination training. This chapter, examining cold-weather human testing in the Canadian North, explores and explains scientific defence research and information exchange between Canada and the United Kingdom in particular.

5) Acclimatization Research on Inuit

Between 1947 and 1954, the Defence Research Board funded a research team from Queen’s University to study the effect of cold on the human body. Designed for and carried out on white medical students and Inuit, a series of physiological and biochemical experiments aimed to determine how much cold exposure was required to achieve acclimatization. A distinguished Canadian scientist with experience from the Second World War led a team of researchers who made six trips to northern Canada over the eight-year period. Five trips took the team to Southampton Island in the north of Hudson Bay and a sixth to both Southampton Island and Igloolik in the northeast corner of present-day Nunavut. Researchers took samples of blood, plasma, urine, skin, and liver from “Eskimo test subjects” and transported the “specimens” to university labs in southern Ontario for independent and comparative biochemical analyses with samples taken from white persons. This chapter situates these experiments in the context of defence research designed to assist military and service work in the Canadian North during the early Cold War.
6) Changing Priorities and the Closure of Defence Research Northern Laboratory

Rearmament for the Korean War had immediate and lasting consequences for the Defence Research Board. When the Canadian military rearmed to assist the United Nations forces in Korea, the Department of National Defence received an influx of funds but also a new agenda. This marked part of a wider change to the institutional priorities of the DRB, and the organization shifted its primary focus from fundamental to applied research. The DRB sent operational research analysts to Korea to examine the fighting tactics and weapons effectiveness of the coalition forces. An international scientific presence strengthened Canada’s stature amongst allies and showed the Department of National Defence exactly where the DRB could continue to make a unique contribution to the Western cause. Korea also impacted the DRB at home. A number of key scientists made important strategic and technical contributions to the development of the North American air defence network. In the years immediately following the Korean War, changes in the strategic threat as a result of Soviet technological developments forced the DRB to reallocate significant portions of its operating budget away from laboratory research. The nature and scope of Arctic research changed because of these circumstances.
Note on Terms and Definitions

For the purposes of this dissertation, the “Arctic” refers to the region north of the tree line (“Inuit Nunaat”), which includes the Arctic Archipelago as well as the islands and waters situated to the north of the Canadian mainland.¹ The term “the North” is a more inclusive term and is employed here in reference to the regions commonly referred to as “North of 60,” including parts of Yukon, the Northwest Territories (NWT), and Nunavut. A significant portion of the dissertation concentrates on Churchill, Manitoba, which lies on the fifty-eighth parallel. Although technically below the sixtieth parallel, the dissertation includes the Churchill area in references to “the North”.

There are differences between the terms “the North” and the “Canadian North,” but I decided to use the terms interchangeably because of the archival records employed here.² In keeping with the context of the period, the dissertations adopts terms and definitions for the Canadian North from the evidentiary record of available government documentation. According to 1948 records from the Department of Indian Affairs, the NWT composed the land portion of the Dominion lying north of the sixtieth parallel between Hudson Bay on the east and Yukon Territory on the west.³ By extension, the NWT also included the islands between the Canadian mainland and the North Pole, including those in Hudson Bay, James Bay and the Hudson Strait. Under the Northwest Territories Act (Chapter 142 R.S.C. 1927), administration in the NWT was

² The “Canadian North” includes the territories and the northern regions of Quebec, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia; “the North” includes Yukon, the Northwest Territories, and Nunavut—commonly referred to as “North of 60”.
³ The United States National Archives and Records Administration (NARA), College Park, MD, RG 319, vol. 2761, file Precis on Canada’s Arctic and Sub-Arctic North of the 60th Parallel, Ottawa: Department of Indian Affairs, January 1948, p. 32.
the responsibility of a territorial government composed of a commissioner of the NWT, a deputy commissioner and five councillors appointed by the Governor General. The council functioned not only as a legislative body, but also in an advisory capacity to the Minister of Mines and Resources on matters pertaining to the administration of the NWT.

In the context examined here, the terms “sovereignty” and “security” are not interchangeable. Internationally, the protection of sovereignty usually refers to state protection of boundaries from foreign interference. Conversely, security commonly describes the methods by which a state protects the well-being of its citizens from a foreign threat. According to these definitions, protection of Canadian Arctic sovereignty refers specifically to the protection of Canada’s northern boundaries, while the protection of Canadian Arctic security refers to the response taken by the federal government to protect the well-being of northern citizens from foreign threats.

Other terms and definitions are in the notes of the dissertation where required to explain the context of the relevant chapter.

---

4 During the late 1940s and early 1950s (the period covered in the dissertation), the territorial government for the NWT included Hugh L. Keenleyside (Commissioner); Roy A. Gibson (Deputy Commissioner); John G. McNiven, Louis de la C. Audette, Harold B. Godwin, James G. Wright; Stuart T. Wood; and Robert A. Hoey (Members of Council).

5 The dissertation borrows definitions for “sovereignty” and “security” from Canadian Arctic policy scholar Rob Huebert; see “Canadian Arctic Security: Shifting Challenges,” in International Relations and the Arctic: Understanding Policy and Governance, Robert W. Murray and Anita Dey Nuttall, eds., (Amherst, NY: Cambria Press, 2014), 131-163; explanation for definitions provided on p. 132.
Chapter 1

The ABC’s of Defence: Tripartite Relations and Canadian Research

This chapter traces key developments in the history of Canadian national research. While substantial government interest in the Arctic region developed during the Second World War, the next two decades saw more permanent and consequential attempts to alter and improve northern landscapes and lives. Yet the history of state-driven modernization in the Canadian North predates the onset of the Cold War period. The roots of defence science in Canada lay in a set of entangled wartime experiences. Both major conflicts of the twentieth century influenced the emergence, growth and evolution of Canadian national research.

Tracing the impact of Canada’s wartime research experience is essential to discern developments in policymaking that created the circumstances for Canadian Cold War Arctic science. While military and defence officials shaped the foundation of Canada’s national research, we should not ignore the crucial role played by social scientists. The relationships established between representatives of the Canadian state and social scientists indicate an intricate web of ambitions and priorities. Moreover, diplomats, bureaucrats and scientists from the United Kingdom and the United States also influenced the structure and pattern of national research in Canada. The extent of that impact is the focus of this chapter. I draw attention to the history of an informal postwar connection among the Atlantic partners known as the tripartite ABC (American/British/Canadian) relationship.¹ Each nation participated in areas of mutual

---

strategic interest, cooperating in joint projects and, to a degree, exchanging vital information on research and development.

For Canada, tripartite relations provided military and defence officials the opportunity to maintain close ties to the United Kingdom and build ties with the United States. Interestingly, the tripartite relationship seems to belie the idea that Canada’s early Cold War defence policy was entrenched in the North American bilateral partnership with the United States. Canadian officials, I argue, remained committed to the Commonwealth and pursued a flexible policy that assured Canadian participation in the tripartite system while enjoying the advantages of British and American resources. The tripartite ABC relationship represents a balancing act, and the cautious diplomacy of Canadian officials provides insight for contextualizing developments in Canada’s postwar science and defence policy.

Origins of Defence Research

The origins of defence research in Canada date to the First World War when the United States and the United Kingdom created government agencies devoted to research. Both countries supported research in a move to direct their national efforts, apply science and engineering to the wartime need for weapons development, and to strengthen the collective organization of defence. The British established the Department of Scientific and Industrial Research (DSIR) in 1915, while the Americans formed a National Research Council in anticipation of their entry into the war in 1916. That same year, Canada established an Honorary Research Council in response to a requirement of the British Empire that all colonial governments create corollary organizations similar to the DSIR.²

Although established under the Imperial British umbrella, the structural model for Canada’s Honorary Research Council differed from its parent organization. The British DSIR emerged as a collection of research facilities administered by high-level advisors and policymakers. In contrast, the Canadian agency did not have research facilities and served government solely in an advisory role. A limited number of scientists and engineers in Canada found wartime employment with government agencies outside the Department of Militia and Defence, but war-related research and development in Canada was minimal because of the military’s reliance on British resources.\(^3\)

A significant period of organizational change began for the Honorary Research Council in 1917. As the First World War drew to a close, the Council decided to divert its focus from the military needs of the British government to the support of university and industrial research in Canada. At the time, Canadian universities relied heavily on scientists and engineers trained in the United Kingdom and the United States to fill faculties and teach undergraduate courses. The Council aimed to change the scope of national research in Canada through a renewed focus on financial support of academic and industrial research external to Ottawa.

Despite its initial modest budget and size, the Honorary Research Council gained political support and grew in the decade following the end of First World War in 1918. The growth of the organization was slow but meaningful. By the mid-1920s, the Council had

---

\(^3\) Some of the government departments that employed scientists during the war included Agriculture, Mines and Fisheries. Canada’s Department of National Defence emerged in June 1922 when the Parliament of Canada passed the National Defence Act, which merged the Department of Militia and Defence, the Department of Naval Services, and the Air Board.
awarded over 300 scholarships and fellowships to nearly 200 students across sixteen departments at twelve Canadian universities. 4 Although statistics are not an accurate measure of quality, the Council had provided funding to support the post-graduate work of no fewer than 155 students by 1926. While 123 of the 155 funded students actively conducted research in Canada, the organization underwent a name change to reflect its renewed status and emerged rebranded as the National Research Council (NRC). 5

The NRC increased its annual allotment of research funding until 1931. The Depression began two years prior in October 1929 and although the Canadian government continued to fund external research, economic forces of the period capped the growing NRC budget and funds stayed internal to support the base salaries of its 300 employees who worked at a series of newly constructed laboratories in Ottawa. 6 As external research funds dwindled, so too did any hope of expanding the existing internal infrastructure of the organization. Operational costs increased during the period, and both the external and internal growth of NRC activities came to a halt.

The 1935 change in federal leadership from R.B. Bennett’s Conservative government to William Lyon Mackenzie King’s Liberal government did little to change the economic situation of national research in Canada. Prior to King’s electoral victory, Bennett had promised Major-General Andrew McNaughton, who succeeded Henry Troy as President of the National Research Council, that an organizational budget increase was on the horizon. McNaughton assumed the Presidency of the NRC in 1935 in part because of Bennett’s promise, but upon taking office the Liberals cancelled these budgetary commitments and the budget of the NRC remained stagnant. 7

4 Eggleston, National Research in Canada, 24.
5 In his history of the National Research Council, Wilfrid Eggleston puts the official numbers at 344 combined scholarships and fellowships to 199 students.
6 Avery, The Science of War, 44.
7 According to Jonathan Turner, Bennett promised McNaughton an increase in NRC funds to support applied research in fields with a military interest. McNaughton had worked on an early version of radar known as Cathode Ray Direction Finders and his well-established military career made him an ideal choice to replace Troy at the helm.
**Science and the Second World War**

In the lead up to the Second World War, the scope and nature of national research in Canada changed in anticipation of another global conflict. Germany violated the Treaty of Versailles and remilitarized in 1935, while Italy defied the League of Nations the same year and invaded Abyssinia (modern-day Ethiopia). McNaughton replied to the escalation in global tension by concentrating NRC resources on applied science projects related to military fields. Under his tutelage, the National Research Council pursued and funded research on artillery, aviation, medicine, gas masks and radar. By the onset of mobilization for the war in 1939-40, the internal and external initiatives of the NRC had converted from peacetime to war-related research.

McNaughton’s desire to support military research lacked federal funding. Although King’s Liberals established a Cabinet Defence Committee in 1935 to respond to the increasing tension in global affairs, Canada’s national defence budget grew only slightly each year prior to the war. The budget was $36,000,000 during the latter years of the Great Depression in 1937-38. Nonetheless, McNaughton had positioned the NRC at the fore of Canada’s scientific and technical effort at the outset of war in September 1939.

The extent of national research in Canada changed again in June 1940 after the fall of France. In support of the United Kingdom against the Axis powers, the Canadian government passed the National Resources Mobilization Act on 21 June, and the NRC immediately assumed full responsibility for the organization and implementation of scientific and technical research related to military applications. The possibility of military defeat at the hands of Nazi Germany

---

forced the British government to seek assistance from Canada and the United States. Defence science cooperation within the North Atlantic triangle increased as a result. Cooperation between Canada and the United States led to the Ogdensburg Agreement of August 1940 and the creation of the Permanent Joint Board on Defence, which formalized a shared commitment to defend the north half of the Western Hemisphere. Seven months later in March 1941, the British and Americans signed the ABC-1 defence agreement for military cooperation. In the following month, Roosevelt and Mackenzie King met at Hyde Park, New York and made a commitment to close cross-border cooperation in defence production.\(^9\)

Formalized wartime cooperation with the United Kingdom and the United States had a significant impact on the structure and performance of Canadian defence research. The National Research Council and the Department of National Defence received only limited access to top-secret British information during the first year of the war, while military technology in the United States remained virtually closed to Canadian officials. The situation changed following the trans-Atlantic scientific missions led by Sir Henry Tizard for the United Kingdom and Dr. James Conant for the United States in 1940-41, after which Canadian scientists gained access to the world of sophisticated American military technology through collaborative work and information exchange with British counterparts.\(^10\)

As the wartime demand created a need for advanced weaponry, cooperation between the National Research Council and the Armed Forces became direct and formal. When McNaughton served from 1939 to 1944 as Commander of First Canadian Corps and later as Lieutenant-

---


General of First Canadian Army, C.J. Mackenzie took the helm as acting President of the NRC. The two men were likeminded in their commitment to defence research and with the support of the military, Mackenzie managed to build and maintain beneficial relationships with powerful Cabinet ministers such C.D. Howe (Munitions and Supply) and C.G. Power (Defence for Air).Although he did not occupy a position comparable to that of Frederick Lindemann, the wartime science advisor to British Prime Minister Winston Churchill, Mackenzie’s connection to the inner circles of wartime government brought the NRC to the fore of Canada’s federal bureaucracy.

Scientific Cooperation and Exchange

The security alliance between Canada, the United Kingdom, and the United States that influenced Canada’s early Cold War experience with defence research derived from wartime scientific military cooperation. Historians seem to agree that the British Scientific and Technical Mission to North America under Sir Henry Tizard was a catalyst for cooperation among the three partner countries. An eminent defence scientist in the United Kingdom and Rector of the Imperial College of Science and Technology, Tizard visited Washington and Ottawa in August and September 1940 to explore methods of scientific information exchange and cooperation in defence research, development and production.

---

11 Ibid.
12 As evidence on this point, historian Andrew Godefroy points to the 1944-45 NRC annual report, which states explicitly that the organization, for the first time in its history, was to act as an advisor to government departments such as National Defence. See Godefroy, “Wartime Military Innovation and the Creation of Canada’s Defence Research Board,” in Canada and the Second World War: Essays in Honour of Terry Copp, Geoffrey Hayes, Mike Beethold, and Matt Symes, eds., (Waterloo: Wilfrid Laurier University Press, 2012), 201.
14 Stacey, Arms, Men and Governments, 507.
The Tizard mission was a response to Britain’s perilous situation following the fall of France in June 1940. The British recognized that there were not enough scientists and engineers in the United Kingdom to fill the escalating wartime requirement. Moreover, according to military historian C.P. Stacey, the vulnerability of Britain’s industrial base to air attack made decentralization desirable.\textsuperscript{15} North American scientists, engineers, land and resources offered a plausible and friendly solution to some of Britain’s most pressing wartime concerns. The situation proved fortuitous for Canadian research and development. As issues over patent rights and security dissipated after the Tizard mission, scientists, engineers and research agencies in Canada gained access to fields of information and technical development previously protected by the British. The National Research Council grew to meet the demand. The organization matured from a single laboratory in 1939 to twenty-two establishments by the end of the war in 1945, and simultaneously facilitated as many as 280 external projects at other laboratories across Canada. The Council also fortified its political power through the operation of thirty-three Associate Research Committees, nearly 100 subcommittees, and continued cooperation with university and industrial leaders. Equally significant, the NRC opened liaison offices in London and Washington to maintain close and continuous information exchange.\textsuperscript{16}

Although it is difficult to ascertain the full impact of Canada’s wartime research and development, Canadians made key contributions to expedite Allied victory. Important scientific advances occurred in such fields and technologies as radar, weapons and ammunition production, medicine, operational research, and chemical, biological and nuclear research.\textsuperscript{17} As the principal

\textsuperscript{15} Ibid.

\textsuperscript{16} Ibid.

\textsuperscript{17} For a detailed first-hand perspective written by Canadian scientists and engineers who contributed to national research and development during the Second World War, both on the home front and overseas, see George Linsey, ed., \textit{No Day Long Enough: Canadian Science in World War II} (Toronto: Canadian Institute of Strategic Studies, 1997).
organizing body of wartime research and development, the National Research Council identified and recruited scientists and engineers from laboratories in universities, industry and government to fill required research needs. Canadians also contributed to the wartime effort with British or American organizations.\textsuperscript{18} Many scientists and engineers from Canada served in the United Kingdom during the early years of the war, while others joined American agencies after the United States entered the conflict in December 1941.

Planning for Postwar Defence

While the complete extent of Canada’s scientific effort during the Second World War is beyond the scope of this dissertation, the topic is essential to the history of Canadian defence research in the early Cold War. The scientific and technical advances of wartime weaponry created a global atmosphere of heightened awareness, in which postwar considerations in the United Kingdom, the United States and the Soviet Union included the potential of rearmament. Although another global conflict seemed unlikely at the end of the war in September 1945, the creation of the United Nations and the promise of postwar peace between the major wartime allies did not quell international tensions. Postwar defence thus required federal support of active research and development.

With regard to the development of postwar defence policy, two important influences grew out of the Canadian experience with science in the Second World War. The first coincides with a decision made by Mackenzie in 1943, when, as acting President of the National Research Council, he became increasingly reluctant to accept new long-term projects that showed little

prospect of a rapid completion.\textsuperscript{19} Mackenzie’s decision was both logical and administratively sound. He insisted that Canada’s research philosophy remain pragmatic and thus he adopted a frugal approach when committing NRC resources. Consequently, federal funds for scientific research and development went solely to projects that promised some hope of early returns.

Canada’s wartime scientific experience also underscored the need to consolidate advances made in research and development.\textsuperscript{20} In the final two years of the war, Canadian government officials, military leaders, scientists, engineers and industrialists pondered the feasibility of sustaining mutually beneficial cooperation and growth. The imperative for a clearly defined national research policy became increasingly apparent as pending postwar issues approached. Unless the federal government, the National Research Council, and the three services acted quickly, Canada’s wartime scientific and technical infrastructure might disperse, or so top Canadian officials feared.\textsuperscript{21}

Four basic principles guided Mackenzie’s vision for Canada’s postwar research policy, and each depended on explicit government support in the areas of policy and finance.\textsuperscript{22} The first was necessary to retain top Canadian scientists and engineers for Canadian research, which would ensure the consistency and advancement of science across the country. Secondly, federal financial support for scientific research must expand after the war. Both the United States and the United Kingdom spent more per capita on research than Canada. This fact did not sit well with Mackenzie. He thought remedial action was necessary to strengthen the scientific and technical

\textsuperscript{19} Interview with C.J. Mackenzie, conducted by Captain D.J. Goodspeed, 28 August 1958; cited in Captain D.J. Goodspeed, \textit{A History of the Defence Research Board of Canada} (Ottawa: Queen’s Printer, 1958), 11.

\textsuperscript{20} Goodspeed, \textit{A History of the Defence Research Board of Canada}, 12.

\textsuperscript{21} Ibid., 12-13.

\textsuperscript{22} Mackenzie’s four principle requirements for Canadian postwar research policy as listed here derive from Captain D.J. Goodspeed’s history of the Defence Research Board, in which Goodspeed references a paper presented by Mackenzie to the Engineering Institute of Canada in Quebec City on 11 February 1944. The referenced paper is titled “Industrial Research in Post-War Canada”; see Goodspeed, \textit{A History of the Defence Research Board of Canada}, 12.
workforce, by improving the sponsorship of university support, and introducing liberal tax policies designed to encourage industrial research growth. National research in Canada required more than an influx of federal funds, however. To nurture the organic growth of national research and development, Mackenzie’s third principle called for greater cooperation between government and civilian branches of Canadian R&D. Successful collaboration between state and civilian agencies was necessary to facilitate his fourth and final principle of an effective postwar research policy, which was the transition of Canadian research facilities to peacetime operations.

Mackenzie was not alone in his concern for Canada’s postwar research policy. Senior members of the Canadian Army also voiced concern for the need to maintain wartime research organizations in the transition to peace. Lieutenant-General K. Stuart, Chief of the General Staff between 1941 and 1943, and his successor, Lieutenant-General J.C. Murchie, were among those who initiated plans to develop a postwar defence structure. Both men had direct experience with the British system of research; Stuart, for instance, had served in London as Chief of Staff at Canadian Military Headquarters. The British armed forces had not only considered the problem of postwar defence research by 1944, but had forwarded a paper written by the First Lord of the Admiralty to the Canadian government. The memorandum recommended that Canada examine the requirements of establishing permanent organizations to conduct naval or inter-service research and development in collaboration with agencies in the United Kingdom.

Canadian officials moved quickly on the formation of postwar defence plans. After having received the British memorandum in May, the Chiefs of Staff submitted a recommendation in July that resulted in Cabinet approval for the formation of a Committee on Research for Defence. The Canadian Cabinet approved the idea for the committee on the

understanding that it would make recommendations to the War Committee about the formation of postwar defence policies. In early January 1945, representatives of National Defence, the National Research council, and the Department of Munitions and Supply met to consider the composition of the Committee on Research for Defence. Those in attendance at the meeting agreed that C.D. Howe should become chair. As a cabinet minister closely associated with research and reconstruction, Howe had the respect and position thought necessary to lead the planning efforts for postwar defence. The other members of the committee included the chiefs of staff and senior technical officials of the three services, the head of the NRC, two representatives from industry, and two civilians. Defence Council agreed to these recommendations in March, and Cabinet gave the final approval to form the committee on 10 August 1945.

While the Committee on Research for Defence controlled the direction of scientific defence work, actual research and development remained the responsibility of the three services and other government agencies. An institutionalized government body made little sense without an infrastructure to carry out policy, so the Committee considered how to alter the structure of postwar defence in Canada. Members of the Committee discussed a number of solutions prior to meeting formally. General Charles Foulkes, Chief of the General Staff, approached Mackenzie about transferring research activities from the three services to create a new military division of the National Research Council. Although the NRC directed military research during the war, Mackenzie was reluctant to oversee the development and implementation of defence research in the postwar period. He envisioned the return of his organization to applied research in non-

---

24 According to Goodspeed, those in attendance at the meeting included General A.G.L. McNaughton, Minister of National Defence; Harry Carmichael, Department of Munitions and Supply; C.J. Mackenzie, President of the National Research Council; Air Vice-Marshall E.W. Stedman, Director-General of Air Research; and Major-General J.V. Young, Master General of Ordnance. See Goodspeed, A History of the Defence Research Board of Canada, 14.

military fields and convinced Foulkes that the existing NRC infrastructure was inadequate to meet the anticipated substantial needs of Canadian defence research.

With none the three services nor the NRC in a position to manage the requirements of Canada’s postwar defence research, Foulkes and Mackenzie searched for another viable option. Colonel W.W. Goforth, head of the army’s Directorate of Staff Duties at National Defence, proposed the creation of an internal division solely for defence research.²⁶ Foulkes accepted the proposal, and his staff used Goforth’s ideas to write a list of recommendations for the Committee on Research for Defence.²⁷

The “Goforth Paper” laid the foundation for Canadian defence policy, research and development in the early Cold War:

Adequate defence … requires an energetic and effective policy of preparation for the type of modern war which may break upon us with great suddenness in the future … Research and development of new weapons must, therefore, be one of the fundamental principles of our new defence policy.²⁸

While Canadians made scientific, technical, industrial, military and civilian contributions to victory in the Second World War, official support for postwar research and development derived in part from the perception of Canada’s limited international position as a middle power at the end of the war. As further reflected in Goforth’s recommendations, the promotion of R&D was a calculated diplomatic tactic:

[Canada is] very interested in obtaining a greater degree of standardization between the United States of America and the United Kingdom in order to ameliorate her own immediate position. This she can only influence by sharing actively in research, development and design with both the United Kingdom and the United States of America.²⁹

---

²⁶ Ibid.
²⁷ Directorate of History and Heritage (DHH), George Lindsey fonds (87/253), Box 15, 85/334 File 104, Defence Research Estimates & Supplementary Information, “To the Cabinet Committee on Research for Defence: Post-War Policy for Scientific Research for Defence,” 31 October 1945.
²⁸ Ibid.
²⁹ Ibid.
The desire to facilitate scientific cooperation among the North Atlantic partners was an explicit goal of the Canadian defence establishment. While Prime Minister Mackenzie King publicly discussed the need for stronger bilateral ties with the United States, defence officials also remained committed to the Commonwealth.

**A New Direction for Defence Research**

The appointment of General Charles Foulkes as Chief of the General Staff in late August 1945 changed the scope and direction of Canadian postwar defence planning. Foulkes had commanded the Second Canadian Division in Normandy and the First Canadian Corps in Italy during the war. His battlefield experience gave him a keen understanding of modern combat, and he was impressed with the tremendous influence of wartime science. Considerations for the application of military research in times of peace were at the forefront of his mind as the hostilities drew to a close. Heading into the postwar period, Foulkes thought Canada’s military scientific effort was too vital for the services to handle alone. The potential for duplication of effort and inter-service rivalry gave cause for concern.

Canadian wartime economics also influenced Foulkes’ determination to promote active research and development after the war, especially when he considered the potential implications of a reduced postwar defence budget. Between 1938 and 1945, federal expenditure on R&D increased from $4.9 million to $34.5 million. Foulkes recognized the impact of this major influx of wartime investment, which fundamentally altered the traditional relationship between science and government in Canada. He strongly believed that adequate and effective postwar

---


31 Ibid., 200.
defence required an active and financially strong research program facilitated by officials and prominent scientists.

Foulkes made his thoughts well known when he presented Goforth’s recommendations to the Committee on Research for Defence. The committee reviewed the recommendations at its first and only meeting, which took place at C.D. Howe’s office on Parliament Hill on 4 December 1945. The implications of the meeting were profound. The committee voted unanimously in favour of the recommendations and decided on infrastructure to support the plan. Moreover, the committee agreed to promote a civilian with scientific training to Director General for Defence Research, a new position whose responsibilities would include the coordination of postwar research for the three services. The plan was promising and simple because it did not require approval from Cabinet. Implementation required only some reorganization of the existing structure of the Department of National Defence and an order-in-council authorizing the appointment of a Director General for Defence Research. A subcommittee then agreed on a list of potential appointees for the new position, C.D. Howe adjourned the meeting, and a new direction for Canadian defence research was in place.

By accepting the recommendations of the “Goforth Paper,” the Committee on Research for Defence laid the foundations of the structure of postwar research in Canada. The most sensitive information contained in the document pertained to resources and exchange. Recommendation sixteen discussed reliance on the United States for heavy-duty military equipment, while the eighteenth made a statement on Canada’s value to the tripartite alliance:

Contributions may be made to special advantage in fields which present problems of particular interest to Canada, such as Winter Warfare and also in the fields in which our present establishments and manufacturing potential are particularly suited … Our contribution to these problems is likely to be a prerequisite to the free interchange of...
defence technology between ourselves, the United Kingdom and the United States of America.\textsuperscript{33}

Science could be used to bolster mutually beneficial postwar cooperation, or so was the determination made by the Committee on Research for Defence. Supporters of the “Goforth Paper” thought defence research should be the responsibility of a single government agency. This idea denied the services their own research empires and subsequently made possible the creation of the Defence Research Board.\textsuperscript{34}

**Creation of the Defence Research Board**

The creation of the Defence Research Board, the executive policymaking body on defence research for the services, dates to 27 March 1947, when an amendment to the National Defence Act received royal assent.\textsuperscript{35} Within one week of the amendment, Order-in-Council PC 1268 stipulated the provisions of legislation for the DRB.\textsuperscript{36} As of 1 April, the DRB was in place to carry out defence-related duties as assigned by the minister of national defence, and to provide advice on scientific, technical and other research matters concerning the national defence and security of Canada. To carry out this mandate, the federal government empowered the DRB to operate research facilities and laboratories, enter into contracts with industrial partners, and establish scholarships to make extramural aid available for defence research.

\textsuperscript{33} In addition to winter warfare, the paragraph listed chemical warfare, radar, electronics, vehicle design and protective clothing as example fields of Canadian speciality. See DHH, George Lindsey fonds 87/253, Box 15, 85/334 File 104, Defence Research Estimates & Supplementary Information, “To the Cabinet Committee on Research for Defence: Post-War Policy for Scientific Research for Defence,” 31 October 1945.

\textsuperscript{34} Ridler, *Maestro of Science*, 116.

\textsuperscript{35} The original proposal for the creation of the DRB dates to 28 September 1946 when Solandt drafted a memorandum for a “Defence Research Board”.

The DRB’s initial operating budget for 1947-48 was slightly more than $5.5 million, an amount that doubled the year after and continued to rise incrementally for the next decade.\textsuperscript{37} Budgetary increases funded civil service wages, employee travel, property and construction, and the procurement of equipment and resources required to fulfill and expand the structure and activities of the organization. At the start of 1948, the headquarters of the Defence Research Board employed 136 personnel, consisting of thirty-eight professional staff, five consultants, eighty-nine non-professionals, and four seconded members of the armed services.\textsuperscript{38} The DRB also included several advisory committees and panels, on which members served without remuneration except for travel and transportation expenses.

Organizationally, the Defence Research Board consisted of two components. Referred to commonly in DRB records as the “Board,” the first component was akin to a commercial board of directors. The Board included a chair, vice-chair and a secretary as its officers, as well as ex-officio members.\textsuperscript{39} The Board met twice annually unless circumstances dictated otherwise. The second component of the DRB was its research organization, which consisted of a headquarters and research establishments. Headquarters directed and controlled DRB activity but also facilitated inter-service cooperation by interpreting the results of research to the army, navy, and air force. In support of the Board and its research organization, the DRB established a number of panels and committees designed to assist and advise the chair on specific fields of research. As advisory support for the DRB, the panel and committee structure provided essential assessments.

\textsuperscript{37} Ibid.
\textsuperscript{38} Ibid., p. 7.
\textsuperscript{39} For details on the composition of the Board, see Goodspeed, A History of the Defence Research Board, 65-68. For information on changes to the composition of the Board, see DHH, George Lindsey fonds (87/253), Box 15, 85/304 File 18, “The Defence Research Board,” 8 April 1965, p. 2.
of scientific activities and the impact of research on the services. The DRB used this information to alter and expand its research programme in areas pertinent to the needs of Canadian defence. The Arctic Research Advisory Committee formed accordingly in 1948.

Although intelligence was not the primary concern of the Defence Research Board, the organization developed intimate ties to Canadian postwar security. This is particularly evident when assessing tripartite relations. The United Kingdom played a pivotal role in the development of Canada’s postwar foreign intelligence, as political scientist Kurt Jensen has observed. In November 1945, the British Joint Intelligence Committee sent a proposal to the Canadian Department of External Affairs asking for the establishment of a joint intelligence bureau. Although the Canadian Joint Intelligence Committee (CJIC) had served as a coordinating body on intelligence for the Chiefs of Staff Committee since its formation in November 1942, members of the CJIC had neither the expertise nor the supporting infrastructure required to carry out postwar intelligence analysis. DEA officials made no immediate decision on the British proposal, but the topic dominated internal discussions on postwar intelligence until the next spring. Early in May 1946, Norman Robertson, the under-secretary of state for external affairs, presented the idea for a Canadian joint intelligence bureau to the Chiefs of Staff Committee. Recognizing the difficulty of military intelligence gathering, DND officials accepted the proposal and the Chiefs of Staff decided to put the proposal before Cabinet. The Cabinet

---

41 Kurt F. Jensen, *Cautious Beginnings: Canadian Foreign Intelligence, 1939-51* (Vancouver: University of British Columbia Press, 2009), 139.
42 Ibid., 140.
Defence Committee deferred a decision on three separate occasions, until approving the creation of the Canadian Joint Intelligence Bureau (CJIB) on 31 January 1947.\(^{43}\)

In Jensen’s assessment, Arctic security triggered the decision of the Cabinet Defence Committee to approve the establishment of a Canadian intelligence bureau.\(^{44}\) Information from the DEA suggested North American defence planning required topographical information on the Canadian North. After considering the dual need to defend Canadian territory against an attack by the Soviet Union and contribute to postwar security relations with the United States, the Cabinet Defence Committee had little recourse but to immediately approve the CJIB. Yet the establishment of a single intelligence body did not preclude pre-existing structures from continuing to collect information. Similar to research and development, successful intelligence depended on inter-service and inter-departmental cooperation and exchange.

As science became increasingly important to Canada’s postwar security agenda, the Defence Research Board thrived in an environment that depended on the production and exchange of knowledge. DRB scientists and engineers were responsible for analyzing information available from universities, research foundations, industry, foreign countries, the three services of the armed forces, and internal research establishments. Using information obtained through multiple sources, DRB employees determined the influence of intelligence on Canada’s plan for a scientific defence against any possible aggression.\(^ {45}\) Moreover, budgetary records of the DRB indicate an early organizational interest in Western intelligence. The DRB

\(^{43}\) The Cabinet Defence Committee deferred a decision on the formation of the Canadian Joint Intelligence Bureau on 16 July, 24 July, and 18 September 1946.

\(^{44}\) According to Jensen, information from the DEA about North American plans to defend the North Pole against an attack by the Soviet Union prompted the final approval on 31 January 1947. See Jensen, *Cautious Beginnings*, 141-142.

administered the Joint Intelligence Bureau, which was responsible to the Joint Intelligence Committee of the Chiefs of Staff for the organization of economic, geographic and transportation intelligence related to Canadian defence and security.46 A significant portion of the DRB’s annual budget also contributed to Western intelligence internationally, specifically through liaison with the United Kingdom and the United States. The international connections of Canada’s defence research and scientific intelligence community owed much to Omond Solandt, the founding chairman of the Defence Research Board.

**Omond Solandt and the British Connection**

When assessing developments in Canada’s early Cold War national defence policy, Omond Solandt represents one of the most influential personalities of the period.47 A physiologist by training and protégé of Charles Best, the co-discoverer of insulin, Solandt worked on operational research for the British government during the Second World War. He managed a number of key scientific research establishments during the war and studied the effects of nuclear fallout as a colonel on the British Mission to Japan in the wake of Hiroshima and Nagasaki. Following the war, Solandt returned to Canada and transformed federal science in both scale and influence.

---

As Director General of Defence Research and Chairman of the Defence Research Board, Solandt occupied a position of significant power and responsibility. He worked under the minister of national defence as a member of the Chiefs of Staff Committee. His position was equal to the head of the army, navy and air force. In this role, Solandt was an influential member of the Canadian defence establishment. He communicated to high-ranking Canadian officials on matters related to defence, policy formation and national expenditure. He negotiated inter-service research and development with the three services and initiated international security information exchange and cooperation with the United Kingdom, the United States, and Australia. Simply put, Solandt wielded control and influence on the direction of Canada’s national postwar defence research effort.

Solandt’s position and authority was put to paper on 13 February 1946 in a memorandum written by the minister of national defence Douglas Abbott. As the official template for the position of Director General of Defence Research, the memorandum described Solandt’s professional duties in full and listed a number of issues that required his immediate attention. Not the least of which was, according to Abbott:

The review of all present and completed research projects with a view to recommending which should be continued and which should be abandoned … In this regard, the general policy to be followed is that Canada should pursue vigorously those projects to which the Nation can contribute special knowledge, ability, facilities and needs rather than those which can more adequately be carried out by other countries.

Although the Arctic did not receive direct reference, the implication was obvious for Solandt. Canada is second only to Russia in Arctic landmass and the heightened importance of the Canadian North in postwar affairs required direct and immediate federal action.

Solandt considered international cooperation imperative to the success of Canadian defence research. He maintained an active and important relationship with Sir Henry Tizard, chairman of the Defence Research Policy Committee (DRPC) for the British Ministry of Defence. The two had met during the war and shared a desire to harmonize alliance cooperation in defence research.\textsuperscript{49} Their correspondence was mutually advantageous for the Canadian and British defence establishments, and the DRB was a direct beneficiary. In fact, in May 1947, Solandt submitted a request asking the Canadian government to extend Tizard a formal invitation to visit the DRB after the Commonwealth Advisory Committee on Defence Science decided against holding a meeting in Canada.\textsuperscript{50} Mackenzie and McNaughton supported the idea and both agreed to participate in confidential discussions of civilian scientific problems related to Commonwealth security. Shortly thereafter, Solandt made the trip official and Tizard returned to Canada as the leader of a British Scientific Group in September 1947.\textsuperscript{51}

The two-week visit included extensive discussion of scientific cooperation between Canada and the United Kingdom at important locations for the National Research Council and Defence Research Board, including Ottawa, Toronto, Churchill, and Suffield, among others. Tizard arrived in Ottawa via New York, where the Canadian Consulate hosted a dinner in his honour the day prior to his departure for Canada. Ministers, deputy ministers and senior officials from Ottawa attended the dinner. Sir Ben Lockspeier, chief scientist for the British Ministry of Supply; Owen Haddon Wansbrough-Jones, scientific advisor to the Army Council of the British

\textsuperscript{49} Ridler, \textit{Maestro of Science}, 201-202.
\textsuperscript{51} For a complete record of the British Scientific Group, including the trip itinerary and related correspondence, see LAC, RG 25 G2, vol. 2171, file 53-AVF-40C. Historian Jason Ridler also provides an overview of the trip in his biography of Omond Solandt; see Ridler, \textit{Maestro of Science}, 202.
War Office; and J.A. Carroll, deputy controller of Research and Development for the British Admiralty joined Tizard on the trip as distinguished guests of the DRB.

Tizard’s trip to Canada involved the exchange of highly-secret information on tripartite security. During his stop in Ottawa, he gave an address to top Canadian officials from External Affairs and National Defence on “The Problems of Defence Research.” The address occurred as a continuation of the DRB’s lecture series on “Science and Defence,” which Solandt initiated to apprise officials of the ongoing work and significance of the organization under his control. In an invitation sent to Lester Pearson, the undersecretary of state for external affairs, Solandt explained Tizard’s intent for “the lecture to refer specifically to some problems of Commonwealth interest.”\(^{52}\) Because the lecture included secret information, Solandt expressed the concern to Pearson that the event required appropriate security measures to safeguard scientific intelligence. Tizard’s speech went unrecorded, but the nature of the trip provides insight into British and Canadian priorities.

Under Solandt’s leadership, the Defence Research Board considered the British defence establishment a source of both personnel and information. The first liaison officer in London was Colonel G. Milroy Carrie.\(^{53}\) He moved to the Canadian Joint Staff building in the summer of 1947 and led a staff that worked closely with British counterparts. Carrie’s experience was largely successful. Working closely with British military officials allowed his staff to gather information on technologies and resources developed in the United Kingdom, but also details on defence relations between British and American organizations. A.L. Wright, the DRB’s liaison

---


officer in Washington, had a contrasting experience. Unlike Carrie, Wright did not have direct access to key research officers, which made obtaining information on American defence research difficult.54

Liaison was particularly important to the Defence Research Board because of the organization’s limited budget and operational structure. Solandt had a responsibility to provide accurate and current scientific and technical advice to the Chiefs of Staff and the Minister of National Defence, but the mandate of the DRB did not cover the full range of modern postwar research and development. Solandt and the DRB thus required tripartite assistance from both the United Kingdom and the United States to fulfill its duties to the Canadian defence establishment. Reliable and current information enabled the DRB to pursue only projects in which Canada had special capabilities and interests. Moreover, knowledge of British and American R&D provided the DRB with information on possible research areas to explore. Duplication of effort was detrimental to the tripartite alliance, so the DRB funded research and development in fields considered unique to Canada.

The desire of the Canadian defence establishment to avoid duplication of work with the United Kingdom and the United States became evident in October 1945 when the Chiefs of Staff approved a document on planning for postwar scientific research.55 The document warned against pursuing a complete and independent program of applied military research, and instead proposed close collaboration with western partners. The impending requirements of postwar defence were considered too large for Canada to shoulder alone. Cooperation with international partners was a necessary obligation, but mutual defence came with economic benefits as well.

54 Ibid.
For the Defence Research Board, this ultimately meant allocating financial resources more to research than development. As is explored in Chapter 3, the DRB developed and financed fundamental scientific research projects to support the three services. Although the DRB funded notable Cold War development projects such as the Black Brant series of sounding rockets and the two Alouette satellites, actual development or creation of weapons, vehicles and related military equipment was not a primary focus of the organization as a whole.\(^{56}\) Canada could not match the development resources of either the United States or the United Kingdom, so senior Canadian officials designed the DRB as a research-first organization capable of finding and pursuing fields of military interest where Canada could make a unique contribution to Western security. The cold-weather sciences in the Canadian North thrived under this guiding principle of Canada’s postwar defence policy.

While tripartite exchange often resulted in beneficial cooperation, frequent tensions in the relationship also offer telling details on the Canadian defence establishment in the early Cold War. By 1951, the number of DRB sponsored visitors to the United Kingdom had increased significantly because of successful liaison and research collaboration.\(^{57}\) A corresponding increase had occurred in the visits of British defence scientists to Canada, but the situation with the United States was different. Although Canadian and American scientists worked on exchange in their neighbouring countries, defence liaison between Canada and the United Kingdom raised the ire of defence officials in the United States. As historian Jonathan Turner pointedly notes, the Americans considered Canada to be “thoroughly enmeshed with the British to the point that the Defence Research Board was locked out of all the same information that the British were.”\(^{58}\)

\(^{56}\) For details on Black Brant and Alouette programs, see Andrew B. Godefroy, *Defence and Discovery: Canada’s Military Space Program, 1945-74* (Vancouver: University of British Columbia Press, 2011).

\(^{57}\) Holness, “The Office of Counsellor Defence Research and Development London (CDRD[L]): A Brief History”.

Whether this American view of Canadian defence research resulted in part from Solandt’s close personal connection to the British scientific community remains unclear, but the early history of the DRB reflects a growing relationship with the British defence establishment. Although the strengthening of bilateral defence with the United States was inexorable in contrast to defence ties between Canada and the United Kingdom, cooperation in defence research bolstered Canada’s contribution to the Commonwealth. This finding nuances the suggestion that closer continental integration with the United States eclipsed Canada’s defence partnership with the United Kingdom in the postwar period.59

Postwar Defence and the Canadian Arctic

Interest in the Arctic increased dramatically during the Second World War with the Japanese invasion of the Aleutian Islands, the establishment of British and Soviet east-west routes for the transport of aircraft, and the initiation of large construction projects by the United States. Infrastructure and facilities to serve the continental defence of North American emerged as Washington funded the construction of the Alaska Highway, airfields to support aircraft service to Alaska, over fifty weather stations, and an oil distribution system between Yukon and the Northwest Territories named the Canol Project. The creation of the Canada-United States Permanent Joint Board on Defence (PJBD) at Ogdensburg, New York in August 1940 also shaped the role of the Arctic in the strategic defence of North America.60 By the end of the war


60 On the establishment of the Permanent Joint Board on Defence, see Sokolsky and Jockel, eds., Fifty Years of Canada-United States Defense Cooperation.
in 1945, the PJBD had become the principal forum for bilateral negotiations among senior defence officials from Ottawa and Washington.

Among the more significant security concerns heading into the postwar period was continental air defence. The Canadian government countered the threat of the nuclear bomb-carrying strategic bomber through cooperation with the United States in the construction of early warning radar systems. As early as 1946, the PJBD had initiated plans to construct a series of radar stations near the Canada-US border along the fiftieth parallel. Funding prevented the project until 1949 when the United States Congress agreed to co-finance radar construction with the Royal Canadian Air Force. Canada first agreed to co-construct thirty-three radar stations known as the Pinetree Line across the mid-north from Vancouver Island to Labrador in 1949.61 Before construction finished, the Soviet Union had upgraded their bomber force and defence officials in Ottawa and Washington agreed to co-fund radar stations farther north. The United States also acquired a lease to an air base at Goose Bay, Labrador in December 1952 to serve as a location from which the air force could potentially bomb the Soviet Union and see its aircraft return.62 Circumstances worsened for Canada and the United States in August 1953 when the Soviet Union detonated its first hydrogen bomb. Within a year, defence analysts recommended the construction of the Mid-Canada Line, along the fifty-fifth parallel, paid for entirely by Canada. The number of northern radar stations increased for a third time by joint agreement in 1955. On 5 May, both countries agreed in principle to construct and operate the DEW Line.63

63 For a detailed timeline of North American air defence cooperation between Canada and the United States with regard to radar, see Heidt and Lackenbauer, “Sovereignty for Hire,” in Lackenbauer, De-icing required!, 95-112.
The focus on the Arctic that occurred in the 1940s is perhaps most evident in the proliferation of maps oriented over the North Pole. Air-age globalism revealed the surprisingly close geographic proximity of the Soviet Union, and North American territory emerged expansive and vulnerable at the top. In the process, the Arctic became a frontier space of both strategic and scientific importance, an ideal laboratory for intellectual pursuit with implications of local and global significance. The American military embraced this logic and approached the North as a vital component of continental defence but also as one of many hostile environments to overcome. The circumstances of northern defence led to an expansive and highly entangled relationship between the American military and state-funded scientists, as historians of science and the Cold War have shown. As Matthew Farish explains in a detailed study of American knowledge production, “the Arctic frontier was engineered—not just in the sense of specific landscapes and bodies as sites for technical manipulation and control but also according to more general principles of development, order, and appropriation for scientific and strategic needs.”

Coupled with the growing tensions between the East and West, the Arctic, as both an idea and physical space, was ripe for a high-anxiety postwar “assault.”

Although the terms sovereignty and defence may seem interchangeable, in the context of the postwar security environment Canada faced two distinct threats. As fears of a Soviet attack grew, research teams, administrators and soldiers pushed northward to study and occupy the largely “unknown” North American Arctic. Collectively, on behalf of the Canadian government, these individuals worked to defend the North against Soviet aggression while also promoting

---

64 Matthew Farish, The Contours of America’s Cold War (Minneapolis, MN: University of Minnesota Press, 2010), 174.
66 Farish, The Contours of America’s Cold War, 176.
territorial sovereignty in the midst of increasing encroachment from the United States. There was certainly mutual agreement in both Ottawa and Washington that precautions were necessary to protect the North American continent, but Canadian officials also showed concern for the rapid increase in American activity north of the border. Concerns deepened periodically in Canada when various American officials mused about the possibility of “taking control” of Canadian territory to prepare their own defences against the Soviet threat, as Rob Huebert notes. Yet Canada was not in a position to provide the necessary resources required of a modern and effective national defence. Despite emerging concerns about American encroachment, Canada had little choice but to collaborate closely with its southern neighbour in defence of the North American continent.

While the nuances of early Cold War defence relations between Canada and the United States require further attention, the current body of literature seems to agree that the Americans respected Canadian claims to territorial sovereignty in the North. Rather than annex parts of the seemingly remote and ignored Canadian Arctic, Washington desired to work in collaboration with Ottawa to establish the defence system that officials in both capitals deemed necessary. In many ways, the situation proved quite advantageous for Canada. The government gained access to the physical and financial resources of the United States and simultaneously bolstered its defensive position against the Soviet Union. Scholars debate whether Canada sacrificed its sovereignty in the process, but diplomatic negotiations resulted in bilateral arrangements with real and lasting benefits to both Canada and the United States.  

68 Shelagh Grant has suggested that Canada sacrificed its sovereignty in Arctic defence negotiations with the United States; see Sovereignty or Security. Others have emphasised sound decision-making, open dialogue, and respect on both sides. See P. Whitney Lackenbauer and Peter Kikkert, “Sovereignty and Security: Canadian Diplomacy, the United States, and the Arctic, 1943-1968,” in In the National Interest: Canadian Foreign Policy and the Department
Canada’s Postwar Military Policy

Canada was a middle power during the early Cold War and senior officials in Ottawa sought to secure Canadian sovereignty at home and abroad through involvement in international partnerships such as the United Nations and the North Atlantic Treaty Organization. Under the umbrella of the Permanent Joint Board on Defence, cooperation with the United States in continental defence was significant. Multilateral and, increasingly, bilateral agreements provided the backbone of Canadian defence. The military underwent a drastic reduction as a result, and the Mackenzie King government reallocated federal finances toward other national priorities that included veterans’ benefits, family allowances and other social-welfare programs.69 Within two years of the end of the Second World War, the army reduced in personnel strength from 478,090 to only 15,852.70

Postwar demobilization affected the other two service branches as well. The Royal Canadian Navy (RCN) emerged from the war as a “fleet-in-being,” and according to historian Peter Haydon, the innovative concept of naval aviation “became the lightning rod for much of the political scepticism concerning and opposition to the postwar navy.”71 Firmly convinced that the RCN did not need carriers, Mackenzie King and the Liberals opposed expanding Canada’s peacetime navy. Demobilization drastically reduced the navy’s strength from approximately 93,000 personnel at the end of the war in September 1945 to only 6,600 by April 1946.72 In place
of a strong naval presence, the Liberals envisioned increasing the role and capabilities of the Royal Canadian Air Force. But as Bertram Frandsen has shown, the fiscal restraint of the immediate postwar years constrained Canada’s existing forces and limited the modernization of air power. With the full technological impact of nuclear weapons, jet fighters, and ballistic missiles unknown, military planners in Ottawa had little reason to embrace the financial costs associated with these potential “game changers.” Despite the arrival of the Cold War in the late 1940s, Canada’s defence budget restricted the three services until rearmament for the Korean War in 1950.

As an instrument of national power, the Canadian military suffered from a lack of coherent and durable political guidance and became both fragmented and disjointed. While American and Canadian scientific and defensive interests largely coincided in the period, government officials in Ottawa supported research of a non-strategic orientation. Hugh Keenleyside, for instance, shared with Minister of External Affairs Lester Pearson the view that Canada should support resource development and research over strategy and politics. As deputy minister of mines and resources, commissioner of the Northwest Territories, and chairman of the Arctic Research Advisory Committee of the DRB, Keenleyside was a high-ranking civil servant with a significant level of influence on northern affairs and budget

---

74 Ibid.
allocation. He received an informal education on the Canadian North and its indigenous populations from Arctic geographers such as Vilhjalmur Stefansson, Erling Porslid and Trevor Lloyd, and used his position in government to promote the spread of “industrial civilization” northward.\textsuperscript{77} Defence considerations in the North were lower on his agenda than the work of scientists, explorers, administrators, educators, doctors, and social workers.

Despite Keenleyside’s relative ambivalence towards northern defence, he supported the Defence Research Board as a modern scientific research establishment. He participated in the creation and subsequent activities of the Arctic Institute of North America and helped develop strong ties between AINA and the DRB. In this sense, Keenleyside saw value in the DRB as a federal and financial scientific resource. The research-first mandate of the Defence Research Board seems to have fit his vision of northern modernization particularly well: “The awakening general interest in the Arctic was in part the result of political and defence considerations that marked the period of the Cold War,” Keenleyside wrote in his memoirs. “But additional recognition of its importance,” he continued, “came also from a new appreciation of the economic possibilities of that region.”\textsuperscript{78} From Keenleyside’s perspective, Canadians living in the southern regions of the country had a growing social responsibility to the North and the people living there. He accepted scientific defence research as a means to support this goal.

While the air threat to North America dominated strategic considerations in Ottawa during the early postwar period, senior defence officials remained cognisant of the vulnerability of the Canadian North by sea and land. In advance of a potential Soviet attack, the military turned to science to find and prepare men for the potential cold-weather battlefield. Defence planners deemed cold climate training important to the development of troop indoctrination and

\textsuperscript{77} Ibid.
\textsuperscript{78} Ibid., 308-309.
preparation, and intelligence confirmed the need to prepare a defence against the shortest and most direct route over the North Pole. As Canadian troops learned how to survive and use their weapons under Arctic conditions, the DRB provided scientific and technical assistance to facilitate service needs in the high latitude environment of Canada’s North.

The history of scientific activity in the Canadian North provides an ideal case study to examine the development of Canada’s early Cold War defence policy. Records of the Defence Research Board document extensive interest and activity in Arctic science. Canada’s defence establishment considered research on winter warfare vital to tripartite security participation with the United Kingdom and the United States, and the DRB thrived on the opportunity created by the political and economic resources made available for Arctic science.

Conclusion

During the Second World War, Canada’s senior military officials recognized the increasing significance of science on the battlefield and decided to implement the mechanisms required to create and sustain a defence research establishment in the postwar period. As a leading agency for military science during the early Cold War, the Defence Research Board played a crucial role in shaping the direction and scope of Canada’s postwar defence effort. Concurrently, the informal nature of the ABC tripartite relationship worked to the benefit of the DRB.

As the remaining chapters of this dissertation show, the Defence Research Board pursued and financed a range of scientific activities, some of which only had loose connections to the immediate needs of Canada’s postwar security and defence. Cold War anxieties that resulted from the fear of another global conflict perpetuated a set of unique circumstances that accelerated the pace and intensity of science. This is perhaps most evident in the DRB’s scientific activities pertaining to the Canadian North. While the DRB made meaningful and
lasting contributions to Arctic research, the “frontier” sciences often lacked responsible or adequate oversight. Delving into the circumstances and processes that enabled the rapid growth of Canadian defence research provides an avenue to understand the implications of Cold War Arctic research in Canada.
Chapter 2
Cold War Prelude: Science and Defence in Northern Canada

In October 1978, the Ontario Science Centre hosted a three-day event in celebration of significant contributions to Arctic exploration in Canada. Titled “Living Explorers of the Canadian Arctic,” the symposium featured a respected group of forty speakers that included Denis Coolican, president of the Royal Geographical Society, and Thomas Manning, who “claimed” Arctic territory for Canada by placing a flag on Prince Charles Island in 1949.1 Among the group also stood Moira Dunbar, noted Arctic geographer and the sole female participant in a collection of individuals renowned for their contributions to Canada. Gender had no bearing on Dunbar’s inclusion in the symposium. By 1978, her contributions to Arctic science had earned international recognition and an appointment to the Order of Canada. She thus stood out amongst her peers not as the sole female participant, but rather as one of the world’s most influential Arctic geographers of a generation. As a leading expert in Arctic research for the Canadian defence establishment, Dunbar furthered our knowledge of geography and northern Canada. She also represented Canada in a unique diplomatic role, helping foster relations with Arctic scientists in the Soviet Union at the height of international Cold War security concerns.

Despite Dunbar’s many accomplishments in Arctic science and the Canadian civil service, she has received little attention from scholars of Cold War Canada. Likewise, although her career grabbed the attention of contemporary journalists, historians have paid scant attention to the significance of her work with the Canadian defence establishment. This chapter highlights

---

1 For a list of symposium participants, see Zena Cherry, “Arctic explorers will tell all,” The Globe and Mail (Toronto), October 13, 1978. The symposium also resulted in a published collection; see Shirley Milligan and Walter Kupsch, eds., Living Explorers of the Canadian Arctic (Yellowknife, NWT: Outcrop, The Northern Publishers, 1986).
Dunbar’s work with the Defence Research Board to introduce and examine key geostrategic considerations that influenced Canada’s early Cold War Arctic defence policy. Dunbar’s research on glaciology and Arctic sea ice played a central role in considerations of sovereignty and security after the Second World War. Although she was not a leading official of the Canadian defence establishment, her research influenced Canada’s Arctic defence policy and her contributions to Arctic geography spanned important developments in the relationship between science policy and international diplomacy in Cold War Canada.

**Moira Dunbar**

Born in Edinburgh, Scotland on 2 February 1918, Isobel Moira Dunbar became independent at a young age. She grew up without her father, William, a lawyer who died when she was a young girl. As a student, Dunbar attended local schools in Edinburgh before graduating from Oxford University with an honours degree in geography in 1939. She spent the war years acting and stage managing in touring stock companies and in shows for the British armed forces. The British government supported theatre as a way to boost morale on the home front, and Dunbar performed small comedic roles until the war ended. She toured England and Wales but never her native Scotland, mostly in comedic roles as a home cleaner. At one of her performances, Diana Rowley, a friend and fellow graduate in geography from Oxford, recommended she consider Canada for postwar work: “Geographers are like gold in Canada,” Rowley told her. The thought piqued Dunbar’s interest, and she decided to move to Canada in 1947. Upon her arrival, she stayed with her brother and his newlywed wife. While searching for work, Dunbar made a call to

---


Ottawa that produced the gold Rowley had promised. She managed to find and secure a job in the federal government with the Joint Intelligence Bureau of Canada, gathering data on ice movement in the North. The position suited Dunbar’s research interests, because she had developed a fascination for the Arctic while horseback riding on a holiday in Iceland in 1939.

Dunbar transferred to the Arctic section of the Defence Research Board in 1952 and studied the physical geography of the Canadian Arctic by observing the distribution and behaviour of sea ice. One of the purposes of the work was to reduce the severe hazard of sea ice to shipping, and thus she tracked the movement of large ice floes under the influence of both winter and summer conditions. Her work became vital to Canada’s sovereignty and security in the Arctic because both the United States and the Soviet Union had begun using large masses of Arctic sea ice north of Canada.

The Arctic: A Cold War Border Zone

Tensions between the Soviet Union and the United States dominated geostrategic realities during the Cold War. The two superpowers competed to demonstrate environmental authority and the Arctic represented an ideal stage to display dominance over nature. While the two sides regularly differed in approach to Arctic science, the shared pursuit of high modernism often resulted in similar social and environmental consequences. Rapid militarization affected

---

4 Dunbar’s career was off to a good start when her friend, Rowley, reminded her that sending a small payment to Oxford might turn her bachelor’s degree into a master’s. Dunbar followed the advice. She sent a small payment to Oxford and received a master’s degree shortly thereafter, which subsequently resulted in a raise to her civil service pay cheque. See “Geographer helped map Canadian arctic,” *National Post* (Toronto), December 15, 1999.


Indigenous peoples in both capitalist and communist regions of the Arctic, while the scale and extent of modernization on both sides of the ideological divide left a deep environmental legacy in the wake of the Cold War.

As a border zone between the Soviet Union and the United States, the geographic location of the Arctic helps explain why the North Polar Region witnessed an unprecedented military buildup during the Cold War. The Arctic represented the front line between the superpowers and neither side was willing to concede the spoils that might result from a scientific or technical victory in the region.\(^9\) While the notion of a friendly Arctic clashed with the realities of a hostile environment, planners in the United States and the Soviet Union viewed the Arctic as a stage to show that their political system was better than the alternative.\(^{10}\)

A major push for science and exploration occurred in the Soviet Arctic during the 1930s. One of the central figures of the era was Otto Schmidt, a scientist and adventurer who became known widely as the “Commissar of Ice.”\(^{11}\) Schmidt published extensively on his scientific exploits and used publicity to climb the ranks of the Communist Party. He became head of the Glavsevmorput, a bureaucratic institution that oversaw Arctic affairs in the Soviet Union. The Glavsevmorput focused on economic development in the Soviet Arctic and promoted meteorology, oceanography, geology and other physical sciences to meet its goal. Practical benefits in weather forecasting and cartography resulted from this investment in scientific research, but science in the Soviet Arctic doubled as a means to demonstrate the superiority of the communist system.


\(^{11}\) Howkins, *The Polar Regions*, 129.
Soviet Arctic research served geopolitical goals as well. On two separate occasions during the interwar period, representatives of the Soviet Union demonstrated sovereignty in the Arctic through political acts of territorial occupation. The first instance occurred in 1926 when a group of Russian explorers brought Wrangel Island under Soviet rule. The second occurred in connection with the International Polar Year of 1932-33, when Russian scientists asserted sovereignty over Victoria Island, east of Spitsbergen (modern-day Svalbard) on the Norwegian archipelago in the Arctic Ocean. In both instances, science and exploration helped to realize the territorial conquests and wider aspirations of the Soviet Union.

Soviet Arctic policy during the interwar period aimed primarily to create a viable route for commercial shipping. To help achieve this goal, the Soviet Union added a number of modern icebreakers to its existing Arctic fleet. In 1932, Schmidt boarded the icebreaker Sibiryakov and led the first yearlong expedition to navigate the Northern Sea Route north of Siberia. The expedition cemented Schmidt’s reputation among Russian observers and provided the Soviet Union with photographs that illustrated a distinct communist attitude toward dominance over nature. The expedition brought practical benefits, too. Researchers learned about Arctic meteorology and sea ice, and gained knowledge in both areas that helped keep Russia supplied with Allied goods delivered through its northern ports during the Second World War.

Interwar ice research in the Soviet Arctic had important implications for scientific developments in the early Cold War period. In the late 1930s, scientists from the Soviet Union instituted a series of North Pole “Ice-Stations” by constructing research camps on floating sea ice. Known as Severny Polus (SP) meaning North Pole, Soviet scientists used SP stations to

---

12 Ibid.
collect meteorological and oceanographic data on the Arctic environment. Utilized for shipping and submarines, this type of information also became important for questions of sovereignty in the postwar period. Consider the Russian interpretation of the Lomonosov Ridge, for instance. First discovered by Soviet high-latitude expeditions in 1948, the Lomonosov Ridge is an underwater continental shelf in the Arctic Ocean that stretches eighteen hundred kilometres from islands off Siberia to Ellesmere Island in the Canadian Arctic archipelago. In a move that had immediate implications for Canada, the Soviet Union claimed sovereignty over the area upon its discovery and expanded their scientific efforts in the Arctic Ocean. Russia’s Arctic presence continued to grow into the Cold War and by the start of the 1970s, Soviet scientists had conducted research on no fewer than twenty-two SP stations.

**Wartime Defence in the North and Activity at Churchill**

During the Second World War, the United States Air Force produced a plan that called for the construction of a network of airfields to facilitate the transportation of planes and forces to Greenland and Iceland should the need arise. In preparation for adverse weather conditions, the plan outlined various routes to enable flying in the North regardless of meteorological factors. As presented to the Permanent Joint Board on Defence, the plan included three transport routes with a series of airfields placed four hundred to five hundred miles apart. The Pas, Churchill,

---

18 The plan outlined eastern, western, and central routes. The eastern route included bases at Fort Chimo, Baffin Island, the east coast of Greenland, and Iceland; the western route included bases at Regina, The Pas, Churchill, Southampton Island, and Baffin Island; and the central route included bases at Moose Factory, Richmond Gulf, and Baffin Island. See Colonel Stanley W. Dziuban, *United States Army in World War II: Special Studies – Military
Southampton Island, and Frobisher Bay were to be important air bases. Each location was to be equipped with two major runways, housing for a garrison of five hundred men, and supporting facilities for the storage of fuel and other supplies. The CRIMSON Route—“Crimson” being a United States code name for “Canadian”—received approval from the PJBD on 28 May 1942.

The United States and Canada agreed to share construction of nine air bases in Canada and Greenland. Each country was responsible for the costs of the airfields it undertook to construct, but all the facilities in Canada were to become Canadian property six months after the end of the war. The plan underwent modifications before construction began, but considerable progress occurred relatively quickly. Canada agreed only to undertake the completion of facilities already underway at Goose Bay and the construction of an airfield and support facilities at The Pas. The United States accepted responsibility for the construction of the remaining proposed airfields, including Churchill, and for the provision of necessary defences that Canada was not in a position to provide.\(^\text{19}\) Construction went ahead accordingly.

By the end of 1942, a civilian contractor under the Canadian Department of Transport had constructed a usable four hundred foot runway at The Pas and housing for the facility was eighty per cent complete. Farther north in Manitoba, an American civilian contractor engaged by the United States Army Corps of Engineers undertook construction of a much larger runway equipped with serving facilities at Churchill. Progress was much slower at Fort Chimo, Southampton Island, and Frobisher Bay, where there was no rail service. Nonetheless, by early 1943, American civilian contractors had constructed unpaved but usable runways at each of the

---

\(^{19}\) Carroll, “Defence Forces Operations in Hudson Bay,” 902.
three sites along with housing facilities required to support 50 per cent of the proposed personnel strength.20

Despite its large grain elevator and port facilities, Churchill was little more than a modest trading post in 1942. Situated near the mouth of the Churchill River, the town dock could accommodate four ships and the harbour had enough space to hold three more at anchor. Including the Indigenous families who lived on the river flats near the shore of Hudson Bay, the population was approximately 150 at this time. Because of security measures agreed to as part of the Crimson Project, the local population at Churchill was uninformed prior to the arrival of the foreign soldiers into their community. According to Margaret Carroll, the local hotel proprietor had some indication of the impending influx. He had received forewarning from his Winnipeg beverage supplier that a number of tourists were travelling via train from Winnipeg to Churchill along with a carload of beer. The number of arrivals was much larger than had been anticipated.21

Townspeople at Churchill welcomed the United States service members as a potential defence force. Rumours of submarine sightings had circulated during the summer of 1942 and Churchill was unequipped with weapons, ammunition, or plans for action in the event of an attempted enemy landing. Feeling ill prepared, the local population was enthusiastic about the arrival of the American soldiers. The town did not have large stockpiles of food, but the local population contributed enough resources to help acclimate the soldiers to their new surroundings. Construction of the airfield commenced on August 2, shortly after the first arrivals came in late July.

20 Dziuban, United States Army in World War II, 187.
21 The first wave of arrivals numbered approximately one thousand troops, but according to records of the United States General Staff, the total number of men enlisted for construction work at Churchill in August 1942 was 2,152. See Carroll, “Defence Forces Operations in Hudson Bay,” 903.
The construction plan for Churchill was ambitious. The airfield and military base were to include two permanent concrete runways and one temporary runway, a 10,000 square foot steel hanger, one maintenance shop, one twenty-five bed hospital, seventy-seven standard frame buildings, a gasoline storage system, and a system for the supply and distribution of water and electricity. Military personnel representing Canada and the United States had chosen the actual site in early July. It was approximately five miles southeast of the town in the shelter of an esker previously worked to provide concrete aggregate for local projects.

Construction of the Churchill airfield and military base proceeded relatively quickly. By the end of 1943, the site included housing to accommodate more than four hundred officers and nearly nine hundred enlisted men, two runways, the hospital, a prefabricated steel hanger, and three mess halls with a capacity to serve 1,300 men at one sitting. The site also included a radio transmitter and receiver station, as well as various buildings for laundry, storage, and garage space. In September 1943, Canada agreed that the United States would assume responsibility for the base. During the winter of 1943-44, the United States Army used the hospital, barrack buildings, and harbour facilities while conducting cold-weather ordnance tests. Responsibility for the base transferred back to the Canadian Department of Transport before the Canadian Army arrived in October 1946.

Despite the construction commitment to Churchill and other locations in the Canadian North, the Allies never used the Crimson Route. Containment of the U-boat threat in the

---

22 Ibid.
23 Ibid., 904-905.
26 Ibid.
Atlantic and the delivery of many new merchant vessels from Canadian and American builders enabled the transportation of aircraft by sea during the war. Increased airport facilities at Goose Bay and Gander also permitted a greater flow of aircraft and supplies on the established routes south of the Crimson Route, while advancements in meteorology and the range and reliability of aircraft made these routes serviceable for short-range planes. Furthermore, successful landings in North Africa opened new terminal bases for flights over the southern Atlantic. The Crimson project was impracticable because of limited resources and environmental challenges. Personnel strength was low for a permanent operational air route, supplies of fuel were limited and difficult to replenish, and the long winter meant few hours of daylight and severe cold temperatures.

**Fort Churchill and the Transition to Postwar Defence Research**

The interdependence of Canada and the United States was clear at the end of the Second World War. Both countries showed concern for possible Soviet ambitions and worried about foreign activity in the high North. Across Canada’s Arctic lay air routes vital to Western Europe and wartime developments in aviation had opened northern routes to commercial interests, but technology had also opened the door for unwelcomed and potentially hostile activity. The Permanent Joint Board on Defence discussed the value of the Canadian North to continental defence at its fiftieth meeting in June 1945. The consensus recognized the need for joint military action to ensure the security of the North American continent, and those present at the

---


meeting agreed to a series of plans designed to test the combined manoeuvres and equipment of the armed forces of Canada and the United States in high latitudes.

Recognizing the importance of the wartime infrastructure constructed at Churchill, the Canadian services established a Joint Experimental Testing Station (JSES) on the location in October 1946. Situated on the former Crimson Route base, military officials named the location Fort Churchill to distinguish it from the town of Churchill. The base offered sufficient shelter, amenities and access to transportation services required to facilitate a fully functional year-round northern experimental military station. There was ready access to rail through the Hudson Bay terminal and the nearby Port of Churchill offered access to sea transportation through the Hudson Strait from approximately late July to mid-October each year. The site also offered a functional aerodrome as well as access to radio and meteorological services provided by the Department of Transport.

In a move to strengthen Canada’s defence presence in the postwar North, the Department of National Defence created a short-term construction plan for Fort Churchill in August 1946 and the Army assumed responsibility to repair the existing facilities. The base did not have running water or an adequate sewage system. Individual huts relied on oil for heat, but delivery of oil by truck from the town was inefficient and frustrating. New construction at Fort Churchill began to alleviate some of these problems in 1947-48. The Army built permanent married quarters and barrack accommodations for single officers, men and civilians working on the base. As operations expanded, so too did construction to meet the growing military and social needs of the base and its personnel (there were as many as 800 civilian workers on the site at the peak of

---

30 The majority of the work in 1947-48 was the responsibility of No. 18 Works Company, Royal Canadian Engineers, who completed the construction along with the assistance of civilian labour.
construction). By the time the Army withdrew in May 1964, Fort Churchill was an independent community equipped with necessary utilities and amenities that included a school, library, chapels, theatre, radio station, bowling alleys, ice arena, post office and an extensive vehicle workshop.\footnote{Carroll, “Defence Forces Operations in Hudson Bay,” 910.}

The base at Fort Churchill provided the Defence Research Board with an excellent opportunity to expand its Arctic research program. With National Defence and the Department of Mines and Resources both keen to maintain northern air bases and photographic mapping in the North, a permanent scientific research laboratory at Churchill meant the possibility of further

integration among federal departments operating in northern Canada. For the Defence Research Board, interdepartmental cooperation meant a sustained budget and the possibility of expansion. Fort Churchill was an ideal location. The base enabled the integration of laboratory work and military testing in a natural environment that offered limitless ice in winter and swarms of mosquitoes, biting flies and spongy tundra in the summer. As former Superintendent of Defence Research Northern Laboratory, Archie Pennie once wrote, “[Churchill was] virtually the crossroads to the Arctic.”

The establishment of a permanent research laboratory at Fort Churchill was an arduous process for the scientists involved. James Croal was the first employee of Defence Research Northern Laboratory, although the laboratory did not exist when he arrived at Churchill in late August 1947. A veteran of the Royal Canadian Navy, Croal arrived at Churchill with a BB X-ray diamond drill and commenced a drilling program to record temperature of the frozen ground in an effort to learn about permafrost. He worked alone on an old searchlight platform made of skids before joining Captain Bill Crumlin of the United States Corps of Engineers. Crumlin was also interested in conducting permafrost tests, and the two researchers made daily trips to various drill sites near the Fort Churchill base.

35 Ibid., 31-32.
By the end of 1947, the Defence Research Board had a permanent staff of four scientists and one clerk stationed at Churchill. As the research activities increased on site, the Canadian Army provided two small huts for the storage of scientific equipment. Warmed by unreliable oil heaters borrowed from the United States Army, the two huts made scientific work extremely difficult during the harsh winter of 1947-48. Nonetheless, the small DRB staff maintained an effective permafrost program and initiated a series of studies to measure human performance under cold duress. In June 1948, A.C. Jones arrived and took his post as the first Superintendent of Defence Research Northern Laboratory. Construction of the laboratory began during the summer of 1947 but the facility was not ready for use until May 1949. Upon his arrival, Jones made arrangements to transport a hut from the Rideau Military Hospital in Ottawa. Delivered to Churchill and rebuilt on the base, the hut provided sufficient accommodation for the DRB scientists already on site and the additional staff who arrived with Jones. The facility served the DRNL team until construction of the laboratory was complete.

With a permanent residence and working space, the team at DRNL initiated scientific work on environmental protection of the human body, nutritional medical problems, design and development of Arctic clothing and equipment, the performance of mechanical parts and supplies in severe cold, and entomology relating to mosquitoes and biting flies in warm weather. The official function of DRNL was two-fold:

a) To undertake such research on problems of Arctic warfare as can most effectively be carried out in the Churchill area and in areas directly accessible from Churchill. The problems include those of clothing, equipment and shelter, pest control and protective measures, acclimatization and nutrition, measurement of environmental

---

36 In addition to Croal, the DRB staff at Fort Churchill included A.V. Hannam, Guy Marier, W. Beckel, and J.D. O’Connor. See Goodspeed, A History of the Defence Research Board of Canada, 180.
39 Ibid., 180.
factors, trafficability and properties of terrain, use of fuels and lubricants, and the
behaviour of materials under Arctic conditions.

b) To provide laboratory facilities, transportation, equipment, clothing, food, supplies,
and communication of scientific workers, test team and observers from other stations
of the [Defence Research] Board or its associated agencies, to enable them to carry
out research in the Arctic, using the Defence Research Northern Laboratory as a base
for their operations.  

The central scientific and administrative organization of the Defence Research Board provided
all resources and funding for DRNL. The total number of personnel employed at the laboratory
in late November 1948 increased slightly to fifteen, which included only two professional
scientists as well as six non-professionals and seven casual staff members. Their approved
operating budget for the first full year was approximately $315,000.

Although the likelihood of a land invasion or establishment of enemy lodgment in the
Arctic was remote, Canada participated in pre-emptive measures with both the United States and
United Kingdom that aimed to counter the postwar threat in the North. The Defence Research
Northern Laboratory was vital to the scientific and military work carried out at Fort Churchill
during the early postwar years. Between 1947 and 1965, DRNL functioned as a multi-purpose
facility for research, training, and education on winter and summer issues specific to the
Canadian Arctic and sub-Arctic climate. Canadian, American, and British forces trained and
developed methods and equipment specifically designed to function under the extremes of
climate and terrain encountered in northern latitudes. This scientific research became important
to Canadian military interests in the North. According to Pennie, the former superintendent of
DRNL, “joint military and scientific work was required to define the problems which faced man

41 Ibid.
42 The exact number listed in the financial records of the Department of National Defence is $315,195; see ibid., 195.
in the Arctic environment — his clothing, feeding, tactical deployment, navigation, re-supply and a host of associated problems.”

Of particular concern for researchers at DRNL was the efficiency of northern military operations conducted by the Mobile Striking Force (MSF) while under the peculiar stresses of the Arctic environment. The Mobile Reserve—renamed the MSF in 1948—resulted from the 1946 Canada-United States Basic Security Plan, which required Canada to provide one airborne or air transportable brigade group for service in the Arctic. Comprised of three infantry battalions with combat support and service support units, officials designed the MSF as a preventative land element to deter the Soviets from establishing forward operating bases in the Canadian North. At the time, technology restricted long-range bombers from making roundtrip flights over the North Pole and continental defence depended on the ability of the MSF to prevent the Soviets from establishing re-fueling stations on North American territory. The MSF also served to promote Canadian claims to territorial sovereignty by facilitating operational cooperation with United States forces.

Scientific research at Churchill was not restricted to military affairs, however. Winter scientific work at Churchill concentrated on permafrost, problems of clothing and equipment, fuels and lubricants, and nutrition. During the summer months, scientists turned their attention to entomology and devised solutions to improve military operations in areas of intense blackfly

---

population. Research at DRNL constituted a variety of scientific disciplines, because problems “dealing with any phase of military operations in the Arctic had to have an input from the operational, the human resources, the biochemical [and] as well as from the engineering side.”\textsuperscript{46} Fort Churchill served many of the joint scientific and military research needs of Canada’s defence establishment, but the federal government also extended its reach in the Arctic by provisioning financial and technical support for northern research elsewhere.

In addition to their own work at Churchill, scientists at the Defence Research Northern Laboratory played a role in the air photography and mapping activities of the Royal Canadian Air Force. The RCAF first operated out of Churchill in October 1946. Part of its function was the provision of aircraft and aircrew to facilitate air requirements for the Canadian and American forces stationed at the base. Search and rescue operations were an important function of the RCAF at Fort Churchill as well. Pilot records make repeated references to mercy flights on behalf of individual citizens and communities, as noted by Margaret Carroll.\textsuperscript{47} RCAF personnel were on watch each day throughout the week and rescue units stood ready and equipped with specially fitted aircraft and highly trained aircrews. Researchers at DRNL frequently questioned survivors who received medical treatment on site at Fort Churchill. According to former laboratory employee M.F. Coffey, DRNL scientists spoke with survivors to collect information that was vital to the modification and improvement of Arctic survival kits issued by the Army and Air Force.\textsuperscript{48}

As Fort Churchill became a gateway to the North, the RCAF used the base to gain access to more remote locations such as Baker Lake in the Northwest Territories and Coral Harbour on

\textsuperscript{46} Ibid., 2.
\textsuperscript{47} Carroll, “Defence Forces Operations in Hudson Bay,” 923.
Southampton Island. As early as 1947, for instance, the RCAF Canso made Fort Churchill an important stop on its annual magnetic research flight into the Arctic for the Division of Terrestrial Magnetism of the Dominion Observatory. By 1951-52, the RCAF had operated polar navigation training flights out of the base and Air Transport Command had used the airfield as a major staging stop for the increasing northern traffic.

Air photography and mapping in the Arctic also represented an important and unique Canadian contribution to the tripartite security alliance. During the early stages of the Second World War, the United Kingdom appealed to Canada for assistance with scientific research in air photography. The geostrategic position of Canada allowed for a greater contribution than had been anticipated. By the end of the war, the RCAF had become an authority on scientific photographic research and survey processing. As applied to tripartite security, one of the more significant RCAF commitments was the photography of all unmapped areas of the Canadian North. The airfields at Churchill and Coral Harbour were essential to mapping Hudson Bay and the surrounding northern regions, which officials considered imperative to wartime defence.

Photographic and mapping commitments continued into the postwar period, of course. Canada and the United States agreed to a joint military “Mapping, Charting and Air Photography Plan” in 1946. The plan outlined a program for the complete air mapping of Canada by 1967, and the Army Survey Establishment provided ground control and produced maps from aerial photography in the area west of Hudson Bay. Concurrently, the Surveys and Mapping Branch of the Department of Mines and Technical Surveys produced maps for the area to the east. The

---

50 For a detailed account of the non-combat activities of the RCAF during the interwar and Second World War periods, with particular reference to the Canadian North, see Keith R. Greenaway, “Air Transport,” in Science, History and Hudson Bay, Vol. 2, Beals and Shenstone eds., 869-895.
Royal Canadian Air Force provided the aircraft, crews, and the transportation of personnel for the ground control of these operations. By 1949, photographic commitments in the North required three RCAF squadrons totalling approximately 550 personnel and thirty-three aircraft. With an aircraft base at Resolute, air photography had mapped nearly the whole of Canada by the end of 1953. The program continued for the next decade until 1964 when a final party mapped an area from the Melville Peninsula to Arviat (formerly “Eskimo Point”) on the western shore of Hudson Bay in the modern-day Kivalliq Region of Nunavut.52

**Continental Defence and the Canadian North, 1945-1950**

Mapping in the Arctic had military applications for the Canadian defence establishment at the dawn of the Cold War. While the Mobile Striking Force prevented land-based incursions, military officials worried that large ice floes could facilitate unwelcomed activity.53 Senior officials in Ottawa and Washington believed that adequate northern defence meant preventing the Soviet Union from establishing a presence in the North, whether on land or floating sea ice. Joint RCAF-USAF flights over Canada’s Arctic tracked ice floes that might serve as landing strips and refuelling stations for Soviet bombers, which lacked the range for the round trip from the Soviet mainland to the cities of North America. Prior to the December 1941 Japanese attack on Pearl Harbor, continental North America had been protected by the isolation provided by the Atlantic, Pacific, and Arctic Oceans. Any attack was defendable by sea, but the development of aeronautic technologies altered the balance of global security. From the 1940s onward, North America has been a single geostrategic entity and continental defence has evolved within this context.

---

52 Ibid., 924.
53 On the Mobile Striking Force, see Coates et al., Arctic Front, 65.
As advancements in aviation increased the technological threat against Canada and the United States, senior officials in Ottawa and Washington paid close attention to Soviet activity in the Arctic. In May 1937, Valerii Chkalov became the first pilot to land at the North Pole. Otto Schmidt was among the crew who landed with Chkalov. Schmidt helped foster close collaboration between Soviet aviators and research teams on floating ice stations. Scientists received necessary supplies and relief while aviators gained extensive experience in trans-Arctic flight. These advancements in sea ice research and polar aviation continued throughout the war and into the postwar period, while North American polar experts watched from afar with a mixture of appreciation and fear.

By the end of the Second World War, the development of long-range nuclear bomb-carrying bombers had exacerbated the potential postwar threat of the Soviet Union. No longer isolated from technological danger, the United States proposed to Canada a unified defence plan in May 1946, and the newly created bilateral Military Cooperation Committee approved the Joint Canada-United States Basic Security Plan. The plan stated clearly that neither the oceans nor the vast territoriality of the Arctic was anymore an adequate barrier to protect the northern half of the North American continent against long-range weapons or invading armies. This reality posed a significant foreign policy issue for the Liberal government of Mackenzie King. In the transition to peace, the government had to reconcile the concerns of a war-wary public while protecting Canadian interests.

---

The Arctic represented a dual-concern for senior officials in Ottawa who pondered how to protect against the Soviet threat while managing encroachment upon or challenges to Canada’s Arctic sovereignty by the United States. Despite repeated assurances from Washington that American plans to undermine Canadian sovereignty over the Arctic archipelago did not exist, the United States refused to formally acknowledge Canada’s sector claims until January 1947.\(^56\) After months of careful negotiations, the Permanent Joint Board on Defence, the senior bilateral defence agency between the North American partners, agreed on Recommendation 36, which recognized Canada’s legal sovereignty in the North.\(^57\) Yet senior officials in Ottawa, according to Peter Kikkert and Whitney Lackenbauer, believed that “paper guarantees were useless unless the government could actually control activities in its jurisdiction.”\(^58\)

The issue of control is a particularly divisive topic in scholarship on Arctic sovereignty and Canadian-American relations during the early postwar period. Historian Shelagh Grant has alleged that Canada sacrificed sovereignty in the North by cooperating with the United States in continental defence.\(^59\) The opposing view emphasizes mutual respect and open dialogue between the North American partners. Historians David Bercuson and Elizabeth Elliot-Meisel, for instance, maintain that senior civil servants in Ottawa crafted a foreign policy to simultaneously protect Canadian sovereignty and support Western security.\(^60\) Kikkert and Lackenbauer fall into


this camp as well. The Canadian government, they put forward, “did not hand the Americans the keys to the Arctic and simply turn a blind eye to events on the ground … [it] crafted agreements on individual defence projects and continued to monitor all American activities in the region to ensure an appropriate level of control.”

Either way, continental defence negotiations and bilateral security agreements between Canada and the United States had immediate and lasting implications for the Canadian services. As policy planner for the Royal Canadian Navy (RCN) from 1940 to 1943, and Secretary to the Canadian Joint Staff Mission in London during 1944-45, Lt. Commander G.F. Todd proposed that the RCN cooperate with the RCAF to protect the coastal waters of Canada, Newfoundland, and Labrador after the Second World War. In his 1944 report on postwar strategy planning, Todd suggested that Canada’s contribution to continental defence required adequate naval and air forces capable of defending Canada by an air or sea attack from the North. While Todd’s assessment held strategic relevance, his view for the RCN clashed with Mackenzie King’s priorities for postwar Canada. In the transition to peace, the federal government demobilized the Canadian services and thereby limited the ability of the RCN to defend Canada at sea. Budget cuts restricted the resources and personnel of the RCN, and the future of Canada’s naval presence in the Arctic was unclear.

Facing a reduced role in defence of Canadian waters, the Royal Canadian Navy looked north to make a case for its significance to postwar security and continental defence. As Richard

---

63 Ibid.
64 At the start of the Second World War in 1939, the RCN had nearly 100,000 naval personnel and 400 ships. By the end of the war in 1945, the RCN included 93,000 personnel and 939 ships, two cruisers, fourteen destroyers, and a former Axis submarine. See Elliot-Meisel, “Arctic Focus: The Royal Canadian Navy in Arctic Waters, 1946-1949,” 24-25.
Mayne has explained, “the Navy gave the Arctic a high priority and stretched its extremely limited resources as much as possible to establish a presence there in spite of the challenges posed by the great distances and extreme environment.”\textsuperscript{65} This presence was most significant in 1948 when the RCN undertook a northern cruise, which departed from Churchill and sailed north beyond Hudson Bay. Over twenty-seven days, an expedition of 300 RCN sailors navigated northern waters with onboard observers from the United States, the United Kingdom, and Canada. Among the Canadian observers were Lieutenant William Bailey of the Defence Research Board, three representatives of the Canadian Army, and three servicemen of the RCAF.\textsuperscript{66} The expedition sailed around icebergs and travelled through fog and snow conditions, eventually reaching 62 degrees N, a latitude that marked the farthest north any RCN ship had reached. The RCN ensured the press published photos and statements from the commanding officers, but the cruise, although successful and highly publicized, did not alter the postwar trajectory of the RCN.

As the high point of the navy’s activity in Arctic waters during the early postwar period, the 1948 northern cruise represented the type of presence the Royal Canadian Navy wanted to maintain in order to secure Canadian interests in the Arctic.\textsuperscript{67} These ambitious were short-lived. As Elizabeth Elliot-Meisel has argued, “the Arctic provided the navy with an important theatre and function in the postwar era, one that was instrumental to not only Canadian but also continental defence … But the RCN was unable to sustain its case.”\textsuperscript{68} While Canada’s maritime strategy considered the significance of the Arctic’s geostrategic location, the range of


\textsuperscript{66} Elliot-Meisel, “Arctic Focus: The Royal Canadian Navy in Arctic Waters, 1946-1949,” 32.

\textsuperscript{67} Mayne, “An unusual voyage in far northern waters,” 43.

commitments needed to participate effectively in continental defence strained the already limited resources of the RCN. Since the PJBD had endorsed military cooperation and collaboration between Canada and the United States, the Canadian government reallocated funds away from the RCN to support other financial requirements of continental defence. The creation of NATO in 1949 further cemented Canada’s commitment to the allied cause, and the RCN had to abandon the dream of providing an independent defence of Canadian waters in the Arctic.

Despite the difficult reality of demobilization, cost cutting, and continental defence commitments, the Royal Canadian Navy adapted to its new postwar role and embraced the opportunity to contribute to NATO. Setting aside unilateral Arctic patrols for allied NATO responsibilities, the RCN decided to move away from asserting sovereignty against perceived threats in the North and committed its resources to help secure international waters. With no clear naval threat to continental security in the Arctic, the RCN made the correct decision. The change provided the RCN with a stable strategic direction, while supporting the Liberal’s foreign policy and strengthening Canada’s commitment to Western security.

Although not the focus of this dissertation, the Defence Research Board conducted a small but important naval research program. On 1 January 1948, the Naval Research Establishment at Dartmouth, Nova Scotia transferred to the DRB. Its facilities included two floating laboratories, an Alergine-class mine-sweeper operated by the RCN on behalf of the Defence Scientific Service (DSS), and a converted infantry landing ship owned by the DSS.

Much of Canada’s early postwar naval research along the East Coast and in the Atlantic

---

69 Joel Sokolsky has suggested that the commitment to NATO saved the RCN from extinction; see Sokolsky, “A One Ocean Fleet: The Atlantic and Canadian Naval Policy,” Cahiers de géographie du Québec 34, no. 93 (December 1990): 299-314.

stemmed from these ships. Scientific work at NRE concentrated primarily on anti-submarine warfare, but researchers also investigated methods to reduce ship corrosion and studied the oceanography of the Eastern Canadian seabed.\footnote{For details on NRE, see John R. Longard, \textit{Knots, Volts and Decibels: An Informal History of the Naval Research Establishment, 1940-1967} (Dartmouth, NS: Defence Research Establish Atlantic, 1993); also see Goodspeed, \textit{A History of the Defence Research Board of Canada}, 211-214.}

The Defence Research Board also operated a Pacific Naval Laboratory across the country at Esquimalt, British Columbia (BC). Opened in 1948, by agreement with the Royal Canadian Navy, the research establishment gave the DRB year-round access to the deep inlets and sheltered waters of the BC coast. Scientists conducted oceanographic and hydrographic work on the West Coast but also travelled as far north as the Arctic. The DRB acquired the HMCS Cancolim II in the early 1950s, and researchers used the vessel to obtain and test the salinity of water from the Beaufort Sea.\footnote{Salinity is the measure of all the salts dissolved in water; see Cloutier, \textit{The Defence Research Board and the Defence Scientific Service}, 14; for information on the Pacific Naval Laboratory, see Goodspeed, \textit{A History of the Defence Research Board of Canada}, 214-222.} Yet the bulk of naval research conducted by the Defence Research Board, including Arctic-related studies, occurred after 1952. For the period covered in this study, the scientific focus of the DRB in the North related primarily to on-land investigation of environment, terrain, and the human experience in both summer and winter conditions.

\textbf{Ice Islands and the Arctic Ocean}

The geopolitical significance of Soviet experience in the Arctic increased drastically in August 1949 when the Soviet Union detonated its first nuclear bomb. The superpower arms race between the Soviet Union and the United States created a highly militarized Arctic. Approximately one-fifth of all Russian nuclear tests occurred in the Polar Region on the island of Novaya Zemlya, and the Soviet Union positioned nuclear weapons as well as nuclear-powered...
ships and submarines in the far North. In a policy of mutually assured destruction, the United States responded to the nuclear weapons buildup in the Soviet Arctic by fortifying its own nuclear presence in the high North. The reason for placing nuclear weapons in the Polar Region was identical on both sides of the ideological divide: weapons close to the Pole would be most effective in the event of a nuclear conflict.

The logic of mutually assured destruction altered the perception of the Arctic for policymakers in Ottawa, and the Canadian defence establishment began to view the Arctic as a potential geographic weak point rather than the top of a “fireproof house.” As tensions grew between the United States and the Soviet Union, both superpowers began to establish semi-permanent stations on ice islands floating north of Canada. This increase in activity concerned senior Canadian officials, and the Department of National Defence began to perceive and prepare for imminent dangers stemming from the vast northern expanse in the early postwar period. Although officials in Ottawa considered the Arctic Ocean north of Canada to be in the Canadian sector of the Arctic, Canada had no legal claim to international waters and the close proximity of the foreign expeditions posed a real threat to Canadian security in the North.

An ice island is a floating mass of densely packed multiyear sea ice that drifts slowly according to the wind and currents of the Arctic Ocean. Appearing as flat-shaped boxes that can rise to forty feet above sea level, most ice islands are large and solid enough for semi-permanent occupation. They usually form by splitting apart from a large mass of shelf or shore

74 Kenneth Coates et al., Arctic Front: Defending Canada in the Far North (Toronto: Thomas Allen Publishers, 2008), 55.
76 For a general interpretive overview of ice islands in the context of the early postwar period, see L.S. Koenig, K.R. Greenaway, Moira Dunbar and G. Hattersley-Smith, “Arctic Ice Islands,” Arctic 5, no. 2 (July 1952): 67-103; Gordon Smith, Ice Islands in Arctic Waters (Ottawa: Department of Indian and Northern Affairs, 1980), 1.
77 Lajeunesse, Lock, Stock, and Icebergs, 49.
ice attached to the northern coast of Ellesmere Island and drift in a clockwise circle at a slow pace of seven kilometres per day. From their starting position, they pass through the Beaufort Sea and drift by the northern coasts of Alaska and Siberia, moving northward along the margins of the Arctic Archipelago towards the Pole.\textsuperscript{78}

The study of ice islands grew increasingly significant during the early Cold War. In fact, both the United States and the Soviet Union established temporary bases on polar pack ice north of Siberia and Alaska in 1950.\textsuperscript{79} In conjunction with reconnaissance weather flights, the United

\begin{itemize}
\item [78] Smith, \textit{Ice Islands in Arctic Waters}, 1-3.
\item [79] Lajeunesse, \textit{Lock, Stock, and Icebergs}, 49.
\end{itemize}
States launched a project to discover and track ice islands drifting in the Arctic Ocean.\(^{80}\) Moreover, the Americans established an ice base in three subsequent years from 1950 to 1953 as part of Operation Ski Jump, which aimed to test and improve techniques for landing heavy aircraft on Arctic ice. For their part, the Soviets established a station called North Pole-2 in April 1950. The establishment of both facilities initiated a long period of the Cold War that witnessed the existence of many polar stations drifting in the Arctic Ocean.

American and Russian activity on ice floating north of Canada concerned officials in Ottawa. For the first time, foreign powers had essentially occupied a sector of the Arctic Ocean that Canadian policymakers considered autonomous to Canada. International law stated otherwise, however. Most states considered the Arctic Ocean an international body of water, so neither the Americans nor the Soviets could actually “occupy” waters thought to be within the Canadian sector.\(^{81}\) Understandably, bureaucrats in the Canadian defence establishment worried about Canada’s inability to claim or exercise autonomy over Arctic waters, especially in areas considered imperative to northern defence.

The Soviet presence north of Canada concerned officials in Ottawa the most. Not only did Soviet stations pose a dual threat to Canadian sovereignty and security, but Russian scientists had also gained extensive experience in Arctic research by the start of the Cold War. Between 1935 and 1941, the Soviet Union executed no fewer than four drift expeditions on ships or ice floes and conducted a series of aircraft landings on sea ice north of Siberia.\(^{82}\) In one isolated attempt at polar research, Russian scientists established a semi-permanent station on an ice floe.

---


\(^{81}\) Lajeunesse, \textit{Lock, Stock, and Icebergs}, 49.

\(^{82}\) Ibid., 50.
in 1937-38. Dubbed North Pole-1, the station came close to the northern-most fringes of the Canadian sector before drifting to the northeast coast of Greenland.

Soviet expeditions in the Arctic Ocean resumed after the Second World War and the Canadian defence establishment took notice. The Soviet Union occupied four separate ice islands or floes from 1950 to 1955. Scientists operated three of the four stations concurrently and conducted research studies on Arctic meteorology and oceanography, and on the structure, distribution and movement of pack ice. While the islands occupied by Soviet scientists generally drifted outside of the Canadian sector, the Department of National Defence maintained a close watch on the ice-related activities of the Soviet Union. This was the case in May 1954, when a Soviet aircraft flew over an American station on an ice island known as T-3 or Fletcher’s Island. The flyover occurred while T-3 was in the Canadian Arctic sector and some officials in National Defence voiced concern for Canada’s sovereignty, but External Affairs was unable to confirm that a violation had taken place. The issue was a matter of interpretation and the legal status of the ice island was unclear under international maritime law.

Of more immediate concern for the defence establishment was a discovery made in August of the same year. With the assistance of the RCAF, the Defence Research Board charted an ice island with a Soviet research team that DRB scientists believed would drift into the Canadian sector. Trevor Harwood of the DRB published a report that called for an immediate diplomatic response to the Soviet “intruders” and the Americans, who were allegedly planning to monitor Soviet activity with scheduled flyovers. Harwood also called for a stronger presence of Canadian military in the Arctic Ocean and recommended that the RCAF patrol and occupy ice

---

83 Ibid., 51.
islands such as the abandoned American T-3. Chairman of the DRB, Omond Solandt, also wrote a report that explained the significance of Russian science conducted on the Canadian side of the Pole. Fearing scientific and possibly military domination by the Soviet Union over Arctic ice beyond the north coast of Canada: “[the] presence of the polar station manned by the USSR in this period of tension should invite profound concern in their activities.”

The ice island ultimately drifted away from Canada and into Danish waters north of Greenland, but the incident raised concerns over the possible military uses of Arctic sea ice.

In the wake of the Soviet scare, the Canadian defence establishment considered a host of theories about the militarization of ice islands. Some strategic analysts believed that floating stations might enable the collection of magnetic data to support guided missiles, while others warned against more imminent concerns. Perhaps most significantly, the DRB cautioned that research conducted on ice islands might yield sea floor data to support Soviet submarines, and that drifting sea ice could facilitate forward operating bases for Soviet aircraft. According to Adam Lajeunesse, the RCAF dispelled many of these concerns through surveillance. A series of RCAF flights reported that Russian ice research concentrated on meteorological, oceanographic, and zoological studies. This information confirmed that Soviet activity on ice islands north of Canada was primarily scientific. Although eventually considered non-threatening, the extent of ice-related Soviet activity in the Arctic Ocean caused alarm in the Canadian defence establishment and instigated a full study of ice islands and the sector theory.

---


88 Lajeunesse, Lock, Stock, and Icebergs, 52-56.

89 On this point, Lajeunesse cites an extract from the 3 November 1954 meeting of the Chiefs of Staff; see note 66 for Chapter 2, Lock, Stock, and Icebergs, 325.
International Maritime Law and Canadian Security

The federal study that followed the ice island incident determined that no violation of Canada’s sovereignty had occurred.\textsuperscript{90} International maritime law did not stipulate state ownership over ice islands and, therefore, the Soviet flyover of T-3 did not constitute a direct violation of Canadian sovereignty. Although not surprising, this revelation revealed Canada’s weak legal position relative to the Arctic Ocean and prompted a more thorough examination of Canada’s sovereignty in the North. External Affairs conducted a study in the summer of 1954 to understand Canada’s legal position.\textsuperscript{91} The study sought to determine if, according to international maritime law, states could make sovereign claim to ice islands or sections of the Arctic Ocean through occupation or use of the sector theory.\textsuperscript{92}

Two important conclusions emerged from the External Affairs study of 1954. First, the sector theory alone was an insufficient legal route to claim sovereignty over areas of water in the Arctic Ocean. Second, and perhaps more important, the study confirmed that international maritime law did not recognize the right of a state to establish sovereignty over an ice island by means of occupation. As noted by Arctic maritime scholar Adam Lajeunesse, both of these conclusions derived from the work of the United Nations’ International Law Commission that recognized the right of a state to operate installations required to extract natural resources from its continental shelf.\textsuperscript{93} According to the commission’s final report, installations did not constitute

\textsuperscript{90} For full details on Canada’s claim to Arctic sovereignty in the early postwar period, from the perspective of External Affairs, see “Report for Department of External Affairs by Dean of Law, Dalhousie University: Canadian Sovereignty in the Arctic,” in Documents on Canadian External Relations: The Arctic 1874-1949, Janice Cavell, ed., (Ottawa: Global Affairs Canada, 2016), 851-878; also available in LAC, RG 25, vol. 425, file 9057-40.

\textsuperscript{91} DHH, 2002/17, Joint Staff fonds, “The Sector Theory and Floating Ice Islands in the Arctic,” August 30, 1954.

\textsuperscript{92} In a memorandum written by Omond Solandt, the chairman of the DRB provided a detailed explanation of the study from the perspective of the Canadian defence establishment; see LAC, RG 25, vol. 1, file 50211-40, O.M. Solandt, “Russian Activities on the Canadian Side of the Pole,” August 12, 1954. Also see Lajeunesse, Lock, Stock, and Icebergs, 53.

\textsuperscript{93} The United Nations General Assembly established the International Law Commission in 1948 to promote “the progressive development of international law and its codification”; see United Nations General Assembly
sovereign territory. Nevertheless, the commission permitted installations under the coastal jurisdiction of a state if the installation adhered to the civil requirements of that state.\textsuperscript{94} In other words, under the interpretation of the United Nations, neither the United States nor the Soviet Union violated Canadian sovereignty by operating scientific research stations on floating ice islands in the Arctic Ocean north of Canada.

With Canada unable to assert legal jurisdiction over ice islands floating into Canadian Arctic waters, officials in National Defence turned to surveillance for security. The Defence Research Board suggested Canada occupy the abandoned T-3 and issue a public declaration stating the government’s intent to appropriate and claim sovereignty over any present or future territories available within the Canadian sector.\textsuperscript{95} The federal government never issued the proposed statement, which resulted in an ambiguous political stance. While officials wanted to assert control over foreign activity in the Canadian Arctic, the federal government was unwilling to upset international relations in an attempt to achieve this goal. After all, the United States operated far more ships in the region than did Canada and was likely to reject any clear statement from Ottawa on ownership over ice islands. Thus, the Canadian position remained cautiously pragmatic and the defence establishment maintained close surveillance of Arctic waters north of Canada.


\textsuperscript{95} DHH, 2002/17, Joint Staff fondo, “The Sector Theory and Floating Ice Islands in the Arctic,” August 30, 1954.
Dunbar and the Military Use of Arctic Sea Ice

Moira Dunbar’s extensive interest in Arctic glaciology and sea ice served a specific scientific research need of Canada’s early Cold War defence policy. As one of the DRB’s most notable contributors to Arctic research, she studied, advised and wrote about Canada’s strategic Arctic interests for over twenty years. Dunbar pointed out in an interview with Stephen Franklin of The Ottawa Journal that the “Russians landed on the polar pack ice in 1937 three four-engined aircraft with 16 tons of supplies aboard and without bothering to look for an ice island.”

Together with RCAF Wing Commander Keith Greenaway, Dunbar flew numerous aerial reconnaissance missions over Arctic North America, collecting intelligence for the Canadian defence establishment. She made multiple trips with Greenaway, flying over the Arctic to photograph topography and ice floes. Greenaway was an ideal pilot to work with Dunbar on mapping the Canadian North. His experience dated to the Second World War when he was a radio man for the RCAF. With a basic knowledge of electronics and an interest in geometry and geography, he spent most of the war instructing in radio navigation. Following the war, he graduated as a navigator and began flying in the Arctic in 1946. He joined the Arctic section of the Defence Research Board in 1948 and quickly earned accolades for his work on polar navigation. In 1951, Greenaway received the Colonel Thomas Thurlow Award, a merit prize awarded annually by the United States Institute of Navigation to an individual who makes an outstanding contribution to the science of navigation. He earned the award for co-inventing a

---

98 Ibid.
100 For a list of award winners, see the Institute of Navigation (ION) Awards, “Colonel Thomas L. Thurlow Award,” accessed August 5, 2016, https://www.ion.org/awards/thurlow-award.cfm.
navigational instrument for pilots that plotted the path of aircraft in relation to both the sun and the stars. The North magnetic pole could disrupt standard aerial navigation tools, so Greenaway’s invention made Arctic flight safer from an operational perspective.

Dunbar’s work with Greenaway culminated in Canada’s largest collection of cartographic and glacial aerial photos of the mountainous expanses of the Arctic, many of which were first presented to the public in a publication titled *Arctic Canada from the Air*. The co-written publication provided an aid to scientists working on polar geography as well as members of the RCAF flying in the Arctic. Dunbar spent three years writing and editing the 541-page text, while Greenaway contributed technical data obtained from his extensive hours of polar flying. “[The book] will be very useful with high-flying radar equipment,” Greenaway said in a book release interview with *The Globe and Mail*. “One of the prime requisites of a good global navigator,” he added, “is the ability to interpret what he sees on the radar scope and anticipate what’s coming up. Anticipation is a must in high speed aircraft. A navigator must have a good knowledge of both climatology and geography.”

Dubbed “the bible on the North American Arctic,” *Arctic Canada from the Air* was extremely successful as soon as it left the press. Illustrated extensively with foldout maps and 504 pictures, the book offered an aerial view of prominent geographic features unique to

---

Canada’s Arctic landscape and waters up to the North Pole. Although designed specifically for use by the RCAF, the Defence Research Board considered the book valuable to both military and civilian operations in the Arctic. Upon its release, the DRB issued a statement that urged the “RAF, the USAF, [and] over-the-Pole commercial airlines and independent air operators in the north” to consider purchasing the text for everyday use.105 Airlines, academics, and air forces did indeed order the book. In fact, the United States Strategic Air Command (SAC), an integral component of the North American air defence network, ordered 360 copies and used the book as a primary reference text for Arctic geography.106

Dunbar’s Contribution to Canadian Defence

Dunbar’s work with Greenaway contributed to a large body of scientific research that supported Canada’s independent and collaborative military needs. Although her research was non-military in nature, Dunbar’s work on Arctic sea ice had important implications for northern defence during the early Cold War. By charting the movement of large ice floes, she helped maintain watch for Soviet activity in the Canadian North at a time when scientists from the Soviet Union had gained international recognition for Arctic science and scholarship. In an interview with the Toronto Daily Star, Dunbar referred to Soviet scientists as leading experts in the structure, distribution, and behaviour of sea ice research in the early 1950s.107 Since her work relied heavily on materials written by Russian scholars, Dunbar spent a year learning Russian at the United States Army Language School in Monterey, California.108 In a paper presented to a Royal Society of Canada symposium, she used her knowledge of Soviet Arctic activity to speak about

107 “Reports Progress in Mapping Arctic,” Toronto Daily Star (Toronto), June 4, 1954, p. 60.
the importance of aerial reconnaissance to the development of maps showing winter and summer ice conditions throughout areas considered remote by the contemporary science community.109

Understanding the structure and distribution of ice provided an opportunity for Dunbar to further her standing in the Canadian defence establishment. In October 1951, she became one of only two women to fly across the North Pole. Along with American air-navigation specialist Virginia Washington, Dunbar made the trip as part of a joint Canada-United States mission to study cold-weather military aerial reconnaissance equipment.110 While Dunbar specialized in the climatological aspects of sea ice research, she also served Canada as an Arctic scientific representative. In 1964, only two years removed from the Cuban Missile Crisis of October 1962, she visited Finland and the Soviet Union to examine icebreaking practices. For her contributions to the Canadian defence establishment and her commitment to Arctic research and the development of Canada’s science and technology policies during the Cold War, Dunbar received the Massey Medal in 1972. She later became a fellow of the Royal Society of Canada. Dunbar retired from government service in 1978.

Conclusion

First occupied by Canadian and United States forces during the Second World War, Fort Churchill became important to the continental defence of North America in the early Cold War period. The Defence Research Board was heavily involved in the elaborate plan to photograph the Canadian North, as is perhaps best shown by the extensive work of Moira Dunbar and Keith Greenaway. But defending the vast territory of the Canadian North was a matter of importance

109 Dunbar’s work with air reconnaissance corrected the erroneous belief that the centre of Hudson’s Bay never froze; see “Reports Progress in Mapping Arctic,” Toronto Daily Star (Toronto), June 4, 1954, p. 60.
beyond geostrategic considerations of mapping and photography. The Canadian defence establishment recognized that soldiers and civil servants required the training and confidence to operate effectively and safely in the high latitude regions of Arctic and sub-Arctic Canada.\textsuperscript{111}

As Fort Churchill grew increasingly significant to the Canadian military and defence establishment, the location served as a base for tripartite science and Arctic studies. Researchers from the United Kingdom and the United States travelled to Churchill to participate in Arctic studies at the Defence Research Northern Laboratory, while teams of scientists, engineers, and medical practitioners from the National Research Council and Canadian universities also used the base and scientific facilities to conduct northern research.\textsuperscript{112} Fort Churchill provided an opportunity for Canada to make a unique contribution to Western security, and Canada’s policy for the North worked on an international political level. Officials in Ottawa successfully leveraged Canada’s geography and limited military resources to strengthen the Canadian position in the tripartite security alliance. Science was the key component, and as documented in the next chapter, the Defence Research Board was Canada’s single largest patron of Arctic scientific research during the early Cold War.

Chapter 3
Funding Defence Research and Development

On 16 February 1952, *The Financial Post* printed a cover story that questioned the military contribution of Canada’s scientists in government, university and industry. Referring to science as the $35 million fourth arm of the armed services, Cyril Bassett, the author of the article, asked, “Are we [the Canadian taxpayer] getting our money’s worth?”¹ To answer this question, Bassett examined the Defence Research Board and highlighted Canada’s unique contribution to military research and development:

> All told, there are currently some 170 separate projects being carried out for DRB in 15 universities; probably another 100 or so will shortly get under way. And it needs little imagination to see that this sort of work can pay off big dividends, not only in supplying essential research information, but in producing the scientists Canada will need in increasing numbers in her ever-enlarging industrial economy.²

Bassett’s conclusion on defence research reflects wider attitudes of the early Cold War period. A strong belief in the power of scientific knowledge emerged during the Second World War when technological innovations such as radar, penicillin, and the atomic bomb helped the Allies secure victory over Nazi Germany.³ Entering the postwar period, civilians in the West looked to scientific experts to deliver social and economic benefits through the development of new technologies and the accumulation of theoretical and empirical knowledge. Stephen Bocking has explored the evolution and grip of “scientific authority” in a detailed survey that examines the impact of science on environmental politics. “In environmental affairs,” Bocking argues, “the

---

² Ibid.
postwar authority of science was epitomized by confidence that the same strategies that had won the war could be applied to defeating “enemies” in nature, such as insects or fire.\(^4\)

This theme of war on nature has attracted considerable attention from recent studies that explore the Cold War sciences through the lens of historical geography. Matthew Farish, for instance, has traced the history of scientific activity in Cold War Alaska to highlight the social, economic, and political implications of northern militarization.\(^5\) The United States military funded extensive scientific projects related to cold-weather operations, including research and development to improve the design and efficiency of mechanical and human movement in northern latitudes. In an attempt to overcome the Arctic environment, the military facilitated research projects across a variety of disciplines with the aim of inventing technologies and techniques to help soldiers survive and operate in severe cold. Supported by organizations that included the US Air Force, the US Army, and the National Academy of Sciences, scientists received extensive funding to investigate chemical methods to increase cold tolerance in the human body. Research included work to develop cold-fighting pills as well as clothes and equipment designed to keep soldiers warm, and on the physiological response to cold in persons indigenous to Alaska.

The Cold War sciences thrived in Alaska largely because of the “military-industrial-academic complex.”\(^6\) Immediately following the Second World War, American military

---

\(^4\) Ibid.


personnel either returned to or belatedly entered colleges and universities in large numbers. Between 1945 and 1950, approximately 2.3 million American veterans attended post-secondary institutions and accounted for one-half of the total student population in that period. The influx of military personnel into academia resulted from the Serviceman’s Readjustment Act of 1944. Known more commonly as the G.I. Bill of Rights, this legislation guaranteed veterans access to education and housing. The subsidies provided to veterans fueled the North American consumer economy and helped avoid another depression, although wartime savings in the United States and Canada were crucial as well.

Scale was the significant difference between the defence economies of Canada and the United States, of course. During the Cold War, Canada’s population and gross national product (GNP) were ten to fifteen times smaller than those of the United States. On a per capita basis, moreover, the United States government spent as much as ten times more on national defence than did the Canadian government. In the early 1960s, at the peak of spending on research and development in North America, the United States committed more annually to defence than Canada’s entire GNP. By a similar token, the number of people directly or indirectly employed by the US Department of Defense equaled the entire Canadian labour force. Perhaps most revealing is the total defence R&D commitment. In the United States, the government spent nearly 90 per cent of the federal research and development budget on defence. By comparison,

---

the United Kingdom spent approximately 73 per cent of its R&D budget on defence, while in Canada the amount was 33 per cent during the same period.\textsuperscript{10}

The circumstances that enabled Cold War defence research to thrive in North America also created new hierarchies of political influence and competition among scientific experts for access to government capital.\textsuperscript{11} Geostrategic considerations of the early Cold War period prompted new political attention to science, and weapons-related research expanded along with fundamental or basic research of the kind undertaken in universities. In Canada, civilian scientists and engineers became key political players in Ottawa and significant portions of the federal defence budget began to flow to research laboratories and universities. While not to the scale of the financial resources expended in the United States, Cold War politics in Canada shaped the nature of university and industrial research during the early postwar years. National political priorities furthered the pursuit of “big science and technology” and gave an increasingly governmental and public voice to segments of the scientific community that had a history of independence. These circumstances also reinforced long-standing hierarchies of scientific authority and technical excellence, where favouritism towards academics and elite institutions deepened already strong research budgets.

Cold War politics in Canada privileged a select group of thinkers, institutions, and places. This chapter focuses on the strategic and economic reasons behind the circumstances that enabled access to, and influence of, the political and financial system established to secure and promote the defence interests of the country. Jonathan Turner argues that “the contribution of the

\textsuperscript{11} O’Mara, Cities of Knowledge, 5.
Defence Research Board to the transformation of postwar Canadian education was far less pervasive than in the UK or the US, because the DRB was just one among several funding agencies.\(^\text{12}\) While this contention has merit, we should keep in mind the key principle behind the postwar research and development structure of the Canadian defence establishment: the pragmatic decision of senior policymakers that Canada would avoid duplication and competition in its defence research effort with the United States and the United Kingdom. This guiding principle of “specialization” applied holistically to Canada’s entire defence economy, whether the National Research Council or the Defence Research Board distributed the federal funds.\(^\text{13}\) Moreover, as Turner correctly asserts, the paper trail for grants awarded by the DRB is sporadic at national and university archives.\(^\text{14}\) The history of research and development in postwar Canada is a puzzle with missing pieces. Nevertheless, available records describe the existence of a carefully planned and executed funding program meant to support the political agenda of the national security state.

**Fundamental vs. Applied Research**

The Defence Research Board recognized two categories of research, fundamental and applied. The former involved investigations of basic phenomena and materials, while the latter involved investigations to determine the feasibility of applying particular scientific knowledge to find solutions to specific military problems.\(^\text{15}\) Under these two categories, the DRB applied several

---


\(^{13}\) Solandt reiterated Canada’s basic policy of “specialization” for research and development at a number of private and public speaking engagements during his tenure as chairman of the Defence Research Board. See, for instance, LAC, RG24, vol. 2425, file O.M. Solandt Speeches and Reports, Dr. O.M. Solandt, “Address to the Engineering Institute of Canada, Ottawa Branch,” 24 February 1949, p. 3.

\(^{14}\) Ibid.

criteria in selecting fields of research. First, the DRB selected fields of research in support of its mandate to provide well-integrated scientific consulting services to the minister of national defence, the Chiefs of Staff and the armed services. Second, DRB research tested equipment and materials for the armed services prior to development and production. Third, a wide information-gathering effort allowed the DRB to keep the Canadian defence establishment aware of relevant research in the United States and in the United Kingdom. Fourth and lastly, the DRB aimed to encourage scientific research and the training of scientists in Canadian universities.

Funding provided by the Defence Research Board supported projects conducted internally at one of its eleven establishments or externally at university and industrial locations. Projects conducted at DRB facilities generally dealt with investigations involving applied research, while extramural projects generally focused on investigations related to fundamental research.\textsuperscript{16} DRB’s policy on research paralleled the R&D policy of National Defence. The policy outlined provisions for the development in Canada of equipment and materials to meet particular needs of Canadian defence. It also outlined provisions to assist where possible the development of equipment and materials by the United States and the United Kingdom, including the provision of facilities for tests and trials under Canadian conditions of climate and topography.\textsuperscript{17}

The Defence Research Board established a Standing Committee on Extramural Research to act as an advisory body to the Board on all matters concerning proposals for grants-in-aid research made by educational or independent agencies. The committee determined the objectives and procedural rules for the extramural research program. According to meeting minutes of the committee, the primary aim of the granting program was to sponsor fundamental research in fields of special interest to defence:

\textsuperscript{16} Ibid.
\textsuperscript{17} Ibid., p. 4.
This is essential if basic principles leading to significant advances in defence science are to be discovered; in particular it is sought to encourage research in fields for which Canada has a natural advantage over the UK or US. These may include problems concerned with climate, terrain, and the geophysical extremes of high magnetic latitude, high geographic latitude and the auroral zone.

To achieve this goal, senior advisors with the DRB designed the extramural granting program as an economic base to initiate the construction of laboratory facilities for the specialized fields of defence research. The support of extramural research ensured a constant flow of well-trained scientists and engineers, which in turn strengthened ties between the DRB and the wider scientific community in Canada. Attracting academic and private institutions to defence science also served the DRB’s internal research establishments. In fields such as armament, radio propagation, and medical research the community of scientists established by the extramural granting program served as a forum for DRB experts to strengthen and expand their knowledge and resource capacity.

Based on experience with fundamental and applied research, advisors of the Standing Committee on Extramural Research decided the Defence Research Board should concentrate work in a particular field to one or two university laboratories. Concentrating research on specific projects allowed the DRB to direct financial support towards the maintenance of effective studies undertaken at universities in fields considered imperative to its own objectives. In other words, while the extramural granting program aimed to create a wide network of defence scientists, grants-in-aid went primarily to research projects directly related to the specific interests of the DRB.

When reviewing applications for grants, the Defence Research Board assessed the scientific worth of the proposed research and its possible application to a specific aspect of Canadian defence. As a general principle of the extramural program, the DRB made a determination on the applicability of a project to defence before awarding a research grant.\(^\text{19}\) The Standing Committee on Extramural Research held a significant amount of power in this regard. While other advisory committees and panels of the DRB were responsible for determining the division of grant funds within their own operating budgets, the Standing Committee on Extramural Research made the final decision to approve a research project for funding. The large size of the granting program effectively reduced the influence of the committee, however. Unless extenuating circumstances dictated otherwise, the committee met only once annually as a collective group.

To expedite the approval of grants, the DRB mandated other advisory committees and panels to indicate the relative order of importance of each of the applications recommended for approval by the Standing Committee on Extramural Research.\(^\text{20}\) Panels were also required to prepare a supplementary list of applications for grants. Arranged in order of priority, each supplementary list included applications deemed worthy of support if provided additional funds outside the independent budget of the granting panel. The DRB implemented this procedure to enable the Standing Committee on Extramural Research to screen out applications loosely related to the defence research requirements of the armed forces and reallocate funds to reinforce work in specific fields of research.

\(^{19}\) Ibid.  
\(^{20}\) Ibid., p. 3.
Extramural University Research

With its inception in 1947, one of the DRB’s primary mandates was to establish a strong program of research in Canadian universities. Omond Solandt wanted to support the growth of the academic sciences in Canada, and the DRB allocated an initial annual expenditure of nearly $500,000 per year. The program consisted mainly of extramural grants-in-aid for research conducted by senior members of university staff across a variety of institutions in Canada, but according to former secretary of the DRB William Barton, the program also supported research contracts for “special projects and the provision of assistance in acquiring certain types of equipment not normally obtainable by universities.”

Upon further examination, it becomes clear that the DRB established its extramural program for three primary reasons. First, as an agency concerned with the application of scientific knowledge, the Board decided it was good policy to set aside a definite proportion of its annual budget for the support of fundamental research. DRB officials considered the support of fundamental research imperative, especially considering the role of the organization during defence preparations in peacetime. Second, the Board saw its extramural funding program as a means to meet its obligations to the institutions responsible for carrying out the training of future employees and proceeded on the assumption that a program of research was essential to direct the training of graduate students. By funding scientists and a wide variety of research initiatives across Canada, the DRB made an annual investment in future talent and reaped the rewards by attracting graduates to government science. Third, contact with university scientists created a

23 Ibid.
unique scientific community of researchers with a shared interest in the problems of defence. Maintenance of close relations between university scientists and those working in the laboratories of the DRB was mutually stimulating and a community of likeminded researchers theoretically meant ready access to scientific expertise in the event of war.

While the DRB respected the intellectual freedom of university researchers and attempted to avoid external control, the extramural grants-in-aid program assumed that university research was most effective when concerned with the investigation of fundamental principles rather than the application of those principles to immediate defence problems. In other words, officials designed the extramural research program as a wide net. University scientists applied for funding to conduct research in areas with potential applicability for defence, but the implementation of the results at the federal level was the prerogative of the DRB.

In a conscious effort to maintain its responsibilities to the federal government and the universities under its funding structure, the DRB established safeguards to govern the procedures of its grants program. First, a number of senior university representatives sat on the Board and were encouraged to voice proposals for research that came directly from university professors who had received funding. Second, in supporting fundamental research to reduce potential problems associated with security restrictions, the Board reserved the right to examine the results of research prior to publication. This ensured that information considered important to the national security of Canada remained out of the public eye. Third, the DRB made an effort to maintain a continuous research program by placing grants in a trust fund and vesting title to research equipment in the institution that used grant monies to make the purchase. Under this third policy, the DRB eliminated the need to maintain elaborate inventories and depreciation.

---

24 Ibid.
records while supplying necessary and modern equipment to university researchers and laboratories. Fourth, grantees did not receive payment for services and institutions did not charge for operating costs. In this respect, the DRB made a concerted effort to remove monetary incentives from the grants-in-aid research program.

Despite the effort to remove the prospect of lucrative gains from its grants system, the DRB openly provided direct financial support for university research projects considered directly applicable to Canadian defence. In such cases where university research could directly benefit National Defence, the DRB provided contracts on an actual costs basis. Each contract came with provisions to control and regulate the allocation of monies exclusively to research and operating costs. Otherwise, the DRB provided flexibility to scientists operating under contract. Although the idea of secrecy and censorship of scientific information aligns closely with our understanding of Western governments during the Cold War, the DRB rarely implemented its second safeguard for restricting the publication of sensitive material. As documented in the notes to Chapter 4 and 5, for instance, the northern research projects of Norman Mackworth and Malcolm Brown were published in various academic and medical research journals.

The Defence Research Board first appointed a Public Relations officer in 1952, when C.A. Pope assumed the new position and began reporting directly to top members of the Board. Prior to Pope’s appointment, the bureaucracy of the DRB was such that leading scientists had the autonomy to determine the sensitivity of defence-related information prior to any publication. The federal government allocated money to the DRB solely for the organization to provide the

---


best possible research program that would meet the needs of the Canadian defense establishment, within the limits of its budget. Inclined to ensure that the Department of National Defence received good value for money spent, the DRB’s extramural grants program was less restrictive than one might expect.

This is not to suggest that DRB scientists openly published sensitive information. On the contrary, DRB scientists who published results of research were extremely cautious in documenting projects funded by the Canadian defence establishment. DRB scientists swore an oath of secrecy and avoided mention of national defence and security when publishing research. As a guiding principle of information control, secrecy about defence research extended to communication with media and public audiences. Scientists employed by the DRB were precluded from communicating research, unless first having received permission from the DRB’s directorates of scientific information or public relations. Indeed, the Defence Research Board was explicitly clear about communication with the public. Chapter VIII of the DRB’s Administrative Reference Manual outlined in writing the official policy on public relations.27 This policy covered all scientists, research assistants, technicians, engineers, administrative employees, military personnel, and federal civil servants working with or for the Defence Research Board.

The Defence Research Board sponsored research directly and indirectly related to its own program. When universities undertook research on certain problems as part of the DRB’s own program, the work focused on fundamental research considered more profitable when conducted within a university where special skills or facilities already existed. On the other hand, the DRB

27 The public relations policy of the Defence Research Board was also tied to government intelligence. In fact, the Chief of Administration for the DRB also administered the Joint Intelligence Bureau of the Chiefs of Staff. On the DRB’s policy on public relations published in Chapter VIII of the Administrative Reference Manual, see LAC, RG 24, vol. 4210, file 69-180-262, DRBC 1-1-269 (DGS), “Public Relations,” 26 October 1950.
awarded grants in certain cases where the research appeared valuable to Canada’s present or future defence effort. Generally, expenditure under the grants program tended to be greater in fields where the existing university infrastructure and expertise was strong. In other words, DRB grants usually supported fundamental defence research with no direct connection to Canadian security.

The Scope and Consequences of Defence Research

The Defence Research Board first considered a policy for extramural research in March 1948 when Omond Solandt discussed the topic during an informal meeting with Charles Best and James Collip. Best and Collip had previously collaborated on the discovery of insulin with Frederick Banting and John Macleod in 1921, and had working relationships with Solandt that dated to the interwar period. In fact, Solandt had been a protégé of Best, and Collip was the Director of the Medical Research Division of the National Research Council. Six months after their informal meeting, the three scientists met again in September 1948, when Best and Collip attended the first meeting of the DRB’s newly formed Medical Research Advisory Committee. Included on the committee were representatives from the three Services, National Health and Welfare, and the Department of Veterans’ Affairs. The committee also included the Directing Consultant from the Royal Canadian Air Force’s Institute of Aviation Medicine (IAM) and five academic members from the universities of Laval, McGill, Manitoba, Queen’s, and Toronto.

---


30 LAC, RG24 S F1, vol. 11995, file DRBS 1-0-43-1 Vol 2, “Agenda No 5.6 (Medical Research Advisory Committee), Defence Research Board from MacNeill,” 22 September 1948.

31 For a detailed list of names and affiliations for members of the Medical Research Advisory Committee, see Turner, “The Defence Research Board of Canada, 1947 to 1977,” 96.
The September meeting marked an important milestone in the history of the Defence Research Board, because the members of the Medical Research Advisory Committee collectively formulated the DRB’s policy for defence medical research. At the meeting, the committee discussed the transfer of responsibility for medical research from the three Services to the DRB. Representatives of the IAM and the Chief of Air Staff allegedly resisted the transfer to protect the interests of the RCAF. The circumstances of the transfer took another two years to resolve. In the end, the DRB absorbed a large portion of the responsibility for research for the Services, while the RCAF maintained control over its internal development and aviation medicine. Morley Whillans of the DRB moved from Ottawa to Toronto in 1950 and became the first superintendent of the Defence Research Medical Laboratories.

The transfer of research responsibilities to the Defence Research Board was not the only concern of the Medical Research Advisory Committee. Members of the committee also had to formulate a policy to determine fields of interest for the DRB and decide what work to leave for researchers at hospitals and universities. Because the primary concern of the DRB was problems affecting the armed forces, the committee decided against supporting research into the diagnosis and treatment of illness. The DRB would instead support research on the unique occupational problems encountered by Service personnel, including training and indoctrination, environment and terrain, military kit and equipment, protective clothing, and food and supplies.

While the Defence Research Board made a concerted effort to distinguish its priorities from those of outside institutions, medical research undertaken at hospitals and universities received grant funding when the work related to the Service problems identified by the Medical

---


Research Advisory Committee. Some of the problems identified by the committee overlapped with the research agenda of the Defence Research Northern Laboratory, which partly accounts for the DRB’s heavy interest in the medical study of cold-weather human physiology. In addition to Malcolm Brown’s research on Inuit biology (Chapter 5), Louis-Paul Dugal received financial support from the DRB to study physiology in relation to cold environments and Wilfred Bigelow for research into hypothermia and resuscitation from cold-induced injury. Bigelow’s research ultimately had little application to Arctic warfare, but it made an important contribution to medical science by helping establish techniques for open-heart surgery and the development of the pacemaker.\(^{34}\)

The medical benefits of Bigelow’s work represent one of the many positive results stemming from the funding system of the Defence Research Board, but the widespread support of scientific research had negative consequences as well. As Jonathan Turner has detailed, there were DRB funded scientists whose research later resulted in legal action.\(^ {35}\) Ewen Cameron of McGill University, a UK scientist from Glasgow, collaborated with James Tyhurst and Donald Hebb of the DRB to study behavioural responses of the human mind. Hebb served on the Psychological Research Panel of the DRB, and the research study conducted by the three men focused on a form of mind control known as “depatterning,” otherwise known as brainwashing.\(^ {36}\) Forty years after the study began in the early 1950s, former patients at the Allan Memorial Institute filed a class-action lawsuit against the United States Central Intelligence Agency (a co-


financier of the research) over the issues of human treatment and informed consent. The CIA settled the lawsuit by test subjects, and the Canadian government ordered a judicial report into Cameron’s experiments. In 1994, the Government of Canada awarded $100,000 to seventy-seven former Canadian patients who suffered “total depatterning,” meaning they were rendered to a childlike state when they received psychiatric treatment at the Institute. More than 250 others were denied compensation at the time of the court ruling.

The role of the Defence Research Board in the research conducted by Cameron, Tyhurst and Hebb remains controversial. Cameron received financial support from the DRB to conduct a series of tests on the behavioural responses of white men to cold-weather adaptation, which had the endorsement of the DRB’s Psychological Research Panel. His research also received approval from Omond Solandt, but the former chairman of the DRB condemned Cameron’s work during the court investigation. “It was my view at the time and continues to be that Cameron was not possessed of the necessary humanity to be regarded as a good doctor,” Solandt said in a statement supporting the victims who had brought their case to court. In questioning the support for Cameron’s research, Canada’s Justice Department assigned former federal Member of Parliament George Cooper to determine whether Ottawa had any legal or moral obligation to the victims. Cooper ultimately decided the Canadian government was not responsible.

39 Omond Solandt, quoted by unknown author, “The legacy of Dr. Cameron”; see University of Toronto Archives and Records Management Services, Omond McKillop Solandt fonds, vol. B93-0041-004, file B93-0041.
40 George T.H. Cooper, Opinion of George Cooper, Q.C., Regarding Canadian Government Funding of the Allan Memorial Institute in the 1950’s and 1960’s (Ottawa: Department of Justice, 1986).
Defence Research Board support for scientific research extended beyond medical work to encompass the whole of its research program. The model for federal support of research in Canada dated to the First World War when the National Research Council began to award grants and scholarships for projects initiated by scientists and engineers outside of government. The DRB continued this tradition, which as model for research was not unique to Canada. Indeed, the NRC had copied the policies and procedural example first conceived by the Department of Scientific and Industrial Research in the United Kingdom. The DSIR funded research to develop a trained workforce and extend its support for empirical science.\(^{41}\) Both of these key principles find extensive documentation in the histories of the NRC and the DRB.

**DRB’s Financial Commitment to Extramural Research**

During a speech to staff members and visiting officials in Ottawa on 30 March 1951, Omond Solandt marked the fourth anniversary of the Defence Research Board by providing a detailed overview of the policies, research establishments, budgetary commitments, and working accomplishments of the organization as a whole.\(^{42}\) The chairman of the DRB gave special attention to extramural research, which, in his opinion, had “produced a considerable volume of research, and, equally important, [had ensured] the training of scientists with the special skills required for defence research.” At the time of Solandt’s address, approximately 150 grants were active in fifteen universities across Canada and more than 500 professors, graduate students, and technicians had worked on various projects in either a part or full time capacity. Over the first four years that the DRB was operational, monetary support for extramural defence research in

---


universities increased fivefold to a payout exceeding $650,000 annually. By 1950, extramural research grants accounted for approximately 5 to 6 per cent of the total annual expenditure of the Defence Research Board.\(^{43}\)

While the financial commitment made by the DRB to extramural research may seem small, there are important factors to consider when contextualizing the grants system in relation to the organization as a whole. It is worth noting that the budgetary details presented by Solandt were slightly inaccurate. According to National Defence financial records for the fiscal year ending on 31 March 1950, extramural research grants funded by the Defence Research Board in 1949-50 accounted for nearly $700,000 of a total approximate budget of $8.5 million.\(^{44}\) The DND records raise the payout for extramural research to 8 per cent of total DRB budget. Although two or three percentage points represent a small increase, the total allotment to extramural research is proportionally significant when we consider the high operating costs of the Defence Research Board. By 1950, the DRB had constructed and staffed nine independent research facilities across Canada that operated year-round in addition to a central scientific and administrative establishment in Ottawa. The cumulative operating costs of all ten locations amounted to approximately $5.7 million in 1949-50, which means the DRB allocated 49 per cent of its total capital investment (budgetary funds less operating costs) to extramural grants that year.\(^{45}\)

Extramural research grants and contracts with Canadian universities expanded annually until the mid-1950s. During 1954-55, the Defence Research Board awarded seventy-nine

---

\(^{43}\) According to the record of Solandt’s speech, the estimated total DRB expenditure for defence research in 1950-51 was between $11 and $12 million.


\(^{45}\) Calculated using the total recorded capital of $1,353,459.46 (see ibid.), the exact number is 49.28 per cent.
extramural research grants to support fieldwork in areas related to aviation medicine, blood
transfusion and preservation, food technology, infection and immunity, psychiatric research, and
radiation and toxicology. The scale of expenditure in most fields began to level off by the end
of 1955 and the DRB decided to cap expenditures on grants to approximately $1 million and
expenditures on contracts to $1 million as well. The $2 million spent on grants and contracts
amounted to 11 per cent of the DRB’s total annual budget of $22 million, which members of the
Board apparently considered sufficient to maintain support for “selected research workers with
particular competence and interest in defence fields.” Of the $1 million expended annually on a
contractual basis, only $200,000 went to universities while the remaining amount funded
industrial research and development. But universities received the whole of the $1 million
made available for research grants, meaning the DRB distributed approximately $1.2 million
annually for university research and $800,000 for industrial R&D. During the life of the
extramural research program in the 1940s and 1950s, over 80 per cent of expended funds
supported research rather than development.

A significant portion of the extramural granting program supported research related to
military problems in the North. During the early 1950s, the DRB expended approximately 40 per
cent of the whole extramural grants-in-aid program on research conducted in the field of
medicine to complement its internal medical program of “keeping the healthy man healthy.”
The remaining 60 per cent of the program supported a variety of fundamental research projects
that had the potential to serve the needs of Canadian defence. In addition to the medical research intended for service personnel, some of the fundamental research sponsored for the Arctic included entomological work on mosquitoes and biting flies, studies of chemical regulation against cold in animals, and meteorological examination of the wind chill factor.

**Intergovernmental and Industrial Defence Spending**

The total investment in research made by the Defence Research Board is even more significant when we consider partnerships with industrial agencies and other government departments. An analysis of the DRB’s wider connection to external interests allows us to appreciate the scale of defence research in Canada during the early Cold War period. Indeed, the DRB created close ties with other agencies of the federal government to expand its scientific and technical capabilities. DRB experts made extensive use of the facilities of the National Research Council to conduct research and development for the armed services. According to DRB records prepared for the Privy Council, the Electrical Engineering Division of the NRC carried a major part of the responsibility for radar R&D while the Flight Research Section of the NRC’s National Aeronautical Establishment directed a significant effort toward solving problems directly related to Canada’s defence.\(^{50}\)

The Defence Research Board supported intergovernmental relations with agencies outside of Canada as well, and the facilities at Fort Churchill hosted visiting scientists and researchers. Scientific activity at Defence Research Northern Laboratory was particularly notable during 1955-56. For instance, the DRB provided laboratory space and equipment to personnel of the United States Environmental Health Laboratory who travelled to Churchill to study general

sanitation problems in the North. In addition to serving as a facility for research teams and individual scientists and engineers, DRNL enabled information and intelligence exchange among the tripartite partners. Laboratory researchers compiled and analyzed statistical data on clothing and equipment from various trials conducted at Churchill by the Directorate of Interservice Development. In cooperation with units from the armed forces, researchers at DRNL shared this information by lecturing on Arctic indoctrination to visiting military and civilian groups from Canada, the United States and Britain.

The extent to which the Defence Research Board mobilized partners for scientific R&D is also evident in the postwar history of the Canadian Industrial Preparedness Association (CIPA). On 22 October 1953, a large assembly of nationally prominent figures from Cabinet, the three Services and government departments convened in Ottawa with representatives from independent agencies at the annual CIPA meeting. Among the government attendees were Omond Solandt, the Minister of Defence Production C.D. Howe, the Minister of National Defence Brooke Claxton, and the Minister of Finance Douglas Abbott. As an “organization encouraging active participation in industrial preparedness for the common defence of Canada,” CIPA had a direct interest in the ongoing activities of the Defence Research Board.

The 1953 annual meeting was particularly full for members of CIPA. The afternoon included a visit to government facilities and the opportunity to hear senior government officials speak at the reception dinner. Solandt arranged two separate tours for the CIPA participants. One group visited the DRB while another visited the National Research Council. The DRB group

---

visited the National Aeronautical Establishment to see wind tunnels and related scientific equipment and laboratories. Participants with the DRB tour group also visited the Central Experimental and Proof Establishment of the RCAF at Rockcliffe to see equipment and methods used in the testing of aircraft and equipment. The NRC group visited an electronics laboratory as well as the establishment for Canadian Signals Research and Development.

A wide and diverse audience attended the CIPA meeting, including senior government officials and defence scientists as well as participants from large corporations such as General Electric and Canadian Arsenals Limited. The meeting also drew the participation of executives from the United States who represented the National Security Industrial Association from New York City. The day culminated with the annual CIPA reception, which featured Solandt and Abbott as keynote speakers. As a closing function, the dinner attracted 292 members and guests.53 C.D. Howe and Brooke Claxton both spoke briefly following Abbott’s address. Howe paid tribute to CIPA, without which, in his estimation, “[Canada’s] defence industry would be feeble.”54 Claxton’s approach was more direct. The minister of defence espoused Cold War rhetoric to caution the audience against any feeling of security from the notion that Soviet Russia’s behaviour had allegedly changed following the Korean War:

If there is a change in the behaviour of Russia and her satellites, there is no change in their design. Any change in Red behaviour was because the free people had shown themselves ready to take action. You don’t cut off your insurance because you haven’t had a fire … Defence payments are our premium on insurance for peace.

Claxton’s comments struck a chord with CIPA. In a bulletin summarizing the events of the annual meeting, the organization published a statement proclaiming Canada’s responsibility to

53 Ibid.
contribute to the military and industrial capacity of the NATO alliance.\textsuperscript{55} The statement referred to defence as “a collective project” and suggested that each nation of the free world work together to withstand Soviet aggression.

Calling on government and industry to recognize Canada’s inability to defend its own interests without support, the CIPA bulletin paints a vivid picture of prevailing attitudes toward research and development in Canada during the early Cold War. While CIPA represents only one voice from the period, the strong presence of government and industrial parties present at the meeting speaks to a distinctive sociocultural response to anxieties over western security. Total preparation for defence in peacetime was the remedy, or so the CIPA bulletin suggests. The statement on collective defence referred specifically to the “crystal clear” necessity that Canada reach its maximum industrial output to support its allies in defence of the free world:

Thus it becomes increasingly important that our capability to produce war material be not impaired by permitting those facilities we now have to lapse into a state of uselessness or obsolescence, and the technical staffs now employed in them to be dissipated. If we were to reach such a state, we would be failing not only in our obligations to our partners in the free community of nations, but in our own defence measures, since, if we do not do our part in full, how can we expect others to give us the help we may need so vitally. [sic]

The key was an unwavering belief in the need to prepare for conflict during peacetime. Accordingly, the principle of “all for one and one for all” applied not only to the armed forces but also to the provision of collective industrial support.

The bulletin from the 1953 annual meeting of the Canadian Industrial Preparedness Association is also valuable for what it tells us about ties between the Defence Research Board and industrial partners during the period. CIPA recorded Solandt’s keynote address and published the text in full. In his address, Solandt briefly outlined the pattern of the scientific

community in Canada and the role of the DRB in operating laboratories to fulfill the research needs of defence. He then discussed the relationship of the DRB to the armed services and industry. Solandt praised a strong and growing relationship between industry and the Canadian defence establishment, but warned industrialists against inflated expectations for government-oriented research and development:

Industrial people often accuse scientists of over-selling their wares. I feel in this case there is far more danger of industry over-buying the wares of the scientist. If we are to have healthy industrial research and development in Canada the same criteria must be applied to expenditure for research and development as to any other industry expenditure.\(^5\)

In Solandt’s view, industrial work was most effective as a supplement to research. His vision for Canada’s defence economy was a ready industrial base equipped with the capacity to develop tangible materials according to the requirements identified by scientists and engineers in government and academia.

Solandt’s emphasis on government and university research may be a reflection of his personal background. Trained in medicine prior to the Second World War, Solandt showed throughout his government career a desire to engage like-minded individuals. He had a strong belief in the education of scientists and showed no hesitation in recruiting university researchers to sit on committees and panels for the Defence Research Board. In so doing, he created levels of bureaucracy that enabled the elevation of a select group of civilian researchers to positions in the Canadian government. The result was a network of researchers who accessed and distributed large quantities of funding made available by the increased R&D investment of the postwar Canadian defence establishment.

**The Arctic Institute of North America and RCMP Surveillance**

While Solandt’s efforts brought considerations for science to the fore of policymaking in the Canadian defence establishment, the DRB’s investment in university research exposed civilian researchers to Canada’s Cold War national security apparatus. Extramural research grants from the Defence Research Board usually supported unclassified projects, but grants went only to recipients who had received a security clearance. Furthermore, all grants recipients and research assistants were required to take an oath of secrecy.

The extent to which security policies permeated into the extramural grant system of the DRB is evident in records on the Arctic Institute of North America (AINA). In June 1950, AINA’s executive director A.L. Washburn wrote to Omond Solandt requesting security clearance for AINA staff and project workers to undertake classified research. Arctic Institute research projects had been of a strictly non-classified nature when Washburn made his request, but the geostrategic importance of the Arctic and the corresponding increased value of scientific research to military intelligence urged him to reconsider AINA’s approach to potentially sensitive security information. The motivation behind Washburn’s request was multi-layered. He suggested AINA personnel should be in a position to undertake classified work to “serve the interests of the Canadian and United States governments,” but stated openly that his organization was unequipped with the “investigation facilities or means adequately to protect itself against the dangers of Communist infiltration or employment of poor security risks.”

AINA was also determined not to jeopardize government financial support. The Institute was a non-profit organization founded in 1945 to study scientific problems common to Alaska,

---

northern Canada, and Greenland. The organization established a headquarters at McGill University in Montréal and worked in close liaison with government agencies, other universities, scientific societies, and independent groups in Canada and the United States to co-ordinate research pertaining to the North American Arctic and sub-Arctic. Incorporated in Canada by an Act of Parliament and in the United States under the laws of the State of New York, AINA developed especially strong ties to government research divisions such as the Defence Research Board and the National Research Council. In fact, the NRC was one of three supporting institutions that paid for the creation of AINA, and the Institute relied heavily on funding from the DRB to continue its research activities.\(^59\)

AINA’s ties to Canadian government ran deeper than financial support. Hugh Keenleyside, the Deputy Minister of Resources and Devolvement and Commissioner of the Northwest Territories, served as vice-chairman on the AINA board of governors. As a senior Canadian official, Keenleyside brought experience and political connections to the leadership group of AINA. He had a close working relationship with Solandt, and researchers under contract with the Defence Research Board often served with AINA in related capacities. For instance, Trevor Lloyd and T.H. Manning both received grant funding to pursue Arctic-related research for the DRB while serving on AINA’s board of governors. With the top-down board, committee, panel and staff organization of the DRB, the Canadian defence establishment contributed to the creation and maintenance of an Arctic research community where university researchers not only gained access to but also shaped the nature and quality of government research.

\(^{59}\) The other two institutions to provide financial support for the creation of AINA included the National Research Council of the United States and the Carnegie Corporation of New York; see LAC, RG24, vol. 4155, file DRBS 106-0-323, “The Arctic Institute of North America, 1950”.
The relationship between the Defence Research Board and the Arctic Institute of North America concerned some representatives of the Canadian government. In particular, the Joint Intelligence Committee (JIC) voiced concern over the possibility of awarding Arctic research grants to scientists from the Soviet Union and Finland:

The Committee realized that it would be embarrassing to the Arctic Institute to have to discontinue Grants-in-Aid to scientists wishing to work in Northern Canada, but felt that such embarrassment might have to be accepted as there was no form of quid pro quo by which Canadian scientists were permitted to work in Russia and possibly Finland. It was agreed to recommend to you [Omond Solandt] that the giving of Grants-in-Aid to scientists from Soviet Russia and Finland for work in the Canadian Arctic was undesirable and should be discouraged.60

How firm the Canadian government was on this stance is unclear. Records indicate that the RCMP examined scientists who AINA nominated to receive grant monies from the DRB for work in the Canadian North, but in one particular case the RCMP identified and cleared a Finnish scientist: “There is nothing in the report on this man to indicate any subversive tendencies.”61 While the details of the investigation are unclear, this case seems indicative of a larger pattern. Earlier that year in January 1949, Graham Rowley of the DRB’s Arctic Research Advisory Committee requested that P.D. Baird of AINA forward copies of grant applications and referee comments. Rowley requested copies and comments only for research projects conducted by foreign nationals in Canada, excluding citizens of the United States and Commonwealth countries. Baird fulfilled Rowley’s request, with the hope of obtaining “speedier clearance from the security authorities.”62

60 LAC, RG24, vol. 4155, file DRBS 106-0-323, CSC 14-10-2, Chiefs of Staff Committee: Joint Intelligence Committee to the Chairman, Defence Research Board, “Grants-in-Aid – Arctic Institute of North America,” 2 May 1949.
61 Ibid.
62 Although the name of the investigated scientist is openly available in the archival record, I decided to respect his anonymity in writing about the case. For the record used to write this portion of the dissertation, see LAC, RG24, vol. 4155, file DRBS 106-0-323, P.D. Baird to Lt. Col. G.W. Rowley, 27 January 1949.
Rowley apparently acted in response to a decision made by the Joint Intelligence Committee. According to records of the Privy Council Office, the JIC agreed in late 1948 that Assistant Commissioner L.H. Nicholson of the RCMP would co-operate with the Defence Research Board to investigate scientists recommended for funding. ANIA forwarded the names of sixty-one grant applicants to the DRB that year; approximately one third were Finnish nationals expecting to work in the Canadian North. The DRB then supplied the applicants’ information to the RCMP along with a memorandum detailing the advertisement of, and review process for, research grants made available through the Arctic Institute.

**Research and Development Priorities**

In February 1952, the Defence Research Board devised a priority system for research and development projects undertaken or supported by DND. The DRB produced the system to standardize assessment of all R&D projects under the umbrella of Canadian defence. Prior to its establishment, each branch of DND employed a separate model to regulate R&D, so the newly created system implemented a single and cohesive framework for the whole of National Defence. The DRB was not only the originator of the priority system but also acted as the “Project Coordination Centre” for all R&D projects supported by the defence establishment. The system mandated that each division of DND allot a priority for R&D projects in accordance with the

---


outlined plan and inform DRB on a continuing basis. Internally, each member of the scientific staff at DRB followed the same structure and allotted a priority to each extramural or industrial grant and contract awarded to support external research and development.

Two key criteria defined the Defence Research Board’s priority system for R&D: the importance of operational research and analysis, and the critical need for the creation of new or improvement of existing weapons, equipment and techniques for warfare.\textsuperscript{67} Both criteria derived in part from the Canadian experience in Korea, the focus of Chapter 6. In short, senior military officials recognized a philosophical issue with the existing R&D mandate of the Canadian defence establishment. Canada was unable to undertake research and development on all items required by the armed forces and military officials were uncomfortable with the idea of relying too heavily on technical assistance from the United States and United Kingdom, but officials also thought that a selective R&D policy was inadequate.\textsuperscript{68} According to the line of thought, the inadequacy of the existing R&D structure stemmed from a concentration on fields in which Canada showed a unique scientific and engineering capacity. “Specialization” was questioned as the key principle of Canada’s postwar R&D structure. The modern problems of the armed forces simply required additional support, or so was the military impetus that led the DRB to create a priority system for research and development. Theoretically, the priority system could reduce the possibility of “serious gaps” from occurring in the existing R&D structure of DND.\textsuperscript{69}

The priority system gave precedence to projects of immediate importance to the defence of Canada and the immediate needs of the armed forces. From a practical point of view, the system ensured vital R&D projects received adequate financial support as well as the scientific

\textsuperscript{67} Ibid.
\textsuperscript{69} Ibid.
and technical expertise required for rapid completion. The system itself consisted of a letter and a digit; the letter denoting the strategic importance and operational category supported by the project, and the digit denoting the need to develop new or improved weapons and equipment to support the technical objectives of the operational category.\(^70\) The Chiefs of Staff Committee determined the value of operational categories and assigned a ranking system according to four sets of criteria. Priority A was for R&D projects in support of operations considered essential to the defence of Canada, while priorities B and C covered projects to support operations that included a major (B) and minor (C) degree of participation by the armed forces. The remaining category was priority X, which covered projects initiated by Canada only at the request of Britain or the United States. The digit portion of the priority system assigned the numbers 1, 2, and 3 to determine the need for new or improved weapons, equipment and techniques. In descending order from 1 to 3, the numbers denoted the need for items “greatly superior,” “markedly superior,” and “marginally superior” to the existing supply available to the armed forces.

Of the sixteen focus categories outlined by the priority system, Arctic warfare did not make the cut. The top three priorities, in order, included air defence, anti-submarine, and land combat operations. The priority list also included atomic, bacteriological, and chemical warfare, amongst others.\(^71\) That Arctic warfare did not make the list may be indicative of a change in institutional priorities, but it may also simply reflect the precise phrasing of the priority categories. Rather than focus on geographical areas of importance to the armed forces, the list defined categories based on information requirements or the need for improved equipment and

\(^70\) Ibid.

\(^71\) In descending order, the priorities listed included “air defence operations” (A), “anti-submarine operations” (A), “land combat operations” (A), “personnel operations” (A), “combat air support operations” (A), “supply and maintenance operations” (B), “sea combat operations” (B), “atomic warfare operations” (B), bacteriological warfare operations” (B), “chemical warfare operations” (B), “intelligence and planning operations” (B), “airborne landing operations” (C), psychological and Cold War operations” (C), “strategic air operations” (X), “submarine operations” (X), “amphibious operations” (X).
resources. Furthermore, some of the listed categories overlapped with Arctic research and development. Operations including land combat, personnel, supply and maintenance, intelligence and planning, and airborne landing all held relevance for military training and research conducted at Fort Churchill and Defence Research Northern Laboratory.

One of the more intriguing areas of research and development outlined by the DRB priority system was “Psychological Warfare and Cold War Operations,” which the original document defined as “the employment of any nonlethal or clandestine means to affect morale and behavior for a specific military purpose.” The technical objectives of research in this area stipulated the need to develop methods for determining the feasibility and potential uses of psychological warfare. Potential research subjects included military and government personnel, with the aim of developing techniques to protect Canadians from “enemy propaganda, sabotage, and the psychological threat of material warfare.” The technical objectives of the research also emphasized the need to develop techniques to demilitarize government and military personnel of defeated enemy nations. Although the approved document listed Canadian interest in this research area as “very slight,” the preparatory thought highlights the extent to which Cold War anxieties permeated defence planning at the highest levels of Canadian government.

Conclusion: The Glassco Commission

The Defence Research Board was not the only granting agency of the federal government to distribute grant monies in the postwar period. By the 1970s, the National Research Council

---

73 Ibid.
distributed $34.4 million annually to scientists, engineers, and industry leaders.\textsuperscript{75} During the first three decades of the Cold War, the number of scientists and engineers in Canada rose from 30,000 to 115,000 and the number of graduate students in science and engineering from 1,500 to 9,000.\textsuperscript{76} The total annual federal expenditure on R\&D over this period increased from under $100 million to $319 million, which is the equivalent of an annual payout of approximately $2.4 billion when adjusted for inflation.\textsuperscript{77} While not the only government agency to fund university and industrial scientists and engineers in the early Cold War, the DRB distributed a significant portion of the federal R\&D pie. According to the personal records of Solandt, the DRB’s annual budget for research and development increased from $13 million in 1947-48 to $52 million in 1955-56.\textsuperscript{78} Over that same period, the professional staff of the DRB grew from under one hundred personnel to 612, and its total staff grew from around 600 personnel to 2,507.\textsuperscript{79}

Although not the only source of federal funding available to university scientists in Canada during the early Cold War, the large sums of annual money funnelled through the Defence Research Board’s extramural grants program did influence university graduate schools and the character of their research.\textsuperscript{80} Similar to its older sibling the NRC, the DRB controlled the intramural research of a handful of establishments spread across the country, and an extramural

---

\textsuperscript{75} Eggleston, \textit{National Research in Canada}, 444.

\textsuperscript{76} Ibid.

\textsuperscript{77} Eggleston’s numbers on scientists, engineers, graduate students, and federal expenditure did not originate from archival sources. Rather, he cited an article written by Omond Solandt, the founding Chairman of the DRB, which reads O.M. Solandt, \textit{Science Forum} 1, No. 2: 3-5.

\textsuperscript{78} The exact figures stated are $13,031,834 in 1947-48 and $52,578,000 in 1955-56; see University of Toronto Archives and Records Management Services, Omond McKillop Solandt fonds, vol. B93-0041-033, file B93-0041-033-03, DRBS 400-1 (DGS), 30 December 1955.


\textsuperscript{80} See W.H. Barton, “Defence research in the universities,” reprinted from \textit{Chemistry in Canada} (March 1951), article found in LAC, RG24, vol. 4133, file 4-901-43-2 vol. 1.
research budget for grants and contracts with universities and industries. Secretary of the DRB, William Barton, wrote about the peculiar circumstances facing prospective researchers in 1951:

[Grant recipients] must satisfy themselves that the prospects of immediate financial benefits are not permitted to obscure the vital necessity for safeguarding their traditional intellectual freedoms ... This is particularly important in the case of a defence agency, which may require military security restrictions.\(^81\)

Through its board, council, committee and panel structure, the DRB facilitated relationships between government researchers, university scientists, military clients and industry leaders to share advice and make decisions concerning Canada’s national security. In the process, the creation and implementation of science policy and its administration was the responsibility of scientists and stakeholders, as was the distribution and use of federal funds allocated to defence research and development. This style of managing science—created during the First World War and implemented successfully during the Second World War under the leadership of C.J. Mackenzie and C.D. Howe—remained largely unchanged until the 1962-63 when the reports of the Royal Commission on Government Organization called into question the impartiality of personnel who simultaneously advised upon and administered policy.\(^82\)

On the advice of businessperson J. Grant Glassco and the other Royal Commissioners, governmental divisions such as the Defence Research Board underwent significant philosophical and organizational restructuring. Glassco chaired the Royal Commission on Government Organization, which formed in 1960 and published the results of its investigations between 1962 and 1963.\(^83\) Glassco was a chartered accountant from Toronto who had first gained experience in government affairs during the Second World War when he investigated the business practices of

\(^81\) Ibid.
Eldorado, Canada’s national uranium company. As chair of the Royal Commission on Government Organization, he led an investigation into the practices of government departments, the armed forces, statutory boards and independent corporations. The twenty-three departments investigated included the National Research Council and the Defence Research Board, both of which received detailed coverage for policies and practices in support of scientific research.

The Glassco Commission questioned the efficiency of management structures at the federal level in Canada. The final report comprised five volumes and the Defence Research Board received direct attention for its connection to the Department of National Defence and Canadian science policy. The first volume referenced the DRB to contest the allegedly special treatment that National Defence received under the Civil Service Act. Unlike similar research divisions in other government departments, the DRB was exempt from the Act. Other questionable regulations and policies stemming from the whole structure of National Defence further opened the Defence Research Board to criticism. The second volume of the report, for instance, highlighted inefficiency resulting from National Defence duplications in military and non-military procurement.

The Defence Research Board received direct attention in volume four of the report, which questioned the role and impact of scientific research and development in Canada. In a scathing report on the DRB, the commissioners claimed that financial support for the organization had

84 For full details on the history of Eldorado, see Robert Bothwell, Eldorado: Canada’s National Uranium Company (Toronto: University of Toronto Press, 1984).
declined by approximately one-third during the period 1947 to 1957.\textsuperscript{87} This claim runs contrary to the financial records of the Defence Research Board, which document growth in the annual budget of the DRB during the same period. The annual budget of the DRB had increased to nearly $79 million in 1958, but the financial growth of the organization was stagnant when proportionally assessed in relation to the full federal defence budget. Moreover, both the United Kingdom and the United States spent significantly more on defence than Canada.\textsuperscript{88} These reasons might account for the contradiction between the Glassco Commission and the financial records of the DRB.

The Glassco Commission also criticized the Defence Research Board for inadequate policy advice to the Minister of National Defence and for allowing the armed services too much autonomy in matters concerning procurement for defence. Such issues stemmed in part from the DRB’s organizational structure, which allegedly gave senior personnel overlapping responsibilities. But the commissioners were more concerned about the possibility of duplication and waste in the whole of Canada’s federal R&D effort:

At present five government agencies have an initiating role in development programmes—the Defence Research Board, the Royal Canadian Navy, the Canadian Army, the Royal Canadian Air Force and the Department of Defence Production … It therefore appears advisable, in the interests of economy and effectiveness alike, to coordinate all defence programmes for applied research and development, including the new “development-sharing” programme, and to provide an effective environment for the conduct.\textsuperscript{89}

The commissioners noted the ability of the DRB to produce results despite a limited budget, but their report made five recommendations that had lasting implications for defence research and


\textsuperscript{88} Ibid., 204-205.

development in Canada. The first four recommendations discussed the creation of a single organization for defence research and development so as to remove the possibility of duplication. Under this plan, as stated in the fifth recommendation, the existing research establishments of the DRB would become “National Defence Laboratories” operated on behalf of the three services under the direction of the new “Defence Research and Development Board.” While the commissioners determined the DRB’s budget was far too small for what was expected of the organization, their reports put pressure on the federal government to address the alleged inefficiencies in defence spending.

Released too late for the Diefenbaker government to take remedial action, the Royal Commission on Government Organization became a precursor to some of the sweeping changes that occurred with the integration and unification of the armed services under the Pearson government during the period 1964 to 1968. Another group of business experts drew similar conclusions to the Glassco Commission in 1974 with regard to R&D spending, and the Canadian government responded to the extreme pressure on the federal budget by reallocating funds away from defence. For the next three years, the Defence Research Board experienced drastic changes to its internal structure and large-scale reductions to its operating budget. Despite the efforts of Board members and employees, the circumstances surrounding Canada’s federal budget were too strong to stem the tide against the withdrawal of funds from defence-related programs.

---

90 Ibid., 211.
Because the Glassco Commission initiated a long and arduous process that reduced the power and influence of the scientific defence community in Canada, the remaining chapters of this dissertation focus on the early Cold War period. Between 1947 and 1960, civilian scientists not only obtained high-level positions in the Canadian government but also created and administered policies to promote their self-interests while simultaneously shaping the scope and direction of Canada’s national defence effort. The political ascendancy of scientific experts strengthened Canada’s commitment to Western security and deepened alliance partnerships with the United Kingdom and the United States. This is particularly apparent in the history of defence research in northern Canada, and Defence Research Northern Laboratory is a useful tool to examine the influence of science in government. The remaining chapters of the dissertation thus provide a fair and accurate historical assessment of the Canadian experience with Cold War defence research in the North, using DRNL as a lens through which to interpret the types of defence research considered important to assist the Canadian armed forces.
Chapter 4

Science and Human Performance in the North

“Great physical and mental effort is required under conditions of extreme cold and high windchill to remain aggressive. The cold and unusual conditions of life can, if allowed, impose a heavy strain on morale. Every opportunity must be taken to seek out and destroy the enemy in order to increase the strain on the enemy, to deprive him of rest and time to prepare food, and eventually destroy him.”

Final Report, Sun Dog One

Between 1947 and 1953, scientists with the Defence Research Board administered physiological and psychological experiments on soldiers conducting indoctrination training for Arctic warfare. Designed in an attempt to determine the ideal characteristics of cold-weather soldiery, one experiment resulted in physical and mental injury to two of the participating soldiers. Although the army immediately questioned its participation in further DRB testing because of the injuries sustained, ethical considerations for human testing did not deeply penetrate military and defence discourse concerning the involvement of soldiers in acclimatization research and indoctrination training. This chapter examines cold-weather human testing and argues that the development of Cold War soldiery in Canada conformed to superficial gender ideals about virile masculinity in the early postwar period.

When the Canadian Arctic became a training ground for Western forces during the early Cold War, troops from Canada, the United States and the United Kingdom took part in a series of military exercises, designed to prepare both men and equipment for cold-weather warfare.

---

1 As quoted in the final report of Sun Dog One, prepared under the direction of the Chief of General Staff and published by the Directorate of Military Training; see LAC, RG 24, vol. 4206, file 270-0-89-6, Winter Exercise “Sun Dog One,” p. 12.

2 The Canadian military participated in no fewer than twenty-two northern operations in the first decade of the Cold War, including exercises “Eskimo,” “Polar Bear,” and “Lemming” (1945); “Musk Ox” (1946); “Moccasin” (1947-1948); “Sigloo” (1948-1949); “Cross Country,” “Sweetbriar,” “Sun Dog One,” and “Shoo Fly One” (1950); “Sun Dog Two,” “Shoo Fly Two,” “Measureall,” and “Pole Star One, Two and Three” (1951-1952); “Sun Dog Three,”
Each exercise aimed specifically to determine infantry requirements as well as the tactical techniques and coordination methods required for military operations in extremely cold winter conditions. The most well-known exercise remains the three-month northern excursion named Operation Musk Ox, which combined efforts by the militaries of Canada and the United States and reinforced notions that the Canadian Arctic represented the first line of defence against a potential attack on North America.\(^3\) Less well-known but also important to the Canadian military and defence establishment was Sun Dog One, a one-month exercise carried out in an effort to study and overcome environmental challenges unique to Arctic military operations.

Sun Dog One served a scientific and military purpose. During the exercise, Defence Research Board scientists observed trials of Canadian, American, and British cold-weather clothing and equipment. Scientists from the DRB also conducted experimental trials on participating soldiers as part of an acclimatization and indoctrination program that aimed to determine the physical and psychological requirements of cold-weather soldiery. Symptomatic of broader Cold War desires to understand and overcome the natural environment, indoctrination training in the Canadian Arctic gave planners, observers, and participants a sense of control. Although training proved effective and educational, the lessons learned came at a cost. Scientists deemed some troops physically or temperamentally weak for cold-weather operations and thus

less suitable for Arctic service than men whose physical and mental attributes posed no apparent or potential detriment to the morale and effectiveness of the other participating soldiers.

Whitney Lackenbauer and Matthew Farish have argued that postwar Western military interest in the Canadian Arctic signalled not only “the systematic consolidation of nature as military entity, but also an extension of the scope and terms of militarization to reflect the cautious longevity of the Cold War.”

Situating postwar northern military exercises in a broader environmental discourse, Lackenbauer and Farish explore the pervasive legacy of Cold War militarism in Canada in a manner that moves beyond the more traditional diplomatic or social analyses of the period. This chapter also examines the pervasive legacy of Cold War militarization in the North, but highlights human as well as environmental aspects.

Cold-weather human testing represents an interesting aspect of military preparedness, but as a topic remains largely unexplored by historians. This chapter examines the connection between military indoctrination and scientific cold-weather acclimatization research in an effort to contextualize an important aspect of Canada’s Cold War legacy while also contributing to a growing international literature on human and environmental science in the early postwar period. Sun Dog One represents an ideal case study. During the exercise, scientists tested the physical and mental qualities of the participating soldiers operating under severe cold-weather conditions. The experiments were part of an Arctic acclimatization research and indoctrination training program initiated to determine physical characteristics associated with military operations in severe cold-weather conditions. In turn, Canada’s defence and military establishment attempted to develop a process to identify men deemed physically and mentally valuable to support a northern defence. Sun Dog One consequently provides a unique window into the development

---

4 P. Whiteny Lackenbauer and Matthew Farish, “The Cold War on Canadian Soil: Militarizing a Northern Environment,” *Environmental History* 12, no. 4 Special Issue on Canada (2007), 920-950.
The Postwar Canadian Military and the North

While the air threat to North America was a fixture of strategic considerations in Ottawa during the early postwar period, defence officials remained cognizant of the vulnerability of the Canadian North by sea and land. In advance of a potential Soviet incursion in the North, the military turned to science to prepare its men for the potential cold-weather battlefield. Defence planners deemed cold climate training important to northern indoctrination and troop preparation, and intelligence confirmed the need to prepare a defence against the shortest and most direct route over the North Pole. Canadian soldiers were to learn how to survive and use their weapons under Arctic conditions, thereby developing efficient techniques to defend the expansive northern approaches.

The Canadian military first tested the capabilities of military personnel and equipment in the North during the winter of 1945-1946. Operations Eskimo, Polar Bear, and Lemming were designed to determine the effects of severe climatic conditions on the mobility and combat efficiency of Canada’s striking forces. The location of each exercise differed, which allowed for the testing of equipment in northern environments under varying conditions and challenges of both terrain and temperature.⁵ Exercises Musk Ox and North occurred the following year, as the army continued to improve tactics, techniques, and procedures for living and fighting in severe cold-weather conditions. None of these field exercises were large-scale operations, nor were they

---

conducted to test the ability of joint land-air operations to resist mock Soviet aggressor forces.\textsuperscript{6} As a result, the army continued to conduct both individual and joint exercises with the Royal Canadian Air Force.

Arctic warfare differed considerably from winter warfare in that its potential battlefield existed in vast spaces only reachable by air. Whereas units conducting winter warfare could rely on roads, railheads, and other supply infrastructure, Arctic warfare units trained to maximize sustainment and rely only on resupply by air to the often limited extent possible in the difficult flying conditions.\textsuperscript{7} Canada took part in cold-weather warfare exercises in both Arctic and sub-Arctic conditions. Canadian and American military planners defined the “true” Arctic as any terrain north of the tree line, including tundra and mountain ranges. Conversely, planners defined the sub-Arctic as any northern treed terrain, including the treed plain of northern Manitoba and Saskatchewan, the Northwest Territories, the mountains of northern British Columbia, the Yukon, and southern Alaska.\textsuperscript{8}

In May 1946, the Canadian chiefs of staff approved the formation of an inter-service committee on winter warfare, with a sub-committee on winter warfare research. By 1947, defence science expanded significantly in Canada and the sub-committee was subsequently reorganized as the Arctic Research Advisory Committee under the chairmanship of Hugh Keenleyside, the deputy minister of mines and resources and commissioner of the Northwest Territories.\textsuperscript{9} The committee held its first meeting on 15 May and decided that, while science

\textsuperscript{6} Godefroy, \textit{In Peace Prepared}, 85.
\textsuperscript{7} Halliday, “Recapturing the North,” 29-38.
\textsuperscript{8} LAC, RG 24, vol. 2484, file HQS-736-10-17-2-5, Dr. O.M. Solandt, Exercise “Sweetbriar”: An Address to The Empire Club of Toronto, 30 March 1950.
\textsuperscript{9} LAC, RG 85, vol. 298, file 1009-2[2]. Defence Research Board Arctic Research Advisory Committee, 5 December 1949, Appendix A “Summary of Activities of the Arctic Research Advisory Committee”.
could assist military operations in the Arctic, the military could also provide occasional assistance to scientific research by provision of transportation, facilities, and personnel.

Although top officials in the Canadian defence establishment showed little interest in placing standing forces in the North, support for cold-weather military exercise training ran deep. Speaking to the House of Commons on 17 March 1950, Minister of National Defence Brooke Claxton spoke about his experience as an observer of exercise Sweetbriar, which took place during the winter of 1949-1950.\textsuperscript{10} The exercise tested the latest developments in clothing, food, aircraft, vehicles, weapons, and other equipment and materials, but the primary objective was to develop doctrine and procedures for the employment of combined Canada-United States forces operating in the sub-Arctic.\textsuperscript{11} Over 5,000 combined forces took part in the ten-day exercise, which also included 978 motor vehicles and more than 100 aircraft. Sweetbriar was the largest joint Canada-United States northern military exercise at the time, so when speaking to the House, Claxton congratulated all officers and men who had contributed to the success of the exercise “in accordance with the best traditions of the Canadian forces.” Claxton further applauded the exercise by noting specifically the effectiveness of cooperation between the army and air force, and Canadian and American troops.

A few weeks later on 30 March, Omond Solandt addressed the Empire Club of Toronto and spoke about his experience as a scientific observer of Sweetbriar.\textsuperscript{12} Echoing Claxton’s comments, Solandt spoke of Sweetbriar with specific reference to training and equipment for combined sub-Arctic operations. The exercise did not involve new weapons and took place in

\textsuperscript{11} Ibid.
\textsuperscript{12} LAC, RG 24, vol. 2484, file HQS-736-10-17-2-5, Dr. O.M. Solandt, Exercise “Sweetbriar”: An Address to The Empire Club of Toronto, 30 March 1950.
weather conditions that were less severe than those encountered by both Canadian and American troops in training, but it did inspire novel equipment development and the need for further controlled cold-weather environmental training. The most important single lesson of Sweetbriar was, according to Solandt, the importance of and ease with which the armies of Canada and the United States operated harmoniously and effectively in severe cold conditions. When questioned about the success of the exercise, other Canadian and American military officials who attended as observers were noncommittal. Some expressed shock at the state of defences in the Canadian North, while others optimistically believed that joint military preparedness remedied any existing deficiencies in defence. With regard to both the training of men and the use of equipment in cold weather, Canada’s military and defence establishment identified many weaknesses in its northern defences. The exercise also made clear that neither Canada nor the United States was ready to conduct winter warfare; additional training was required.

Exercise Sweetbriar demonstrated the potential ability of soldiers to operate efficiently in the sub-Arctic and demonstrated the adequacy of logistical support under such conditions. Canada-United States support was an essential component of exercise Musk Ox, but not for the force strength that was available during Sweetbriar. Observers of Sweetbriar pointed out certain aspects of northern exercises that required improvement, but overall the exercise dispelled fears of the efficiency of cold-weather military operations. With proper clothing, equipment and training, soldiers were able to manoeuvre under sub-zero temperatures with fewer mock casualties than estimates had forecast. Observers concluded that logistic support was adequate to maintain larger forces and ongoing military operations in Canada’s northern environment.

---

Participants and observers drew similar conclusions from military exercise Sun Dog One, which occurred about 2,000 kilometres east at Fort Churchill, Manitoba.

**Defence Research Northern Laboratory and Sun Dog One**

After visiting the Defence Research Northern Laboratory at Fort Churchill on a review assignment in December 1954, E.F. Schmidlin of the DRB’s Arctic Section emphasized the importance of the establishment to Canadian defence in his official report:

> DRNL is unique in defence research. It is the only station of its kind in the tripartite family. There is much to be done yet, before warlike operations can be successfully prosecuted in the high latitudes. Because of this I think we are justified in providing adequate facilities, both scientific and domestic. Unless we do, we cannot expect the maximum results for the effort expended.\(^{15}\)

The tripartite emphasis placed on DRNL by Schmidlin reflected wider attitudes within the Defence Research Board. As a principal user of DRNL, the DRB conducted basic research concerned with military problems peculiar to living, working and fighting in the Arctic but also used the facilities to house visiting scientists operating out of Fort Churchill on short term or seasonal projects. In order to achieve this goal, military and civilian agencies of the governments of Canada, the United Kingdom and the United States utilized DRNL to conduct trials, research, and training under Arctic conditions.

The terms under which visiting scientists and military personnel operated pre-dated the formal establishment of the Defence Research North Laboratory. On 25 March 1947, representatives of the Department of National Defence accepted a formal agreement with the United States War Department that required the Canadian Services to provide facilities for the

\(^{15}\) LAC, RG 24, vol. 7329, file DRBS-100-30/0, DRBS 52-0-240 (Arct), Visit to DRNL, 22 December 1954.
US Army at Fort Churchill. In exchange for the construction of new and renovation of existing facilities, the Canadian government received $350,000. The agreement stipulated that the US Army Corps of Engineers would supervise the construction. One month later, a Canadian inter-service committee on winter warfare drafted a memorandum that outlined a proposed long-term plan for the establishment of a joint Canada-United States experimental and training station at Fort Churchill. The impetus of the plan was clear. As stated in the memorandum, the creation of a permanent operating station would “provide facilities to develop the art of warfare in the Canadian Arctic through study, experimentation, and training.” This framework satisfied two important requirements of Canada’s early postwar Arctic defence policy: the training of personnel, and the development and testing of equipment for research related to military equipment. More precisely, the plan outlined the need for a directed program at Fort Churchill to study the environmental conditions of the Canadian Arctic and the effect of those conditions on personnel, supplies, equipment and logistics. Exercise Sun Dog One helped contribute to the achievement of these goals.

Sun Dog One was an extension of infantry training that had taken place at Fort Churchill during the winter of 1948-1949. The exercise comprised 251 personnel, which made the exercise significantly smaller than Sweetbriar. The exercise consisted of an entirely self-contained and mobile force that lived and carried out manoeuvres for nearly one month close to Fort Churchill. The tactical goal of Sun Dog One was to determine the capabilities of armour, field artillery, and engineers in support of one infantry company operating in a severe cold-weather environment.

18 LAC, RG 24, vol. 4206, file 270-0-89-6, Winter Exercise “Sun Dog One”.
All appreciations assumed that supply to all units was available. The one-month time frame allowed for repetition of certain trials, photographic retakes, and variation in weather.\textsuperscript{20} Planners sacrificed some measure of realism for scientific observation.

The operational concept of exercise Sun Dog One was the pursuit and destruction of an enemy party approximately fifty strong, which dropped near the Hudson Bay railway at Chesnaye. The exercise began on 16 February 1950 and ended on 15 March. Planners chose the route and terrain of the exercise specifically to test the supply and communication organisation of participating units. The first leg of the route took soldiers through heavily bushed terrain on a trail prepared by a Royal Canadian Engineers Test Team. The remaining distance traversed flat and open tundra lands broken by many small lakes and sloughs. In open areas, snow was hard, shallow, and rough with wind anvils, while in treed areas it collected in deep and soft powdery drifts. Temperatures during the exercise were somewhat below the normal mean for that winter. The lowest temperature recorded was minus forty-two degrees Celsius and the mean approximately minus twenty-nine degrees Celsius. The maximum recorded wind chill was 2,300 or approximately minus fifty degrees Celsius and the mean was 1,700 or approximately minus thirty degrees Celsius.\textsuperscript{21} While these temperatures were comparatively higher than other Arctic locales from the same winter, high winds experienced during the exercise did at times drastically increase the rate of body heat loss.

Canadian exercises in winter and Arctic warfare prior to Sun Dog One demonstrated the limits of troops operating in demanding conditions, not of survival but of endurance. Varying topography and climate in both dry and wet cold conditions reduced the operational effectiveness of all forces. Sun Dog One was a combined military exercise of a tactical nature in Canada’s

\textsuperscript{21} Ibid.
eastern Arctic. The exercise served to test certain military assumptions about cold-weather operations and demonstrated many operational difficulties peculiar to Canada’s northern environment. For instance, soldiers found that the same clothing that enabled them to conduct operations in the Canadian Arctic also reduced their maneuverability and overall effectiveness. Clothing restricted motor control, particularly during periods of high wind chill when closed parka hoods reduced visibility and hearing. Mitts restricted dexterity of the hands and the soldiers’ ability to handle weapons. Frequent and rapid weather changes also significantly decreased the operational effectiveness of both men and equipment during Sun Dog One. As noted in a diary of the exercise, the constant breakdown of snowmobiles was a dominating feature of the troop experience.²² Reoccurring failures of equipment significantly reduced opportunity for tactical study and in turn slightly obscured the value of recorded information. Nevertheless, the exercise allowed observers to make useful conclusions about cold-weather military operations.

**Acclimatization and Indoctrination**

Considering the vast range of the potential cold-weather battlefield, acclimatization of personnel to the Arctic environment was a chief scientific concern of Canada’s defence establishment early in the Cold War. While making his remarks about exercise Sweetbriar to the House on 17 March 1950, Minister of Defence Brooke Claxton stated: “Fighting in the north we know requires specially trained personnel of high morale and top physical condition with first-class equipment and air supremacy. These have been our targets and we are making good progress.”²³ At the time, the logistical difficulties of cold-weather military preparedness of both men and equipment

---

²² Ibid.
had extended beyond the institutional capabilities of the Army, or so was the belief of Canada’s top military advisers.

Despite rapid demobilization and cost cutting, the Canadian military maintained a notable contribution to national security in the immediate postwar years. As argued by Andrew Godefroy, “[that] the postwar Canadian Army was ultimately capable of innovating and adapting to meet new threats alongside its two main allies under such conditions suggests that a great deal of military enterprise and innovation occurred within the institution.” Godefroy does not suggest that all changes in postwar military structure were novel and successful, but he nonetheless maintains that historical scholarship is too critical of the Canadian military during the early Cold War period. Godefroy’s assessment finds support when we consider northern cooperation between the military and the Defence Research Board.

By order of Lieutenant-General Charles Foulkes, Chief of the General Staff, the Canadian Army conducted exercise Sun Dog One in part to assist the Defence Research Board in the execution of its “Acclimatization Research Programme.” The DRB was civilian staffed and directed, but a significant portion of its personnel had military experience from conducting operations research in the Second World War. Operational researchers and defence scientists helped the military to better understand the many characteristics of winter warfare by collecting

---

26 Operational research involved scientific investigations carried out in the field of operations and became widely recognised during the Second World War when careful observations, analyses, and conclusions were first applied profitably to wartime operations. For information on Canada’s wartime OR in the Second World War, see Terry Copp, Montgomery’s Scientists: Operational Research in Northwest Europe (Waterloo, Laurier Centre for Military, Strategic and Disarmament Studies, 2000). Postwar OR concentrated primarily on combinations which involved weapons, communications, transports and other systems that employed electronic and mechanical components; see University Archives and Special Collections, University of Saskatchewan, JGD/MG01 (John G. Diefenbaker fonds), vol. 76, file VII/A/614, 44327—The Defence Research Board Canada. The Operational Research Group of the DRB was specifically responsible for projects of joint-service or general defence interest and for supply and coordination of civilian scientific personnel. See LAC, RG 24, vol. 4210, file 69-180-262, Defence Research Board: Debate of the Annual Estimates in the House of Commons 1952.
raw data for further analysis through study of army physical training exercises. Among the more active of DRB’s research facilities in the early Cold War period was its Defence Research Northern Laboratory at Fort Churchill.

Although northern military exercises aimed to determine the requirements and tactical techniques of supporting arms and services operating in cold climate conditions, a select number also supported Canada’s wider military and defence research that aimed to understand the physical and physiological requirements of cold-weather soldiery. The DRB conducted its Acclimatization Research Programme as part of this process at Fort Churchill during the winter of 1949-1950. The research aimed to study the effect of vitamin C on the physiological adaptation to cold of personnel while operating in Canada’s Arctic environment. Scientists administered two sets of pills to two groups of soldiers who conducted physically demanding military operations under severe cold as part of exercise Sun Dog One. The first group received placebo pills containing no vitamin C while the second group received pills containing 500 mg per day. Each test participant underwent a medical examination prior to and following the experiment. Scientists also conducted urinalysis, blood pressure measurements, and blood analysis twice weekly on soldiers throughout the duration of the programme, which lasted from January to March 1950. Each participant received pills prior to, during, and following exposure to cold and was granted one week extra leave following the completion of the test period.

Vitamin C research and physiological screening allowed the Defence Research Board to test scientific hypotheses related to human performance in the cold. The scientific evaluation of

29 LAC, RG 24, vol. 4206, file 270-0-89-6, Winter Exercise “Sun Dog One”.
30 The exact number of test participants remains unclear, but the DRB initially requested the volunteer participation of thirty soldiers. See LAC, RG 24 vol. 2484, file HQS-726-40-39-7, Defence Research Northern Laboratory: Acclimatization Research Programme 1949-50 Fort Churchill.
the capabilities and limitations of military personnel was important to the Services in evolving tactical doctrine for northern warfare. While senior military officials showed little desire to station standing forces in the North, the DRB supported cold-weather research on the human body in an attempt to develop techniques to select and prepare men for service work in the North. The Soviet Union increased its scientific activities in the Arctic during this period, and the DRB carried out cold-weather research on the human body as a means to find a scientific advantage for the Canadian military. In their capacity as observers, DRB scientists received instructions to avoid doing anything that would interfere with the conduct of exercise Sun Dog One. Their role was strictly scientific, but their experiments had potential for a military applicability.

The DRB’s acclimatization research associated with Sun Dog One was not the first attempt by scientists to deduce information about cold-weather operations from participants. Scientists utilized volunteers as test subjects in similar trials a year prior to Sun Dog One in January and February 1949. Arrangements at the time were in place to use volunteer soldiers stationed in the North, but the army pulled its participation before the tests commenced. In order to meet the requirements of British scientist Norman Mackworth, working in Canada on an extramural research grant from the DRB, representatives from the DRB and the military held a meeting and attempted to find a resolution: “After much controversy over morale and other problems … it was realised that the absolute limit had been reached on the provision of test subjects.” Tests went ahead nonetheless and the scientists utilized persons already employed at Defence Research Northern Laboratory.

---

32 LAC, RG 24 vol. 2484, file HQS-726-40-17-11, Provision of Test Subjects for Defence Research Board.
Funded jointly by Canada and the United Kingdom, the tests conducted at DRNL were the first in a series of two. Fort Churchill provided researchers the opportunity to conduct fieldwork in the Canadian North under “natural conditions of cold” and to compare results to data recorded from physical observations of participants who underwent similar examinations in a simulated cold-weather experiment at Cambridge, England (Mackworth’s home institution). Although reluctant to cooperate, it seems the Canadian army eventually provided soldiers already stationed at DRNL as volunteer participants for the study. Mackworth and his team conducted two experiments to test the hypothesis that cold exposure may bring about changes in skin texture that act as a “glove,” thereby improving manual dexterity and performance in the cold by protecting the hands against the transmission and loss of heat. In the first test, researchers compared the sensitivity of a group of Indigenous soldiers considered “well acclimatized” to that of “unacclimatized” white soldiers. In the second, researchers compared recorded skin sensitivity measurements taken before and after exposure to severe cold while on exercise to results of similar tests conducted in the Cambridge laboratory simulation. Results from both cases reported no significant differences between those considered already acclimatized and those not.

Thirty-five volunteers comprised the first test group, of which twenty were members of the Canadian army, nine were scientists, and the other six were “labourers.” Mackworth and his

---


34 Available records are slightly ambiguous on this point. Military documents suggest troops from exercise Prairie Tundra Two (1952) were utilized as test subjects, whereas Mackworth’s published report in the *Journal of Applied Physiology* dates the experiments to January and February 1949. The dates provided by Mackworth coincide with the operational dates of Sigloo, seemingly making it the exercise during which troops also volunteered to participate in acclimatisation research. It is also plausible that troops volunteered to take part in DRNL research while not as part of a formal military exercise.

team conducted finger numbness tests on volunteer participants using an experimental V-test apparatus. As shown in Figure A.F4 and A.F5 (Appendix A), the apparatus consisted of a flat wooden ruler cut in half. The two halves of the ruler were bolted together at one end, and at the other end were separated by half an inch. The gap between the two inner edges of the device ranged between zero and thirteen millimetres, according to the particular part that touched the tip of the tested finger. Instructed to look away as researchers administered the test, participants said whether they felt a gap when the examiner firmly pressed the two edges against the tip of the left forefinger. Researchers obtained ten such threshold readings from each participant prior to cold exposure and averaged the readings to establish an individual control.36

To test participants in the cold, researchers constructed a canvas-lined tunnel equipped with a system of adjustable shutters designed to channel prevailing winds. Researchers administered the test only on “cold” or “very cold” days, when temperatures ranged from minus twenty-five to minus thirty-five degrees Celsius and wind speeds in the tunnel ranged from zero to ten miles per hour.37 Each test participant entered the wind tunnel and stood at such a position that their test hand was to the direction of the wind. A woolen glove fully covered the test hand, except for one finger, left entirely bare for an exposure time of three minutes. While exposed to the cold, researchers obtained ten threshold readings from each participant. The first reading was after one minute had passed and the others roughly at twelve-second intervals thereafter. Administrators of the test used these readings to devise a “numbness index” and compared the effect of cold and wind speed on manual dexterity.38

37 Ibid.
38 Ibid., 535.
Mackworth calculated his data based on results obtained during cold exposure at five to ten minute intervals. He used measurements from the two-point tactile discrimination V-test to assess the finger numbing effects of severe cold and wind chill conditions. Researchers recorded 109 pairs in total, and Mackworth concluded that even moderate winds lowered skin temperatures and increased the risk of frostbite. He made this assessment partly in response to injuries that occurred during the tests. On 9 February 1949, three “test subjects” reported to the local station hospital complaining of pain in the left index finger. The hospital report dated two days later stated that all three men were “in a painful stage of defrosting” that “render[ed] their fingers useless for an average of seven days.”39 Prevented from carrying out their regular duties because of their physical injuries, these men were also reported to have suffered from a “morale problem.”40

Mackworth told a slightly different version of the story. In a published report of the experiments, he noted two rather than three injuries: “Two of the subjects later developed a minor frostbite in the finger that had been exposed and both were from the small group of four persons who experienced the worst environment of all—the highest wind speed of 8.1 to 10.0 mph and the very cold air temperature.”41 Under such extreme conditions, a change from normal sensitivity to “total anesthesia,” or the complete loss of feeling in the finger, occurred in under two and half minutes from the beginning of exposure. The sudden onset of numbness resulted in a “[p]rolonged lowering of skin temperature … especially in subject D, who later developed a rather more severe lesion perhaps because of the nutritional impairment [that] lasted longer [possibly as a result of reduced blood flow].”42 Both frostbite “subjects developed definite

39 LAC, RG 24 vol. 2484, file HQS-726-40-17-11, Provision of Test Subjects for Defence Research Board.
40 Ibid.
42 Ibid., 539.
surface reddening of the exposed finger” in under three minutes of return to the warm room, at which point “their fingers were still nearly freezing.”

Mackworth further described both frostbite victims with specific reference to each injury: “Subject C had a pale, white area about two inches long and one-quarter of an inch broad on the index finger on the side that had been nearest the wind source. This stretched from the proximal inter-phalangeal joint to the tip of the index finger where it broadened to about half-an-inch across.” The injury was severe enough to restrict movement of the measured joint by forty-five degrees and caused “some pain and tenderness but no detectable swelling.” Yet by comparison, the other frostbite victim fared worse, according to Mackworth: “Subject D was more severely affected and had a definitely red and swollen forefinger … [that] was markedly tender and painful, although it did not keep the subject awake at night.” Fortunately, for both men, these injuries, what Mackworth referred to as “accidental” and “temporary” effects of research, did not prevent complete recovery. In both cases, the injured soldiers returned to work after being off for four days.

Although Mackworth concluded that only two out of all tested personnel succumbed to frostbite, another thirteen recorded single skin temperature readings lower than five degrees Celsius following exposure to severe cold. Of the thirteen, seven had skin temperature readings in the range between those recorded of “subjects C and D,” or three point four degrees Celsius and minus two point three degrees Celsius respectively. At such low skin temperatures the onset of pain felt by participants, especially those subjected to wind chill conditions, resulted in reports of “definite discomfort.” The provision of “test subjects” stopped immediately following the

43 Ibid.
44 Ibid.
45 Ibid., 540.
reported injuries, but on 24 February DRNL and Mackworth submitted a further request for test subjects for use in “modified less-severe tests.”\textsuperscript{46} In response to the request, the army agreed to provide volunteers for use in manual dexterity tests where, according to military records, “no temporary or permanent injury [would] result.”\textsuperscript{47} Moving forward, the army agreed only to provide volunteers if experimental trials did not interrupt military training.

Sun Dog One offered an opportunity to extend acclimatization research conducted at DRNL. While scientists limited testing to a select number of volunteers, all participating soldiers underwent a three-week long indoctrination course prior to the exercise at either Shilo, Manitoba or Petawawa, Ontario, followed by an additional two weeks of Arctic acclimatization training at Fort Churchill.\textsuperscript{48} Training involved manoeuvres in severe cold as well as the attempted development of a specific mental acuity derived specifically from the necessity to overcome the determinants of manual dexterity in northern military operations. To meet this goal, indoctrination training included lectures and exercises on snow craft, sea ice, bush living, and over snow vehicles.\textsuperscript{49} Soldiers learned how to erect tents, use sleeping bags, give first aid, use a cooker, ski and snowshoe, transport by sled and sleigh, navigate, and protect their hands in order to properly and effectively handle metal weapons and supplies in extreme cold.\textsuperscript{50}

The extent of northern military training highlights the perceived value the Canadian Services placed on environmental and scientific knowledge. As pictured in Figure A.F6 (Appendix A), indoctrination also adopted cold-weather living and survival techniques known to Inuit. Soldiers learned to construct snowhouses similar to an igloo, tested clothing and dress

\textsuperscript{46} LAC, RG 24 vol. 2484, file HQS-726-40-17-11, Provision of Test Subjects for Defence Research Board.
\textsuperscript{47} Ibid.
\textsuperscript{48} Wainwright, Alberta was also used as a location for indoctrination training but not in preparation for Sun Dog One—the Princess Patricia’s Canadian Light Infantry were indoctrinated there in training for Sweetbriar; see George Bain, “Canadians Show Up Favorably,” *The Globe and Mail*, March 6, 1950, p. 17.
\textsuperscript{50} “Will Teach War This Winter At Four Canadian Schools,” *The Globe and Mail*, November 29, 1948, p. 17.
techniques other than army standard, and practiced Arctic navigational methods that utilized demarcation points in the natural environment around Fort Churchill. Scientists with the Defence Research Board observed military personnel and equipment to determine any existing deficiencies that modern science and engineering might overcome. Indeed, the marriage of traditional environmental knowledge and modern science was central to military research at DRNL.

**Cold-Weather Performance and Military Masculinity**

The direct effect of cold and climate on military personnel during northern training was a considerable issue for the Canadian military. Low temperatures were not the primary concern of study, however. Medical literature in the early postwar period reflected psychological anxieties associated with the inability to protect oneself from cold. According to psychologist and DRB grant recipient T.J. Boag, the fear of cold rather than the cold itself could disturb “subnormal, supersensitive, and ill-disciplined people.” Boag drew this conclusion from a series of interviews in which government employees with Arctic experience responded to questions about the problems of adjustment to living in the North. The term “temporary” applied to workers who travelled to northern Canada to fulfill a department requirement that all permanent employees spend a certain time at an isolated station. The term “permanent” described persons involved with the north and its inhabitants on a continuing basis, such as the Royal Canadian Mounted Police and federal representatives concerned with the “health and welfare of the Eskimo.” While

---

51 The term igloo derives from the Inuit word iglu (plural igluit), which can refer to a structure built of any material and is not restricted exclusively to snow houses. For details on “snowhouse” construction at Fort Churchill as part of indoctrination training, see LAC, RG 24, vol. 4206, file 270-0-89-6, Winter Exercise “Sun Dog One”.

temporary workers tended to have little or no contact with Inuit, permanent workers assumed “many responsibilities toward the Eskimo and derive[d] satisfaction of his needs for power and prestige from this paternal position.”

Dominance over the Arctic was closely associated with postwar perceptions of gender as well. For military personnel, problems associated with performance in the North extended beyond the psychiatric or psychological to include physical indoctrination and training. In a discussion of Boag’s study, Australian polar explorer Sir Hubert Wilkins, stated: “the proper man for service in the Arctic is the average, common-sense man with keen sensitivity and normal physical and mental ability … The Arctic is no place for the subnormal, a difficult place for the supernormal, and impossible for the supersensitive man who lacks control.” The DRB’s Arctic experiments align closely with this line of thought, as demonstrated by the types of scientific work financed by the extramural research program. For instance, the DRB provided financial support for a study on the relationship between exposure to cold and deterioration of motor performance. Scientists working as part of Sun Dog One drew similar conclusions.

Based on the collective experience of Arctic acclimatization and indoctrination, the final report of Sun Dog One declared that ten weeks was the minimum period acceptable for northern cold-weather training up to the battalion level. A proposed schedule of training suggested three weeks indoctrination, two weeks trades training, three weeks cold-weather familiarisation, and two weeks collective training. The report further suggested that training only take place in conditions of climate and terrain comparable to those of the projected theatre. Otherwise, the

success of the military operation “would be seriously prejudiced.”\textsuperscript{55} The report concluded that properly trained and equipped soldiers could operate successfully and with a degree of high morale in climates of extreme cold for periods up to thirty days under active conditions. The “ordinary” soldier conducting “normal” duties was comparable in efficiency in the North to the soldier operating in other, more temperate theatres. Yet the efficiency of the tradesman in tasks requiring manual dexterity was as little as 50 per cent of “normal” under severe cold weather and high wind conditions.

Observers of Sun Dog One also noted that tactical mobility, both dismounted and mechanised, was a primary deficiency of the exercise. Three out of every five men were required to either haul or carry the group living equipment, which left only a maximum of 40 per cent human strength to transport infantry support weapons, additional ammunition, and fulfill other necessary operational duties. Observers considered this unacceptable and recommended in the exercise report that weight reductions in rations, fuel, tentage, and other operational equipment be implemented to produce the “lower standard of comfort” necessary to overcome the “dangers and hardships of the cold [that] have been brought into reasonable perspective” by Sun Dog One.\textsuperscript{56}

Manliness was a characteristic of the successful soldier on Sun Dog One. Although the conclusions of the Royal Canadian Infantry Corps conceded, “there is no requirement for special troops” to conduct cold-weather military operations, the experience had shown that “special Arctic training” was necessary to acclimatize and indoctrinate “ordinary” soldiers. The final report of Sun Dog One noted the necessity of indoctrination to “weed out any soldiers who are weak physically or who are NOT temperamentally suited to be part of a small group for a long

\textsuperscript{55} LAC, RG 24, vol. 4206, file 270-0-89-6, Winter Exercise “Sun Dog One”.

\textsuperscript{56} Ibid.
Indoctrination aimed specifically to remove the “undesirables” who “only cause a lowering of morale and do not pull their share of the weight.” This extended to persons with glasses or persons who had undergone skin grafting on the face, as both might be unable to operate to the required level of efficiency in certain cold-weather capacities.

In exceptional circumstances, frostbite necessitating medical attention was a matter of disciplinary action. Planners of Sun Dog One recommended that soldiers receive penalty for personal injury that resulted from negligent exposure to severe cold. If frostbite were to occur, soldiers were to assume personal responsibility for their injuries and report for subsequent punishment. While this might have been a test of virility, the more likely explanation points to the responsibility of the soldier for his personal health and safety. In other words, a soldier could be found guilty of carelessness or willful self-injury if he had suffered frostbite after moderate exposure to cold. In this scenario, the soldier violated a health and safety measure because he had the proper protective clothing, knew the dangers of cold exposure, and was negligent. Despite the recommendation, there seems to be no record of disciplinary action ever having resulted from a frostbite injury.

The military ultimately concluded that “troops need not be hand-picked” for Arctic service, but “some weeding out during the training period must be permitted to eliminate temperamentally or physically unsuitable men who would otherwise become liabilities during operation.” According to DRB scientist and Arctic military exercise observer Cecil Law, well trained and indoctrinated soldiers “could run circles around the mobile strike force” and were

---

57 This is the exact wording and style of the text from the report; emphasis on the word “NOT” is original to the text.
58 Disciplinary action was “taken against personnel in camp suffering from frostbite when there [was] evidence of negligence”; see LAC, RG 24 vol. 2484, file HQS-726-40-17-11, Provision of Test Subjects for Defence Research Board.
59 LAC, RG 24, vol. 4206, file 270-0-89-6, Winter Exercise “Sun Dog One”.
essentially no match in the cold against untrained and unacclimatized units.\textsuperscript{60} Military and defence records pertaining to Sun Dog One paint a similar picture. Reports suggest that Arctic acclimatization and indoctrination was effective training for cold-weather military operations. Canadian soldiers never fought in an operation that would test their abilities in the cold, so the effectiveness of northern training remains questionable. What seems clear is that acclimatization did not instill in soldiers certain innate qualities required of northern military defence.

\textbf{Arctic Research Outside of Fort Churchill}

Research on scientific problems relevant to northern military operations expanded at Defence Research Northern Laboratory into the mid-1950s. The biological sciences featured regularly in laboratory work that focused on such topics as the rearing of mosquitoes, the cold tolerance of small mammals, and on general sanitation problems in the North. Scientists also conducted research on northern plants and vegetation specific to the Churchill region, but the primary area of research at DRNL remained the physiological response of the human body to severe cold.\textsuperscript{61} Studies of the deterioration of human functions in cold and wind chill conditions initiated related work into the development of Arctic clothing and military kit. The improvement of individual motor functions in cold depended not only on indoctrination training but also on the development of ground navigation techniques and cold-weather equipment for northern operations.

Fort Churchill was not the only Canadian location for Arctic-related research. With the expectation that Canada be particularly familiar with problems associated with Arctic warfare, the DRB decided to support the establishment of an Arctic medical research unit at the

\textsuperscript{60} Interview with Cecil Ernest Law [sound recordings]: CWM Oral History Project, 6 August 2008, Interview Control Number 31D 9 LAW, Canadian War Museum Archives.

University of Manitoba to work in cooperation with its existing facilities at DRNL in Fort Churchill and the Defence Research Medical Laboratory in Toronto. The decision to invest in the University of Manitoba resulted in part from a series of successful physiological tests conducted for the DRB by Professor B.M. Springbett, who had spent over two years measuring the effects of exposure to cold on motor performance. In Toronto, scientific work at DRML concentrated on occupational and environmental problems of armed forces personnel. Researchers focused on improving methods for the preparation and packaging of standard rations and meats that permit prolonged storage while retaining palatability. In this regard, DRML maintained close liaison with the food industry. Scientists conducted experiments on the dehydration of vegetables and the storability and transfer of dairy products.

One of the more intriguing studies produced by DRML scientists pertained to joint stiffness suffered because of cold exposure. A series of experiments conducted to assess the work decrements of carrying heavy loads over long distances and challenging terrain showed that joint stiffness in the cold is due to a physical alteration in the lubricating fluid of the joint. In an attempt to devise a solution to the problem, researchers conducted a follow-up study on the effect of ascorbic acid in the human body during periods of cold stress and low calorie intake.

Other studies conducted at DRML had close ties to the wider interest of the Defence Research

---

Board in human performance under cold duress. While there does not seem to be any direct link to the research of the Queen’s University Arctic Expedition (examined in Chapter 5), scientists at DRML conducted studies to assess methods for the training and selection of personnel for the armed services. In fact, researchers at DRML carried out an experimental scientific program on the psychology of individual recruits under operational situations. Designed for implementation in 1954-55, the “armed forces classification test” never occurred.

**Conclusion**

As a small portion of Canada’s early postwar Arctic military training, Sun Dog One does not represent the full extent of the scientific collaboration between the DRB and the military. Indeed, the Canadian military participated in no fewer than twenty-two northern exercises in the first decade of the Cold War.\(^{66}\) Scientists featured regularly as observers, referees and participants. Nevertheless, Sun Dog One was unique. When Omond Solandt made his address to the Empire Club of Toronto on 30 March 1950, he spoke briefly about Sun Dog One and of the importance of collaboration between Canada, the United States, and Britain in defence of the Arctic. In his mind, exercises Sweetbriar and Sun Dog One had demonstrated that two or more sovereign nations could effectively carry out joint military exercises in severe cold conditions. Solandt’s speech was a clear and public Cold War message that the Canadian military and defence establishment was fully committed to Arctic defence, and was not alone in its stand. Yet when discussing the importance of northern military operations to the Canadian public, Solandt and other military and defence representatives chose to highlight only the benefits of indoctrination training and joint operational execution. It seems the specifics of vitamin C research and

---

\(^{66}\) See the second note in this chapter.
acclimatization testing went unknown to the public, but evidence has survived through military and defence records as well as published medical reports.

Available records indicate that, in the immediate postwar period, the Canadian Army sought a deeper understanding of the many characteristics of winter warfare and in its search embraced experimental scientific study in an attempt to deduce information unique to the development of cold-weather soldiery. Northern environmental conditions required special investigation because the Canadian Arctic and sub-Arctic climate deviated significantly from the conditions under which most of the army’s concepts, doctrine, and tactics were developed. Operational researchers and defence scientists contributed by collecting raw data for further analysis through participatory study of army training exercises. Men were the chosen test subjects.

In scholarship on Canadian history, terms such as acclimatization and indoctrination find little reference to the Canadian military. This should be of particular concern to scholars of Canada’s military in the Cold War, because acclimatization and indoctrination comprised the base upon which a unique form of military preparedness developed in the Canadian North during the early postwar years. Canada’s postwar military doctrine derived from societal factors and the nature of the Cold War, within which science, defence, and diplomacy occurred. As evidenced by cold-weather research and training conducted at Fort Churchill and as part of Sun Dog One, defence science, in addition to geopolitics, shaped Canada’s Cold War national security apparatus.

Cold-weather testing on male soldiers supported and perpetuated idealized notions of virile soldiery. Involving researchers and scientists in important military investigations on

---

northern warfare developed, in theory, a model for future combat development work. From proper scientific analyses in “natural” climatic conditions, the Canadian military and defence establishment hoped to derive information to improve operational concepts, doctrine, and tactical principles pertinent to cold-weather warfare. Sufficient knowledge and adequate research material was deemed to have been obtained because of Sun Dog One and other comparable cold-weather exercises. The consequences that resulted from acclimatization research appear only briefly in available records. Researchers pursued the potential benefits of cold-weather scientific discovery in spite of any moral or ethical issues that stemmed from human testing. As documented in the next chapter, acclimatization research on people extended beyond the use of military volunteers.

---

68 Ibid., 89.
Chapter 5

Acclimatization Research on Inuit

“To be an Eskimo is not necessarily to be acclimatized to cold, but it is our conclusion, for the reasons given, that our selected Eskimo subjects were so acclimatized.”

G. Malcolm Brown et al., 1958

After having made five trips to the Canadian Arctic, medical scientist G. Malcolm Brown wrote a progress report for the Defence Research Board in December 1950 that described a series of environmental studies conducted on Inuit and white “test subjects.” Designed and carried out as a long-term study of the effect of cold on the human body, the research aimed to determine how much cold exposure was required to achieve acclimatization. To make this determination, Brown oversaw the administration of medical treatment services and biochemical work over an eight-year period with financial support from the Department of National Health and Welfare, the DRB of the Department of National Defence, the National Research Council, and the Arctic Institute of North America. Four trips took researchers to Southampton Island in the north of Hudson Bay and a fifth to both Southampton Island and Igloolik in the northeast corner of present-day Nunavut. Brown and his team returned to Southampton Island on a final trip in 1954. While on location over the eight years, researchers took samples of blood, urine, skin, and liver

---

2 The word *Inuit* means “people” and is plural; the word *Inuk* is a singular reference to one person. For a more detailed explanation, see Alan Rudolph Marcus, *Relocating Eden: The Image and Politics of Inuit Exile in the Canadian Arctic* (Hanover and London: University Press of New England, 1995), xv-xvi. See note 5 for more on terminology in this article.
from “Eskimo test subjects” and transported the “specimens” to university labs in southern Ontario for independent and comparative biochemical analyses with samples taken from white university students.⁵ Records indicate that Brown and his colleagues worked on no fewer than 288 Inuit, including at least sixteen children who ranged in age between one and ten.⁶ Although the exact number remains unclear, at least sixty-seven of the 288 were men used to study acclimatization.⁷

In the absence of a full physiological description of cold acclimatization, scientists conducted the research in an attempt to deduce information that might better prepare both government and military personnel to work and defend in the Arctic. The theory of acclimatization offered a potential solution to the problem of cold tolerance. Inuit represented acclimatized “experimental subjects” while “85 male, healthy medical students” from Queen’s University represented the “control group” of unacclimatized white “subjects.”⁸ Researchers subjected both groups to similar studies, but Brown and his team of scientists seem to have obtained organ samples from Inuit alone. Administered during medical treatment, “needle biopsies” resulted in samples of liver from at least ten adult Inuit “test subjects.”⁹ In the end, Brown deemed the studies inconclusive because testing failed to detect definitive evidence of the

---

⁵ This chapter uses the word Inuit to refer to persons indigenous to the Canadian North who were the “test subjects” of the discussed acclimatization research. I use the term Inuit because the evidentiary record does not distinguish the “Eskimo” persons subjected to the research, other than one reference to “Iviliks.” It is possible that the scientists conducted research on Indigenous persons who might not have been Inuit.


⁹ Researchers performed needle biopsies of the liver in two “subjects” in 1947, see “Northern Research Reports: Medicine,” Arctic 1, no. 1 (1948): 65; and three in 1948, see Malcolm Brown, “Northern Research Reports: Medical Investigation at Southampton Island,” Arctic 2, no. 1 (1949): 70-1. The December 1950 report (see note 3) states that “punch biopsies have been carried out on ten subjects ….,”
existence of cold acclimatization. Nonetheless, the circumstances and attitudes that gave rise to the research point to some important considerations for understanding postwar physiological perceptions of Inuit as well as the impact of the Cold War sciences in Canada.

Operating under racialized perceptions of human biology, the defence establishment funded medical science in an attempt to devise a method for selecting male white bodies with “Eskimo-like” cold-weather-fighting physiological traits. In the process, scientists supported a colonial agenda by imposing medical practices on Inuit communities, asserting claim over the Inuk body, and subjecting Inuit to physiological experimentation. This chapter argues that while wider government initiatives aimed at Inuit health in the period, as far as cold acclimatization research is concerned, assimilation was secondary to the primary goal of biological appropriation. In the context of the acclimatization research examined here, I define biological appropriation as the attempted use of Inuit biology for a non-Inuit purpose. To be clear, the scientific use of Inuit biology was theoretical. Researchers did not attempt to extract and then transmit blood or tissue from Inuit bodies, but instead used comparative sampling of Inuit and white “test subjects” to pursue a scientific understanding of an abstract physiological response to cold tolerance. Under the auspices of the Canadian government, comparative biochemical research intended primarily to isolate the vascular characteristics of cold acclimatization. Theoretically, the researchers believed, this type of information could be useful for devising a process for the “physiological screening of persons considered for service in the far north.”

If scientists could identify the vascular characteristics of cold acclimatization, they thought it

---

possible to “provide some guides as to the best method of rapidly acclimatizing a group of men, and of selecting those likely to adapt quickly and completely.”

The attempted appropriation of Inuit biology for a non-Inuit purpose suggests a new area of interpretation for understanding colonial views of Indigenous peoples. In contrast to wider perceptions of the Indigenous body, scientists involved in acclimatization research considered the Inuk’s ability to live and work in the cold an “enviable” physiological trait. If science could unlock the “Eskimo” secret to cold-weather survival, the “functional capacity of white men in the Arctic” might increase, thereby improving the ability of Canada’s government and military personnel to work and defend in the North. In this instance, white peoples viewed Inuit bodies as having superior, rather than sickly and inferior physiological traits. That the scientists conceived the research from an imagined racial dissimilarity suggests they operated under deeply entrenched colonialist positions. The biologized Inuk body, according to the interpretation of the scientists, was better suited than the white body to survival in the harsh Arctic climate of northern Canada.

At the core of acclimatization research, the socio-medical perception of the Inuk body is important to our understanding of the impact of the Cold War in Canada. The studies conducted by Brown and his team did not originate from a military or strategic Cold War agenda, but Canada’s defence establishment assumed responsibility for the research on the advice of Arctic policy makers who championed the widespread applicability of the intended results. Predicated on the basis that the environment determines biological traits, acclimatization research in Canada

---

11 Ibid.
13 For a comprehensive account of southern views towards Indigenous health in the Canadian North, see Liza Piper and John Sandlos, “A Broken Frontier: Ecological Imperialism in the Canadian North,” Environmental History 12, no. 4 (October 2007): 759-95.
first aimed to determine physiological evidence of biological variation between Inuit and white bodies as part of a wider international scientific interest in defining the vascular characteristics of cold tolerance. Originally financed by the National Research Council, the Defence Research Board absorbed the acclimatization research of Malcolm Brown with the intent to apply the science of cold-weather physiology to service work in the North. Although the defence of Canada in the nuclear age did not depend on the successful appropriation of Inuit biology, acclimatization research found and maintained federal support as a potential means to protect the lives of white service personnel during an era of intensifying Arctic activity.

The context in which the acclimatization research took place is extremely murky. At the time of the research, Canadian law did not require scientists to obtain written consent to conduct research on the Inuit and white “test subjects” studied for cold acclimatization. The Nuremberg Code set a base international standard for medical ethics in 1947, but Canada did not implement formal ethical guidelines for medical research until 1980.\(^\text{14}\) Contemporary international standards stated that voluntary consent was mandatory for clinical research, which meant that all persons subjected must agree to participate without coercion and must understand the risks involved in the research. Sources indicate that Brown and his colleagues used an “excellent native interpreter” to communicate with Inuit involved in the research, but the details of any verbal contract went unrecorded.\(^\text{15}\) According to the progress report referred to at the outset of this


\(^\text{15}\) See G. Malcolm Brown, “Northern Research Reports: Medical Investigation at Southampton Island,” *Arctic* 2, no. 1 (1949): 70.
article, “the only method of selection used in these surveys was to take family groups as a whole as they became available.” Brown expanded this explanation in 1954:

[The] selection of experimental subjects from among Eskimos who continue to live in their traditional dwellings and who still gain their livelihood by hunting and trapping has … the merit that such Eskimos as these have an ability to live and work in the cold that permits, on the basis of performance, their acceptance as acclimatized individuals.

Brown’s explanation reflects the findings of the research, and the 1954 publication date is significant. When the research began in 1947, Brown and his team pursued innate biological factors to explain the vascular characteristics of acclimatization. By 1954, the findings of their research pointed instead to environment, culture, and diet as an explanation for Inuit cold tolerance. This shift reflects wider scientific changes towards the perceived value of northern Indigenous knowledge. As Stephen Bocking has argued, the development of postwar research laboratories meant that “scientists no longer needed to live among Indigenous people, learn their techniques for travel and survival, or indeed, have any contact with them” by the mid-1950s.

The interim years between 1947 and 1954 are thus the focus of this chapter. During this period, Brown and his team perceived cold acclimatization in strict biological terms and the Canadian defence establishment funded the research in an attempt to appropriate the superficial cold-fighting physiological traits of Inuit in the North.

The socio-medical perception of the Inuk body, based on biology rather than cold performance, came to bear on Inuit as developments in science and technology pronounced the geostrategic significance of the Arctic in the early postwar period. The demands of science that

---

drove imperial policy during the Second World War had woven relationships that influenced Western science diplomacy well after the war had ended. Not unlike the bureaucrats and doctors responsible for carrying out the assimilative agenda of the Canadian welfare state in the postwar period, scientists engaged in acclimatization research exploited contemporary circumstances to achieve distinctly southern goals. As Ian Mosby explained in his important work on the mistreatment of malnourished Aboriginal peoples, shifting attitudes in Canada supported racialized medical testing and experiential human science. Predicated on the exploitation of Inuit bodies and communities, acclimatization research also occurred within the edifice of colonial science, but the so-called “Indian Problem” of “dependency” is noticeably absent in records pertaining to the work. Although researchers used southern understandings of Indigenous health and welfare to gain access to Inuit communities, cold-weather research on human beings derived specifically from a scientific and medical agenda that sought to describe superficial connections between the physical body and the natural world. The research was not militarily strategic in origin, but studies on acclimatization were perpetuated in response to Cold War anxieties and a desire to pursue science as a solution to military problems.

---

21 Whitney Lackenbauer has challenged protagonist narrative structures that pit “Aboriginal peoples on one hand, and the “Euro-Canadian” (non-Aboriginal) camp on the other.” His extensive work on military-Aboriginal relations has shown that avoiding dichotomous language can serve well in assessing complex historical interactions. See Lackenbauer, “The Irony and the Tragedy of Negotiated Space: A Case Study on Narrative Form and Aboriginal-Government Relations during the Second World War,” *Journal of the Canadian Historical Association* 15, no. 1 (2004): 177-206.
22 Acclimatization research was not unique in this regard, as evidenced by the diverse range of other federal scientific research initiatives that became essential to Canada’s Cold War agenda. See, for instance, Stephen Bocking, “Seeking the Arctic: Science and Perceptions of Northern Canada,” *The Dalhousie Review* 90, no. 1 (Spring 2010): 61-74.
Although cognizant of the value of oral history material, this chapter relies exclusively on written records to examine what insights the colonial archive holds about early postwar perceptions of the Inuk body in Canada. The findings are the result of archival investigation in digital and print repositories. Extensive primary research at Library and Archives Canada and the National Archives and Records Administration in the United States yields insight from the personal papers of lead scientist Malcolm Brown as well as the federal departments and independent agencies that jointly conceived, supported, and financed the scientific work.

Published materials in the fields of medicine and the Arctic also proved useful. Collectively, these sources provide sufficient detail to contextualize acclimatization research within a framework that shows the interplay of Cold War politics, national defence, and racialized experimental science.

Science and the Cold War Arctic

To defence policy makers in Ottawa, the North only figured increasingly as a prominent location of geostrategic importance towards the end of the Second World War. Outside the small

---

23 The experiences of Inuit who had contact with Brown and his group of medical researchers may be lost to history. Unfortunately, it seems those experiences went unrecorded and untold. I contacted and received no response from Aboriginal Affairs and Northern Development Canada, and the Nunavut Food Security Coalition. The Government of Nunavut’s Department of Health sent a kind response, recommending further contacts, but had no information pertaining to environmental or medical research in the 1940s and 1950s. Likewise, the friendly people at the Unikkaarvik Visitors Centre of Nunavut Tourism graciously provided a list of contacts, but also had no information. The Hamlet of Coral Harbour and the Hamlet of Igloolik also politely responded to my inquiries, but equally had no information.

24 The personal papers of G. Malcolm Brown are located at LAC in Ottawa, Ontario, as part of RG 128 (Medical Research Council/Canadian Institutes of Health Research). The papers comprise seven volumes of documentation, nearly the entire contents of which were released to me, following review, under the Access to Information and Privacy Act. Volumes and files of interest are listed extensively in the notes of this article. Other important files from LAC derived from RG 24 (National Defence) and RG 85 (Northern Affairs), while documents from NARA were taken primarily from RG 319 (Army Staff).

25 If Inuit experiences or stories have survived, the details may further elucidate what information we do have and/or bring to light important insights for further consideration. Such insights may point to what Mary-Ellen Kelm refers to as “medical pluralism,” which recognizes the resistance of Indigenous peoples to colonial medicine. See Kelm, Colonizing Bodies: Aboriginal Health and Healing in British Columbia, 1900-50 (Vancouver: University of British Columbia Press, 1999). Currently, it remains unclear if Inuit subjected to cold acclimatization research resisted or embraced medical treatment services. Available records state the “Eskimos” were “very cooperative.”
presence of the Royal Canadian Mounted Police, federal activity had shown little concern for the North and the people living there.\(^{26}\) Officials commissioned an Eastern Arctic Patrol in 1935 to investigate the clinical and metabolic health of northern Indigenous populations, and the responsibility for Inuit health care passed to the new Department of Mines and Resources the year after.\(^{27}\) The provision of health services to Inuit changed again in 1945. Under the new direction of Health and Welfare, the federal government again commissioned vessels to patrol the eastern Arctic and provide medical and evacuation services to Inuit.\(^{28}\) Northern patrols promoted Canadian sovereignty as well, but the onset of a possible Soviet-American conflict in the postwar world provided new considerations for the role of the North on the federal agenda.\(^{29}\)

The perceived need to have a white acclimatized body for the North highlights the importance of white settlement and the grip of the “colonial project,” especially when we consider Canadian defence policy in relation to postwar problems of sovereignty and security.\(^{30}\) As a well-developed body of literature has shown, Canada’s top officials saw little intrinsic value in funding or facilitating a widespread defence of the North in the early postwar period.\(^{31}\) Nevertheless, Canadian geography dictated a response to key strategic issues. As has been

---


\(^{28}\) The Hudson’s Bay Company ship *Nascopie* patrolled eastern Arctic waters in 1947 but the main patrol belonged to the *C.D. Howe*, which made its maiden voyage in 1950 and sustained operation until the patrol was discontinued in 1969. See Grygier, *A Long Way from Home*, 86-103.


discussed earlier in the dissertation, if Ottawa was not prepared to defend the northern reaches of the continent, Washington might take charge to ensure the protection of the United States. Responding to the dual concern for Soviet and American encroachment on Canadian territory, defence officials in Ottawa abandoned any thought of an isolationist postwar security posture. Simultaneously to accepting bilateral agreements and the continental defence radar network, the Canadian defence establishment pursued inexpensive options to further protect and promote northern sovereignty and security. The concept of the Canadian Rangers developed consequently in 1947, according to Whitney Lackenbauer, when defence officials created “a military space for citizens who live in isolated coastal and northern communities and who would not otherwise be suitable for or interested in military service.” Equipped with only a “rifle and an armband,” the Rangers assisted the Mobile Striking Force (MSF), the airborne brigade discussed in Chapter 2. If a potential invasion required Canadian soldiers in the North, aircraft could theoretically fly and drop the specially trained MSF to form a northern frontline resistance and counter the enemy presence. The “Queen’s University Arctic Expedition” led by Malcolm Brown became a supplement to this plan. As a northern initiative, the scientific research program served a specific scientific research need beyond the area around Churchill. Brown’s biochemical work on cold acclimatization contributed to a large body of multi-purpose scientific research, designed simultaneously to support Canada’s independent and collaborative military needs associated with defence and sovereignty in the North.

34 Ken Coates et al., Arctic Front: Defending Canada in the Far North (Toronto: Thomas Allen Publishers, 2008), 65.
The connection between Brown’s medical acclimatization research and the military needs of Canada is further evident in the early postwar environmental protection programme of the federal government. A progress report published by the Department of National Defence in 1954 defined the field of environmental protection as research on “the protection of the serviceman and his equipment against the adverse physical effects of his environment.” The program employed a diverse set of scientific disciplines across multiple government divisions, resulting in co-operation between the DRB, the National Research Council, the Science Service of the Department of Agriculture, the Ontario Research Foundation, and from direct support by branches of the Armed Services. While each division made both individual and collective research contributions, coordination of all program activities was the responsibility of the Environmental Protection Section of DRB headquarters. As a coordinating body of environmental protection research, the DRB facilitated “field testing” in the Canadian Arctic and liaised international information exchange between Canada, the United States, and Britain to improve co-operation on geographical considerations pertinent to security in northern latitudes.

Scientific investigations on the effect of cold on human physiology and climatic adaptation were vital components of the environmental protection research financed by the federal government between 1947 and 1954. At the height of Brown’s work in 1951, scientific study on “physiological stress produced in men by cold” topped the list of 14 research activities conducted at DRNL. Scientists conducted blood and urine sampling on service personnel in an attempt to determine quantitatively the physiological and biochemical responses to cold in men, with the aim to “determine the degree to which adaptation to cold occurs … [and] the best

---


36 LAC RG 85 299, 1009-2[3], DRBS 3-750-43-2, DRB: Minutes of the 2/51 Meeting of the Arctic Research Advisory Committee, 30 April 1951, “Activities of the Defence Research Northern Laboratory”.
methods of bringing about adaptation.” Thus, the comparative sampling conducted on Inuit and white “test subjects” by Brown and his team did not occur in isolation. The Canadian defence establishment showed significant interest in acclimatization research, facilitating and funding multiple studies at different locations in the North during the first decade of the postwar period.

**Malcolm Brown and the Federal Organization of Arctic Research**

When the threat of Soviet activity captured the attention of Canada’s defence and military establishment, the roots of a southern Arctic romanticism came to bear on Inuit. Long-entrenched cultural beliefs shaped the work of the acclimatization researchers. From a privileged position, Brown and his team exploited contemporary understandings of Indigenous health to gain access to Inuit communities and bodies. Their intentions of providing medical services were sincere. Brown and his team treated Inuit for nutritional, metabolic, and respiratory disease, but simultaneously the administration of medical treatment services gave researchers access to Inuit bodies for a purpose unrelated to Inuit health and welfare. The circumstances constructed the “Eskimo” as a racially pure, cold-weather adapted body. Scientifically, researchers considered the Inuk body as the ideal “test subject” to study the vascular characteristics of cold tolerance. A discourse of “assistance” gave Brown’s team initial access to Inuit communities and bodies, while the longevity of acclimatization research resulted from Cold War anxieties that produced a distinct scientific agenda.

The first “Queen’s University Arctic Expedition” to Southampton Island took place during the summer of 1947. Malcolm Brown led a team of four researchers that also included medical professor R.G. Sinclair, biochemist L.B. Cronk, and George Clark. Brown graduated

---

37 Ibid.
38 In the December 1950 progress report, Brown listed the following personnel: R.G. Sinclair, L. Bruce Cronk, G.C. Clarke, J.E. Green, John Page, J.E. Gibbons, D.L. (Don) Whittier, Frederick deSinner, J.D. Hatcher, T.J. (Thomas)
in medicine from Queen’s in 1938 and obtained a Ph.D. from Oxford University in 1940. Following a three-year research term, he served with the Canadian Army Medical Corps between 1943 and 1946. During two of those years, he was on loan to the Royal Army Medical Corps as a physiologist with the Malaria Research Unit. Discharged with the rank of major after having served in the United Kingdom, Italy, and northwest Europe, Brown held various academic and professional positions following the war. His appointments included an associate professorship with the Faculty of Medicine at Queen’s University in 1946 and a membership with the Defence Research Board’s Panel on Arctic Medical Research in 1947. While with the DRB, Brown simultaneously held a position with the Department of National Health and Welfare, and maintained scientific advisory roles in government to the 1970s.  

Brown’s personal experiences at war shaped his postwar research and views towards acclimatization. Having witnessed unparalleled death first-hand, his physiological work on wartime malaria gave him cause to pursue and promote blood sciences as a means to prevent unnecessary death in the postwar period. Armed with the desire to prevent further loss of life, human survival became fundamental to Brown’s acclimatization research and, by extension, his work influenced perceptions of acclimatization among defence officials in charge of the implementation of Arctic policy. Brown’s research was particularly fundamental to the Arctic division of the Defence Research Board.

Throughout the duration of Brown’s acclimatization research, the administration of the Northwest Territories and the Yukon fell under the jurisdiction of the federal government at the

---


time of the research. The Northwest Territories Council held the place of provincial
governments, while the Bureau of the Northwest Territories and Yukon Affairs of the
Department of Mines and Resources managed executive functions. It was the position of the
Advisory Committee on Northern Development to advise Cabinet on northern matters and ensure
consistency in policy where the interests of different government departments were concerned.
The Arctic Research Advisory Committee, although under the auspices of the DRB, had
representatives of various government agencies and coordinated scientific research activities in
the North. When scientists aimed to conduct research activities in the Northwest Territories,
work depended on licences issued by the Bureau of the Northwest Territories and Yukon Affairs.
Brown’s research conformed to federal standards, according to the minutes of the first meeting
of the Panel of Arctic Medical Research.\textsuperscript{40}

The basis of support for acclimatization research formed when the Arctic Research
Advisory Committee decided to establish a section to meet the needs of Arctic medical research.
The first meeting of the Arctic Medical Research Panel, a division of the larger advisory
committee, took place on 16 December 1948.\textsuperscript{41} As an authoritative body, the panel brought
attention to advances in Arctic medical research pertinent to defence and suggested areas of
potential research interest. The terms of reference for the panel stipulated the responsibility of its
members to review and report on the progress of Arctic medical research projects of both the
DRB and the Services.\textsuperscript{42} The work was confidential and all members were bound to an “oath of
secrecy … sworn before a Justice of Peace or Commissioner for Affidavits.”\textsuperscript{43}

\begin{thebibliography}{99}
\bibitem{40} LAC, RG 24, Vol. 4129, File DRBS 4-78-53 vol. 1, Minutes of the First Meeting of the Panel of Arctic Medical Research, DRB, 16 December 1948.
\bibitem{41} LAC, RG 24, Vol. 2529, File 801-100-M91 Vol. 1, Minutes of the Third Meeting of the Medical Research Advisory Committee – Appendix “C”: Arctic Medical Research Panel, 3 February 1950.
\bibitem{43} LAC, RG 85, Vol. 299, File 1009-2[3], DRBS 3-750-43-2 DRB: Minutes of the 1/51 Meeting of the Arctic Research Advisory Committee, Appendix “A” Confidential, 2.
\end{thebibliography}
Malcolm Brown was one of the six original members of the Panel, and was chair between 1952 and 1954. He reported directly to both the Defence Medical Research Advisory Committee and the Arctic Research Advisory Committee. Under the oath of secrecy, Brown, as an official member of a DRB panel, had full security clearance to discuss and write about cold acclimatization research.\(^{44}\) His authority to communicate research was autonomous, confined only by the limits of the Official Secrets Act, Chapter 49 of the Revised Statutes of Canada. Under the Act, it was “an offence to communicate to any person, except under lawful authority, information which might be useful to a foreign power — or to fail to take reasonable care of, or to endanger the safety of such information in one’s possession or control.”\(^{45}\) These restrictions did not prevent Brown from publishing extensively about cold acclimatization, which speaks to the popularity of the science but also to the results of the work. When the research failed to isolate the vascular characteristics of cold acclimatization, Brown had no secrets to protect.

The studies administered by Brown and his colleagues were a direct, non-military extension of the DRB’s wider cold acclimatization programme that studied the physiological adaptation to cold of personnel while operating under the cold environmental conditions of the Canadian North.\(^{46}\) About 40 per cent of the total amount granted by the DRB for research in Arctic regions in the late 1940s went to medical projects that supported “basic studies of the Eskimo and experiments on nutritional problems, on physiological and other responses to cold,

\(^{44}\) For an outline of the security policy of the DRB, see LAC, RG24, Vol. 2529, File 801-100-M91 Vol. 1, DRB: Care and Communication of Classified Information, 10 January 1949.

\(^{45}\) LAC, RG 24, Vol. 2529, File 801-100-M91 Vol. 1, DRB: Care and Communication of Classified Information, 10 January 1949.

and on conditions resulting from exposure to cold.”

The studies provided scientists an opportunity to conduct “field work” in an actual cold environmental locale and the defence establishment an opportunity to assess a theatre considered imperative to Canadian security in the early postwar years.

**Acclimatization Research on Inuit**

Arctic research in the early Cold War period was a highly cooperative venture. When the DRB began to fund northern research in 1947, the federal government had already supported Arctic science through the National Research Council. In addition to participating in a number of scientific investigations, the DRB served as a coordinating agency in making arrangements for the transportation of scientific personnel and the organization of Arctic research.

At the request of the NRC, the DRB accepted five medical research projects in 1948. All five projects were concerned with human performance and physical response under varying conditions of stress and environment. Among the five projects were an investigation into cold acclimatization by Louis-Paul Dugal and Malcolm Brown’s study entitled “Clinical and Biochemical Studies on the Eskimo.” Both projects were financed by a grant-in-aid from the NRC, but following examination “as to their suitability for support by the Defence Research Board, and with the permission of the applicants, the Defence Research Board assumed responsibility” for the

---

projects.50 Upon acquisition, the DRB absorbed each project into its wider extramural research program.

The first acclimatization project financed by the DRB commenced at Churchill, Manitoba in December 1947.51 Louis-Paul Dugal of Laval University and a team of scientists collaborated with R.E. Johnson of the United States War Department Medical Nutrition Laboratory to “prove that ascorbic acid is necessary for acclimatization to cold.”52 Dugal’s previous work indicated the importance of ascorbic acid in the acclimatization of animals to cold, and based on his experience the DRB decided to fund his Arctic research. Dugal’s project aimed to determine scientifically if ascorbic acid was capable of increasing the ability of the human body to acclimatize to cold, and the DRB determined that his research fit well with wider defence initiatives in the North. Under the supervision of DRB Arctic scientist Guy Marier, Dugal’s team at Churchill experimented on a group of thirty-six “volunteer” Service personnel from the Canadian Army who were engaged in winter exercise training. The troops underwent a two-day physical examination prior to and following the test program. Examinations included the taking of blood samples, urinalysis, chest x-rays, and dental inspections. Split into three groups, troops took Vitamin C pills daily without knowing the dosage. Troops in “Group A” unknowingly received placebo pills containing zero Vitamin C, while “Group B” received pills containing a 300 mg dosage, and “Group C” a 1000 mg dosage. In the end, the trials proved inconclusive because of a “shortage of accommodation and other administrative difficulties” on location.

50 Ibid., 153.
52 Ibid.
during the winter of 1947-1948. Nevertheless, scientists believed the research produced valuable information for further study.

Aside from collaboration with the United States War Department, Malcolm Brown’s DRB research mirrored the trajectory of Dugal’s work. Brown’s experience with peripheral blood vessels and diseases made him ideally suited to research cold acclimatization for the Canadian defence establishment. He first flew to Southampton Island in the summer of 1947, along with the three other members of his team, in RCAF planes by way of Winnipeg and Churchill. Former wartime huts at Coral Harbour on the Island provided space for temporary housing as well as a medical clinic to examine Inuit and administer tests.

Brown’s team reportedly brought 80 per cent of the Indigenous population of Southampton Island by boat to the clinic for medical examination and testing during the first trip in 1947. The results of the examinations suggested that respiratory tract infections and tuberculosis were the primary causes of illness and death among the local population. Researchers also observed that a third of those examined had enlarged livers: “Specimens of liver obtained from two subjects showed that the enlargement was due to the presence of large amounts of fat, and further work is being done on this problem which is of considerable interest.” In response, Brown and his team carried out further nutritional intervention experiments that draw obvious and grim connections to other federal studies of malnourished Aboriginal peoples.

---

54 “Northern Research Reports – Medicine: Queen’s University Expedition to Southampton Island,” 65.
55 Ibid.
56 See Mosby, “Administering Colonial Science.”
Clinical research at Southampton Island extended beyond Inuit health. In a comparative physiological study, researchers used water immersion to analyze cold tolerance in Inuit and white “test subjects.” Brown and his colleagues studied Inuit “subjects” on location during June and July, and white “controls” during October and November in comparable outdoor temperatures in Kingston, Ontario. Although described as acute or short-term exposure tests, researchers immersed the hand and forearm of each “test subject” in water for a duration of one to two hours at temperatures between 5 and 45 degrees Celsius.\(^{57}\) Tables A.T1 and A.T2 (Appendix B) show the results of the immersion test at 5 degrees Celsius.\(^{58}\)

Researchers measured rectal temperature at the conclusion of each immersion and compared the data with measurements taken prior to the test. Inuit tolerated the coldest water temperature for nearly an hour longer than the white subjects did, but the coldest conditions were so severe that all persons tested experienced a drop in core body temperature. A different test measured hand and forearm blood flow, skin, subcutaneous tissue, muscle, and rectal temperatures while subjects rested in a room at 20 degrees Celsius.\(^{59}\) Researchers determined skin, tissue, and rectal temperature after the subjects’ hand and forearm was clothed with cotton wool for 30 minutes. The results of both experiments indicated that Inuit maintained a greater blood flow through the extremities than the white students. Researchers attributed the difference to hormonal thyroid activity. They postulated that increased metabolic heat production in the “Eskimo” body resulted in increased thyroid secretion, which enabled the vascular system to

\(^{57}\) Brown, Bird et al., “Cold Acclimatization,” 259.


maintain a higher level of heat distribution to the extremities than was measured in the white students.

To Brown and his group of researchers from Queen’s University, the hyperthyroidism seen in Inuit represented a potential physiological explanation for the existence of cold acclimatization. The wider medical community reacted with intrigue and caution. In reference to the findings, the founder of the Department of Medical Biophysics at the University of Western Ontario, Alan Burton, stated: “[Brown] finds that the liver in the Eskimo is markedly enlarged by clinical standards, and plainly palpable. Yet liver biopsies obtained from a number of very cooperative natives, have shown no microscopic abnormality whatever.” To Burton, the findings were inconclusive and only a seasonal change could show the existence of acclimatization. For Brown and his colleagues, the research continued with the intent to investigate further the link between hormonal thyroid secretion, blood circulation, and cold tolerance in the human body.

**Acclimatization Research Outside of Canada**

Acclimatization science was not restricted to Canada. Strategic considerations also led the United States to invest in cold-weather science to support military operations in northern latitudes. As documented by Matthew Farish, extensive militarization during and after the Second World War turned the North American Arctic into a Cold War “laboratory” for scientific investigation. Researchers at the Arctic Aeromedical Laboratory in Fairbanks, Alaska conducted an extensive program on acclimatization and cold survival that included

---

experimentation on Indigenous Alaskans. Testing a hypothetical connection between hyperthyroidism and cold tolerance, scientists used a radioactive medical tracer to measure thyroid activity in 120 subjects, including “19 Caucasians, 84 Eskimos, and 17 Indians.”62 The administration of radioactive iodine was “one of many methods deployed to understand the physiology of the (singular) Eskimo as a gateway to military success in the North,” according to Farish.63 Ethical questions regarding the selection process of the participants and the associated medical risks of the research led to a public inquiry in the 1990s. After hearing testimony from medical scientists and persons directly involved in the study, the committee leading the inquiry published a report that described the details behind what it considered a gross disregard for human life.64

Despite certain and obvious similarities, no direct evidence links the experiments in Alaska to the acclimatization research conducted in Canada. The experiments in the United States took place after the Canadian researchers returned from their final trip to Southampton Island in 1954, and Brown’s personal correspondence does not indicate that he or any member of his research team was involved with the Alaska scientists. Brown read extensively on the experimental use of radioactive iodine in thyroid treatment, however.65 In a letter dated 2 November 1954, Brown wrote to Keith Wightman of the University of Toronto’s Banting

62 Ibid., 3.
63 Ibid., 19.
Institute to inquire about the practice of administering “therapeutic doses” of radio-phosphorus.\textsuperscript{66}

In reply, Wightman confirmed that he had treated cancer patients with doses of a radioactive isotope of phosphorus and radioactive iodine. The correspondence seems to have ended with the reply and evidence does not suggest that Brown inquired with the intent to administer radio-phosphorus in his own practice.

Brown was also careful to keep the findings of his research separate from similar studies developed in the United States. When George Mann of Harvard University sought permission to co-publish results on acclimatization research in 1955, Brown declined: “Despite any estimates, I [Brown] don’t believe anyone really knows what is the average fat intake in the Eskimos and it is a mistake to say that the results of our carefully done but necessarily restricted dietary experiment provide such a figure.”\textsuperscript{67} Mann specifically wanted to co-publish the results of a study that examined the relationship between diet and serum lipid in a group of 161 “Eskimos” of various ages, but Brown declined because his results derived from separate and inclusive research on the biological characteristics of cold acclimatization. Nonetheless, the correspondence in Brown’s personal papers reflects a fascination with race and science. His team conducted research in relative isolation, but the acclimatization research that took place in Canada fits a wider narrative of Cold War militarism and experiential human science.


\textsuperscript{67} Mann wanted to co-publish Brown’s results with that of his own from similar research conducted in the United States, but Brown refused because it would be “unsatisfactory” to have the data combined. See LAC, RG 128, vol. 259, file Dr. G. Malcolm Brown – List of Publications, Curriculum Vitae, etc. (Part 1), letter from Malcolm Brown to Dr. George V. Mann, 2 March 1955.
Perhaps best epitomized in suggestions for future projects submitted to the Arctic Medical Research Panel of the Defence Research Board, postwar military science in Canada embraced colonial perceptions of the Inuk body. Light reflection from snow made military operations difficult on Arctic terrain, and some defence officials thought science might provide a useful solution to the problem of “snow blindness.” One concept suggested “a study on the special senses of the Eskimo, especially eye function. As the Eskimo is ‘racially pure’ and has had high ultra-violet exposure for generations …. ”\textsuperscript{68} This hypothesis proposed research into the biological functions of the Inuk eye, which, based on rudimentary scientific observation, seemed effectively capable of resisting “snow blindness.” In other words, researchers thought that studying the eye function of Inuit could prove beneficial to developing protective materials to assist the vision of white troops in the North. Another idea submitted for further consideration was “a study of the adaptability of the Eskimo to unfamiliar tasks.” Although both suggestions seem to have gone unexplored scientifically, Arctic policy makers pondered and discussed a range of possibilities for the “Eskimo test subject.” Brown made a final request for grant monies from the DRB on 15 January 1954 at the tenth meeting of the Panel: “Considerable discussions arose regarding acclimatization [and] Brown indicated his reasons for believing that his work did constitute a study of acclimatization itself and not racial differences, etc.”\textsuperscript{69} The specifics of Brown’s reasoning went unrecorded, but the Panel did move to approve his funding request. He used the funds to make another trip north, which proved to be the last. Brown’s research ended in 1955 without clinical evidence showing the existence of cold acclimatization.

\textsuperscript{68} LAC, RG 24, Vol. 4129, File DRBS 4-78-53 vol. 1, Minutes of the First Meeting of the Panel of Arctic Medical Research, DRB, 16 December 1948.
\textsuperscript{69} LAC, RG 24, Vol. 4129, File DRBS 4-78-53 vol. 2, DRB Panel on Arctic Medical Research: Minutes of the Tenth Meeting, 15 January 1954.
Federal funding for cold-weather research remained at the conclusion of Brown’s work, although DRB grant monies went increasingly to non-human cold studies such as weather and terrain. Science continued to support the defence establishment through collaborative projects in the North, and the military continued to indoctrinate and adapt its personnel to the potential Arctic battlefield. In the process, white service members turned to cultural appropriation of Inuit. Military records refer to the value of “Eskimo” shelter and living techniques, and the DRB provided funding for scientists to study and make military kit based on Inuit clothing. Science had failed to appropriate the perceived cold-fighting biological traits of the Inuk body, but peoples indigenous to the Canadian North remained valuable to both the military and national defence.

Conclusion

When read more than fifty years following its conclusion, the acclimatization research on Inuit and white “test subjects” represents a disturbing and complex symbol of Canadian science in the Cold War. The research assumed that human testing might produce civilian as well as military applications, and ethical issues concerning the use of human subjects did not deeply penetrate the scientific or medical discourse. The studies contributed to a popular and growing area of environmental scientific inquiry and unlike the chemical and biological weapons testing that occurred in Canada during the same period, acclimatization research was not highly restricted or classified. Acclaimed scientists and doctors received support from state and academic institutions to conduct the research and publish the findings in reputable scholarly journals, illustrating the militarization of science in Canada and an increased integration between the defence

---

establishment and civilian scientists in the early postwar period.\textsuperscript{71} When the studies failed to yield practical results, Canadian science moved on and the experimental work gradually faded from relevance. Yet the survival of medical papers, unpublished reports, and defence records makes it possible to investigate the purpose of the research and contextualize the studies in the perceived scientific intent.

Records indicate that Brown and his team did not operate with the primary aim of “assisting” Inuit to “reduce” any perceived strain on the Canadian state. Although acclimatization scientists helped introduce the welfare state to the North by providing medical treatment services to Inuit, they did so while pursuing an unrelated goal. Unlike the persons responsible for carrying out the government’s extensive Inuit relocation program during the same period, intrigue in the Inuk body rather than a desire to reform Inuit health care was the primary influence for the scientists engaged in acclimatization research.\textsuperscript{72} The superficial problem of Inuit “dependency” merely opened the door to a different form of colonialism, where the biologized Inuk body could serve scientific and Cold War agendas.

The cold-acclimatized scientific perception of the Inuk body was a constructed idea. The scientists engaged in the research pursued an unattainable goal, conceived and perpetuated by racialized conceptions of peoples indigenous to the Canadian Arctic. Sources refer to the “dependency” of the “Eskimo,” but the majority of those references are outside records pertaining to cold acclimatization. Where cold-weather research is concerned, defence reports and medical publications largely avoid discussion of the “Eskimo problem.” Those engaged in

\textsuperscript{71} In the many published reports of the acclimatization research documented extensively in this article, the Canadian government goes unmentioned, save for the odd footnote that credits financial support from Grant DRB No. 80 and the Department of National Health and Welfare.

\textsuperscript{72} For an extensive and well-crafted study of postwar Inuit relocation, see Alan Rudolph Marcus, \textit{Relocating Eden: The Image and Politics of Inuit Exile in the Canadian Arctic} (Hanover and London: University Press of New England, 1995).
acclimatization research biologized Inuit in a process that advanced southern interests first and the colonized second, but the southern interests pursued a dual-purpose agenda distinct from cultural assimilation.

Unfortunately, available sources speak little of the personal convictions of each scientist engaged in the cold acclimatization research. Published medical papers describe Inuit and white human “test subjects” as material objects. Brown’s personal papers are much the same. Correspondence remains between Brown and his colleagues, but written records make seemingly no reference to interactions between researcher and subject. Brown was heavily invested in Arctic research and medical activities. He enjoyed his work and valued contributing to the Canadian medical profession through government initiatives. Brown died in 1977 and entered the Canadian Medical Hall of Fame in 2000. Remembered as a pioneer of medicine, his participation in acclimatization research should be considered as part of a wider intersection of complex circumstances and events. Brown’s personal records provide a window of clarity without match, but he was amongst others engaged in the medical treatment services and acclimatization research activities described herein. Although they are beyond the focus of this chapter, the many persons who jointly conceived, supported, and contributed to the work also deserve attention.73

Imbued with visions of dominance and superiority, cold acclimatization research in Canada ultimately provided an opportunity for science to serve multiple agendas. The research intrinsically posited the possibility of biological appropriation, contributing another disturbing layer to the colonial treatment of Indigenous peoples in Canada. The nordicity of the “Eskimo” was absolute in the eyes of the Arctic scientists, and the Inuk body became eminently well suited

73 These persons include, but are not limited to, Omond Solandt, L.P. Dugal, and Hugh Keenleyside.
to meet the needs of the Canadian defence establishment when reduced strictly to a biological function. As Brown wrote in 1954, “[because] of their performance in the cold it seemed safe to assume that [Eskimos] were acclimatized, though in the beginning uncertainty had to be admitted.”

The defence establishment endeavoured to exploit Brown’s assumption, but cold acclimatization extended beyond the control of the state. Adaptation to the cold Canadian Arctic remained elusive and, by the end of the research, a dejected Brown could only conclude, “the degree of acclimatization seen in the Eskimo is not really important for any purposes but theirs.”

While available records describe a complex set of circumstances, the perceived acclimatization of Inuit served a specific scientific pursuit. Originally conceived from a medical effort to define the biological functions of cold tolerance, acclimatization research offered the potential to serve yet unrealized military problems. The inability of the scientists to define the vascular characteristics of cold acclimatization is thus irrelevant when assessing the impact of their research. The intended pursuit of an abstract biological variation between the Inuk and white body is the imperative point. An idea conceived by medical science took on an agenda distinct and unrelated to its original purpose. Perpetuated by a calculated response to postwar anxieties, acclimatization research represents a brief but important intersection between the colonial state and defence establishment in Cold War Canada.

---

75 Ibid., 351.
Chapter 6

Changing Priorities and the Closure of Defence Research Northern Laboratory

During the 1950s, Arctic defence research in Canada changed as the government responded to the intensifying circumstances of the Cold War. With tensions running high in Europe, East-West relations had worsened in 1949 when the Soviet Union successfully detonated an atomic bomb. The outbreak of the Korean War on 25 June 1950 further exacerbated Western concerns over the aspirations of Soviet leader Joseph Stalin.¹ When the North Korean People’s Army, with support from both the Soviet Union and China, invaded the Republic of Korea, the West came to the assistance of the South Korean army. Fighting alongside the South Koreans, a multinational force led by the United States resisted the invasion from the north. As a signatory to both the United Nations Charter and the North Atlantic Treaty, Canada had committed to support multinational efforts to maintain both international and Western security.² In response to the outbreak of war in Korea, the Canadian military underwent a large-scale rearmament that had immediate and lasting consequences for the Defence Research Board.

When the Canadian military rearmed for Korea, the Department of National Defence received an influx of funds and a new agenda. DND immediately focused its resources to increase its support for Western security in Korea, Europe and North America. For the DRB, whose primary mandate was to provide scientific and technical assistance to the armed forces, this meant a heightened focus on applied research projects that could produce quick results. The

DRB sent operational research analysts to Korea to examine the fighting tactics and weapons effectiveness of the coalition forces. An international scientific presence strengthened Canada’s stature amongst allies and showed DND exactly where the DRB could continue to make an important contribution to the Western cause. As the Defence Research Board increased its focus on operational research, fundamental laboratory research declined. In the process, the DRB began to phase out Arctic research at Defence Research Northern Laboratory, and the establishment eventually closed its doors in the mid-1960s. This chapter explores these circumstances to explain the origins of the decline of Arctic defence research in Canada.

Canada’s Response to the Korean War

In January 1950, NATO formulated a plan that required each member of the alliance to make a specialized military contribution to an integrated defence structure. The plan initially called for the United States to provide strategic air power and naval forces, while the European member states would concentrate on ground forces. This plan was quickly revised with the outbreak of the war in Korea. When South Korean army ground forces proved unable to defend against invasion from the north, the United States military diverted three army divisions from Japan to support South Korea. Although surprised that the United States chose to intervene in Korea, the Canadian government was reassured by President Harry Truman’s decision to turn to the United

---

4 The initial aim of the American-led UN forces was to demonstrate to the communist forces that superiority in numbers could not overcome determined troops with first-class equipment and fighting tactics. The United States Joint Chiefs of Staff had hoped that a successful show of coalition force strength in Korea might deter communist operations in other parts of Asia. See Extract from Minutes of Meeting of Cabinet Defence Committee, “VII. Contributions to the United Nations Forces in Korea and the Integrated Force in Europe,” 20 February 1951, in *Documents on Canadian External Relations*, Volume 17, Greg Donaghy, ed., (Ottawa: Department of Foreign Affairs and International Trade, 1996), 174-177.
Nations as a means to resist communist aggression.\textsuperscript{5} Shortly after the United States diverted forces to South Korea, Canada entered into the conflict by sending naval and ground forces to bolster the multinational front.\textsuperscript{6}

The outbreak of the Korean War provoked a philosophical change toward domestic and international security policy among senior defence officials in the West. China and the Soviet Union concluded the Treaty of Friendship, Alliance and Mutual Assistance on 4 February 1950, which concerned American officials who worried about Stalin’s intentions in Asia and Europe.\textsuperscript{7}

At the time, the United States and the Soviet Union were locked in a diplomatic standoff amid military buildup in Europe. The outbreak of war in June, and Stalin’s decision to support the North Korean People’s Army, raised concerns in the West about the possibility of a general war in Europe. For the first time, the United Nations had to deal with a major military conflict involving the superpowers, and had to organize collective military aggression against the aggressors.\textsuperscript{8} In line with their Western partners, Canadian officials believed that Stalin had orchestrated events in Korea as a distraction to expose Europe to Soviet aggression. Throughout the war, the West feared possible Soviet moves in Europe. In response to the Soviet threat, NATO established large standing forces in Europe. Canada played its part by contributing forces

\textsuperscript{5} Denis Stairs, \textit{The Diplomacy of Constraint: Canada, the Korean War, and the United States Stairs} (Toronto: University of Toronto Press, 1974), 8; Bothwell, \textit{The Big Chill}, 36.

\textsuperscript{6} For details on the Canadian military experience in the Korean War, see William Johnston, \textit{A War of Patrols: Canadian Army Operations in Korea} (Vancouver: University of British Columbia Press, 2003); David J. Bercuson, \textit{Blood on the Hills: The Canadian Army in the Korean War} (Toronto: University of Toronto Press, 2002).

\textsuperscript{7} According to Shen Zhihua, the Americans misinterpreted Stalin’s intensions in Asia. Zhihua contends Stalin did not want to gain control over the Korean peninsula as he had done with Poland in Europe. In Asia, the Soviets did not see themselves as a match for the United States, so Stalin was cautious not to provoke the Americans in the Far East. As to why Stalin made the decision to support the North Korean People’s Army only four months later, Zhihua suggests Stalin calculated that the People’s Republic of China could pin down American power in Asia and reduce its pressure in Europe and the Middle East. See Shen Zhihua, \textit{Mao, Stalin and the Korean War: Trilateral Communist Relations in the 1950s} (New York: Routledge, 2012), 7-9; 34.

\textsuperscript{8} On the United Nations and Korea, see D.J. Goodspeed, \textit{The Armed Forces of Canada, 1867-1967} (Ottawa: Queen’s Printer, 1967), 243-244.
in Korea and Europe, and also undertook a buildup of forces to defend North America against a potential bomber attack.

The Canadian government announced its commitment to provide military assistance to the United Nations forces in Korea at the end of June 1950. Canada’s military contribution initially included three RCN destroyers and RCAF No. 426 Transport Squadron.\(^9\) Shortly after, early in August, Canada agreed to dispatch ground forces, in what would become the 25\(^{th}\) Canadian Infantry Brigade. The Army contribution represented the most substantial effort.\(^{10}\) A total of 26,791 Canadian military personnel served in Korea, during the combat phase of the war and in a peacekeeping role afterward.\(^{11}\) In Europe, during the fall of 1950 and the winter of 1951, Canada’s contributions to the buildup of NATO integrated forces included a RCAF air division of twelve fighter squadrons and a Canadian Infantry Brigade totalling over 12,000 military personnel.\(^{12}\)

Minister of National Defence Brooke Claxton announced a three-year $5 billion rearmament plan in February 1951 that outlined a robust buildup of the RCAF. The plan devoted funding and resources for forty regular and reserve squadrons with 3,000 aircraft, an air division in Europe, and a radar system with fighters for the continental air defence of North America.\(^{13}\) According to historian Bertram Frandsen, Korea was the catalyst for this massive expansion of


\(^{10}\) On the Canadian Army in Korea, see Herbert Fairlie Wood, *Strange Battleground: The Operations in Korea and their Effects on the Defence Policy of Canada* (Ottawa: Queen’s Printer, 1966); Johnston, *A War of Patrols*.

\(^{11}\) The last of the Canadian soldiers left Korea in 1957. During the war, 516 Canadians were killed and another 1,200 were wounded. See Alex Herd, “Korean War,” *The Canadian Encyclopedia*, accessed 26 April 2017, http://www.thecanadianencyclopedia.ca/en/article/korean-war/; Bothwell, *Alliance and Illusion*, 95.


\(^{13}\) The rearmament plan also included the establishment of extensive training organization and a strong aircraft industry to manufacture aircraft for both the RCAF and other nations; see Bothwell, *The Big Chill*, 40; Frandsen, “The Rise and Fall of Canada’s Cold War Air Force, 1948-1968,” 121.
the RCAF.\textsuperscript{14} Rearmament was an essential measure to address the escalating Cold War threat. Where once there was concern mostly for communist subversive tactics, Soviet actions in Korea now forced Western officials to consider the possibility of imminent armed aggression.\textsuperscript{15}

As the reality of the Soviet threat became clear and the possibility of general war increased, Louis St. Laurent’s Liberal government had acted to meet the demands of the challenge and the Canadian armed forces had substantively rearmed. The changes made to Canada’s defence policy and spending for the armed forces had immediate implications, regardless of whether those changes occurred in response to the increasingly tenuous international circumstances or pressure from within the NATO alliance. No matter the exact impetus, the Liberal commitment to domestic and international security came in the form of increased spending on defence.

The Korean War thus marked a turning point for defence spending in Canada. To be precise, the budget for defence increased from approximately 1.4 per cent of Canada’s gross national product in 1947 to almost 8.8 percent of GNP by the final year of the Korean War in 1952-53.\textsuperscript{16} In monetary terms, defence spending increased from a low of $196 million in 1947 to $787 million during the first year of the war, and reached $1.95 billion in 1952.\textsuperscript{17} The influx of funds not only doubled the standing forces but also made defence a centrepiece of budgetary considerations for the next decade. Defence became the single largest item on Canada’s federal budget, and remained so until priorities changed in 1964. Behind only the United States, Britain, Britain, Britain,

\begin{quote}
\textsuperscript{14} Frandsen’s work makes clear that Korea triggered the large expansion of the RCAF, which included the Air Division for Europe and the increased capability for the continental air defence of the North American homeland; see Frandsen, “The Rise and Fall of Canada’s Cold War Air Force, 1948-1968”.
\textsuperscript{16} Godefroy, In Peace Prepared, 76.
\textsuperscript{17} Robert Bothwell, Alliance and Illusion: Canada and the World, 1945-1984 (Vancouver: University of British Columbia Press, 2007), 94.
\end{quote}
and France, this financial commitment to defence made Canada the fourth largest contributor to NATO.

The Defence Research Board was an immediate beneficiary of the federal investment in defence that resulted from the Korean War. The DRB’s operating budget had increased from an initial $2.4 million in 1946-47 to approximately $6.5 million for the fiscal year 1948-49, which included $1.5 million dedicated for capital expenditures such as building and equipment.18 In the year prior to the war, the DRB’s budget amounted to 2.1 per cent of the overall budget for the Department of National Defence. The year 1950-51, however, saw a drastic increase in both the operating budget and staff of the Defence Research Board. According to the annual reports of the chairman, the total number of employees grew from 1627 to 2137.19 Scientists comprised the single largest increase employed by the DRB that year, with the number of qualified personnel growing from 242 to 352. Overall growth of the DRB levelled off in 1952, and further increased only marginally by the end of the war in 1953. Nevertheless, the response of the St. Laurent government to the events in Korea confirmed Canada’s willingness to participate alongside the United States and the United Kingdom in any future conflict. While the Defence Research Board remained important to the structure and operation of National Defence throughout much of the Cold War period, the growth in defence science experienced in Canada between 1948 and 1951 represents the height of the DRB. As Jonathan Turner suggests, the remaining years of the Defence Research Board amounted to a “fight of retention against attrition.”20

When the Korean War began in 1950, the DRB allocated approximately $25 million for defence research and science in support of the armed forces. By the final year of the war in 1952-53, the DRB’s estimated expenditure for defence projects increased to $42 million. This increase allowed for internal growth of the DRB’s research program and facilities as well as support to defence projects undertaken by other federal agencies such as the National Research Council, the Bureau of Mines, and the Department of Agriculture, and to university and industry partners. The DRB also continued its policy of directing defence resources into fields for which Canada had special facilities, capabilities, or requirements. This enabled the DRB to produce valuable results for the Canadian armed forces whilst maintaining active liaison with the United Kingdom and the United States in support of the Western security alliance. The result was a growing commitment to defence and security in the North. Ultimately, however, technological changes introduced in the 1950s affected the role and structure of research laboratories, which led to the eventual demise of the Defence Research Northern Laboratory at Fort Churchill.

**Defence and Canada-UK Relations**

While for Canada the early postwar years marked a period of clear autonomy in foreign policy from the United Kingdom and growing interdependence with the United States, imperial ties to the British Commonwealth remained important. As Robert Teigrob argues in a comparative study of Canada and the United States, “the idea that postwar Canada sloughed off its imperial bonds overlooks important evidence to the contrary.” With the Ogdensburg Agreement of

---


22 Ibid.

1940, which established the Permanent Joint Board on Defence for the bilateral defence of North America, and the Hyde Park Declaration of 1941, Canada and the United States had strengthened their economic, political, and military ties. By the end of the war, the United States had replaced the United Kingdom as Canada’s leading partner in foreign investment and trade. In 1949, ties between Canada and the United States grew even stronger when Canada played a role in the founding of NATO. Yet ties to the United Kingdom remained important within government and among the public. Indeed, Teigrob contends, English Canadian support for the Korean War derived from the recognition that the United States had set aside its anti-imperial stance and joined the United Kingdom in its civilizing mission.24

The perception of American acquiescence to the British worldview eased concerns amongst Canadians who were not prepared to support a general war under the United States. At the same time, important elements in Canada’s foreign policy developed independently of both the United States and the United Kingdom. Although the armed forces emerged from the Korean War strong and supported by a healthy defence budget, the federal government showed little desire to focus foreign policy initiatives strictly on military affairs. The need to maintain a middle power position in the Western security alliance was significant for Canadian officials who looked with some alarm at the increasing militarization of American foreign policy. In the United States, the national security acts of the late 1940s had established a new Department of Defense and institutionalized the Joint Chiefs of Staff, a body that had come into existence to coordinate the armed services and provide consolidated advice to the government during the Second World War. Those laws codified the American national security state, wherein, according to presidential historian Matthew Moten, “the answer to every diplomatic question

24 Ibid., 127-128.
came to have a significant if not dominant military component.”

For Canada, the appetite for military affairs never ran as deep. As John Holmes has observed, a *pax Americana* was not what Canadian officials had in mind at the end of the Second World War. They nonetheless recognized the dangers of international communism to world order and decided to act in support of the Western cause. All the while, according to Holmes, Canadian officials did not blindly follow the United States; rather, they operated under a clear and astute understanding of Canada’s national interests.

Even before the war in Korea escalated, Canadian officials made concerted efforts to shape elements of their foreign policy distinct from that of the United States and to create a role for Canada as an international mediator, what had come to be a key element in the concept of “middle power.” Although the Canadian government was in general agreement with the American policy to contain communism, officials in Ottawa had quite different views on aspects of its execution. The deliberations of senior officials over the nature and scale of Canadian

---


27 Historians continue to debate the nature of the Canadian-American relationship during the Korean War. In 1974, Denis Stairs argued that Canadian forces fought in Korea, under the auspices of the UN, to support collective security. This approach simultaneously constrained the extremes of American policy; see Stairs, *The Diplomacy of Constraint*; and “Canada and the Korean War Fifty Years On,” *Canadian Military History* 9, no. 3 (Summer 2000): 49-60. In 1992, historian Robert Prince challenged Stairs’ interpretation by arguing that Canada and the United States shared common goals in Korea. Prince suggested, moreover, that diplomatic concerns among Canadian officials for the maintenance of the Western security alliance hampered their ability to voice their opinions and to constrain the United States; see Robert S. Prince, “The Limits of Constraint: Canadian-American Relations and the Korean War, 1950-1951,” *Journal of Canadian Studies* 27, no. 4 (Winter 1992-1993): 129-152. Historian John Price supported Prince’s argument in 2004 by contending that Lester Pearson, then Canada’s undersecretary of state for external affairs, had presssed to strengthen Canada-United States relations during the negotiations to create the United Nations Temporary Commission on Korea in 1947; see John Price, “The ‘Cat’s Paw’: Canada and the United Nations Temporary Commission on Korea,” *The Canadian Historical Review* 85, no. 2 (2004): 297-324. Other assessments support the initial interpretation provided by Stairs. While Canadian officials were limited in their ability to influence American action in Korea, historian Timothy Sayle has argued that “Canada was prepared to use the full extent of its diplomatic capital to keep the Americans from undertaking any atomic offensive deemed unnecessary by Ottawa”; see Timothy Andrews Sayle, “A pattern of constraint: Canadian-American relations in the early Cold War,” *International Journal* 62, no. 3 (Summer 2007): 689-705; quote on p. 690. Recent studies corroborate this interpretation. Historian Ryan Touhey’s close analysis of relations between Ottawa and New Delhi
participation in the Korean War suggest that Ottawa developed reservations about the scope and direction of the American anti-communist containment strategy. Any reservations were certainly not new, however. Consider what Brooke Claxton wrote in his 1947 statement on Canadian defence policy: “The similar arrangements envisioned between Canada and the United States in no way interfere with or replace our Commonwealth connections in matters of defence training and organization.” The imperatives of Canadian geography certainly necessitated strong bilateral ties with the United States, but Claxton considered cooperation with the United Kingdom equally important.

As minister of national defence, Claxton worked hard to position the Defence Research Board as an integral component of national defence plans and policymaking. His experiences during the Second World War had made him particularly aware of the need to integrate the work of military personnel with civil servants and scientists, which was one of the reasons behind his decision to establish the National Defence College in 1951. The events of the Korean War only strengthened Claxton’s resolve for a strong and integrated program of national R&D. In an address at the opening of the Defence Research Chemical Laboratory of the DRB at Shirley Bay, Ontario on 16 October 1953, the defence minister said:

It is safe to say that never before in history have research and development assumed such preponderant importance. It is not too much to say that the forces of freedom did not go

---


Many of the research initiatives undertaken by the DRB after the Korean War reflect Claxton’s admiration for British science. Even in the North, which experienced an intense militarization to support the continental air defence efforts of Canada and the United States, scientific collaboration between researchers from the United Kingdom and the DRB remained strong. During and after the war in Korea, British and Canadian scientists continued to utilize northern Canada as a “natural laboratory” to conduct research related to the diverse military needs of the Western alliance.

**The DRB’s Response to Korea**

As the Cold War turned hot with the Korean conflict, the mandate for the Defence Research Board changed abruptly from support for fundamental to applied research. While basic research at universities remained important, the DRB turned its attention to operations research and other war-related studies that could pay immediate dividends for the armed forces. The directive from National Defence was clear: the Cold War had arrived and the DRB was responsible for active support. This meant a direct engagement in scientific and technical fields considered important to Canadian defence and security, both at home and abroad.

One of the first initiatives of the DRB was the placement of scientists in the field. Having representatives on the ground, even in small numbers, showed the DRB’s direct investment in Korea and enabled the organization to determine areas of research that would support the immediate operational needs of the armed forces. In collaboration with the Canadian Army, the

---

Defence Research Board initially sent one scientist to Korea to conduct operations research and collect information on the opinions of American Army officers. W.L. “Bill” Archer spent seven months in the Japan-Korea theatre. He spent his first five months engaged in a study of close air support, examining attack bombers of the United States Fifth Air Force when called by ground forces to strike targets within a mile or two of the front lines. He spent his final two months on assignment working with the 25th Canadian Brigade on ordnance problems. On his return to Canada, Archer produced a report—complete with photographs of his experience—on seemingly all aspects of multinational combat capability, from ground and air fighting tactics to the effectiveness of flame warfare, napalm, and heavy artillery.32

Although primarily focused on operations research with the United States Army, Archer’s impact extended beyond the direct and immediate interests of the Defence Research Board. A.R. Menzies, Head of the Canadian Liaison Mission in Japan, spoke highly of Archer in his correspondence with External Affairs:

I do believe that a useful purpose in international scientific relations has been served by sending a man of Dr. Archer’s quiet competence to a theatre such as this, to register the Canadian interest in and willingness to contribute to scientific military research programmes of the type in which he has been engaged.33

Reflecting on the co-operation between Canadian and British operational research groups in Korea, Archer suggested in a report to N.W. Morton, the Director of the DRB’s Operational Research Group, that “a tripartite operational research effort, in a theatre of operation, is well

---

32 The original report was larger than thirty-nine pages, but Appendices “B” and “C” remain classified; see LAC, RG 24, vol. 4206, file DBRS 270-180-105-1 Vol. 1, W.L. Archer, “Canadian Army Operational Research Establishment: Notes on Operational Experiences in Korea,” 21 November 1951.

worthwhile and that every opportunity for participation should be taken.”

In Archer’s opinion, the benefits of OR extended beyond Korea. “In this way,” he continued, “mutual aid in the development of operational research techniques can be achieved through the accumulation of common field experience.”

Archer’s report was not the only positive correspondence received by Morton. In June 1951, Ellis A. Johnson, the Director of the Operations Research Office at Johns Hopkins University, praised Archer in a letter to Morton. A founding member of the Operations Research Society of America, Johnson played a leading role in bringing operations research to the United States military. In his letter to Morton, Johnson spoke of Archer’s “extreme willingness” and efficient work ethic in making a material contribution to the tactical air studies of the US Air Force. He wrote the letter intent on strengthening the working relationship between his organization and the Operational Research Group of the DRB.

Following Archer’s successful field experience, the Defence Research Board committed another OR scientist to Korea. Attached to an infantry brigade of United Nations forces, George D. Kaye spent one year on assignment beginning in July 1951. While important from the perspective of international cooperation, Kaye’s departure from the Canadian Army Operational Research Establishment at the Royal Military College in Kingston created a void in Canada’s OR structure. In a letter written prior to Kaye’s departure, the vice chairman of the DRB, Emlyn

Davies, told the chief superintendent of the Suffield Experimental Station (SES) that Archer’s excellent performance in Korea had created too many “good problems” for the existing operational research capacity of the Defence Research Board.38 Suffield’s superintendent E.A. “Ted” Perren hoped that Archer might visit and brief the SES staff on his experiences in Japan and Korea, but Davies rejected Perren’s request. Evidently, with Kaye’s pending departure to Korea, the DRB lacked personnel qualified in operational research. Davies decided to retain Archer in Kingston, citing the need to train younger people for future replacements abroad. The subtle undertone of the letter indicates the DRB recognized the importance of operations research to its mandate for the armed forces and had committed to expand its capacity in the field.

While two operational researchers from the Defence Research Board hardly constitute a numerically significant contribution to the international efforts of the Western security alliance, Archer and Kaye do reflect wider governmental attitudes in Canada toward defence and security. As historian Isabel Campbell argues in her thorough analysis of the Canadian brigade first sent to Germany in 1951, the St. Laurent government showed a “willingness to engage actively in international affairs.”39 The decision to send troops overseas was extremely contentious, and Campbell cautions against the suggestion that the decision to send troops to Europe represented a complete change to Canada’s foreign policy. Continuity certainly remained important to the pragmatic policymaking process. Nonetheless, committed to NATO, Canada explored a variety of means to help resist communist totalitarian rule.

38 LAC, RG 24, vol. 4206, file DBRS 270-180-105-1 Vol. 1, E.L. Davies, Vice Chairman, Defence Research Board to Dr. E.A. Perren, Chief Superintendent, Suffield Experimental Station, 8 June 1951.
An international presence also provided an opportunity for Canada to reaffirm and strengthen its position among allies. “Canada’s officials, its policies, and the presence of its brigade in Germany,” Campbell contends, “allowed the nation to assert its right to a formal seat in key decision-making forums … Without a seat, officials received only second-hand information and had no direct means of expressing national views.” 40 In theory, acquiring a seat alongside the powers of the North Atlantic alliance also allowed representatives of the Canadian government to assert national views should international tensions escalate. The brigade in Germany was, therefore, an indirect avenue to promote Canadian priorities internationally.

It would be an overstatement to suggest that the operational research contributions of Archer and Kaye fulfilled a distinct Canadian agenda to obtain political influence in the Western security alliance. The two individuals spent limited time overseas and their work amounted to only a small portion of all operations research conducted during the Korean War. Still, their work is central to understanding changing priorities within the Canadian defence establishment. Soviet actions in Korea showed that they were prepared to fight local wars, despite risking the outbreak of a large-scale general war. Canada responded with a robust commitment to the armed forces and national R&D. “The Korean campaign [has] added active aggression to the so-called cold war,” Omond Solandt told the Manitoba Chamber of Mines during an address in Winnipeg on 20 October 1950. “We have now entered upon what some experts have called the 25% war,” he added, “[and] we must win it if we are to prevent the 100% war that we all dread.” 41 For the DRB, this meant a philosophical change to its R&D structure, marked by the shift from fundamental to applied research.

40 Ibid., 8.
There is also some evidence to suggest a direct link between operations research in Korea and the DRB’s scientific activities that took place in northern Canada. One of the more difficult problems facing United Nations forces during the Korean War was frostbite resulting from cold exposure. Indeed, the failure of the multinational forces to prepare adequately for military operations in cold regions was a defining feature of the wartime experience in Korea. While Canada and the United States had conducted cold-weather training and simulated operations prior to the war, the soldier experience in Korea made clear the many problems associated with military operations in cold regions. After the war, the US Air Force increased its capacity for cold-weather science at the Arctic Aeromedical Laboratory in Alaska. Research specialists from disciplines including biology, civil and materials engineering, geophysics, and physiology and psychology traveled to Alaska to devise cold-weather solutions for the military. In Canada, military training in cold conditions continued at Fort Churchill and scientists with the Defence Research Northern Laboratory increasingly participated as field observers to learn first-hand about the effects of cold on the physical and mental conditions of the soldier. As shown in the 1954 National Film Board production *Vigil in the North*, Canadian soldiers training at Fort Churchill had to overcome the enemies of “fear and fatigue”—the initial response to the Arctic environment. DRNL scientists studied the human body under military duress to help inure soldiers to the rigors of the Canadian North. Yet, while northern military research remained important on the ground, in Ottawa, the Defence Research Board had increasingly turned its attention to the air.

---

Continental Air Defence and Atomic Warfare

Two of the more notable research areas for the Defence Research Board were continental air defence and atomic warfare. Solandt created the Operational Research Group within the DRB in 1949 and the year after recruited George Lindsey to join a small OR team in support of the RCAF. Lindsey was a friend and former wartime colleague of Solandt; the two met during the Second World War while conducting operations research for the British Army. When Solandt recruited Lindsey to work in OR for the DRB, strategic concerns in Canada centred on continental air defence against Soviet long-range nuclear-carrying bombers. Lindsey quickly became an important asset to the Canadian defence establishment. As a key member of joint Canada-United States negotiations on continental air defence, he worked with Harold Larnder, the originator of the term “operational research,” on the development of a semi-automated radar defence system commonly known as the McGill Fence.44

For the Defence Research Board, contributions to the development and implementation of radar represented an important achievement. The DRB year-end roundup for 1953, released to the press through the directorate of public relations for National Defence, noted the “outstanding accomplishment of the Defence Research Board made public during 1953 was the development of an early warning device designed to supplement radar chains in the Canadian north.”45 Directed by the DRB with the assistance of the Eaton Electronics Research Laboratory of McGill University and the National Research Council, the project tested experimental equipment manufactured by the RCA Victor Company of Montréal. Summer trials confirmed the value of

the device as a warning system, and all reports suggested that manufacturing the device in Canada was economical.

The 1953 investigations were a continuation of earlier DRB research into radar equipment. Early in 1951, G.A. Woonton of McGill University, operating under contract by the DRB, discussed the use of a doppler detection system with American officials in Washington. The so-called McGill Fence was an electronic early warning line meant to detect any penetration of Canadian territory by hostile aircraft. The DRB initiated the project under the direction of G.S. Field, while electronics scientist L. Guy Eon assumed coordination responsibilities. Most of the research and work conducted on the McGill Fence occurred at the Electronics Research Laboratory, which the DRB helped establish through its extramural program. In fact, DRB grants totalling $55,000 provided all of the initial scientific equipment and materials required to open the laboratory.46 The success of the project led the RCAF to study the logistics and construction implications of a line of radar stations along the fifty-fifth parallel. Financed by the DRB, the project resulted in the construction of the Mid Canada Line, joining the Pinetree Line and later the DEW Line to form the North American continental radar defence network.

George Lindsey’s most significant contribution to the development of North American air defence occurred in the strategic assessment and planning phase for the Mid Canada Line. During the summer of 1952, a joint Canada-United States study group consisting of scientific defence analysts gathered at the Lincoln Laboratory in Cambridge, Massachusetts to consider the placement of radar in Canada.47 Lindsey and John Foster of McGill University were the only two Canadians to participate in the study. Comprised mainly of scientific defence analysts, the forty-

46 Captain D.J. Goodspeed, A History of the Defence Research Board of Canada (Ottawa: Queen’s Printer, 1958), 201.
five member group estimated the potential impact of a Soviet nuclear strike on North America and determined that significant improvements in continental air defences required increased early warning. From this conclusion, the Lincoln Summer Study Group made recommendations that helped provide a foundation for the initial framework of the North American Air Defence Command agreement, which both countries ratified in 1958.\(^\text{48}\) In the formative days of NORAD, officials in Washington considered continental air defence to be the first and last line of defence against a potential Soviet attack on North America. In spite of its much smaller forces, Canada was anxious to be an equal partner with the United States in continental defence. In operational research, brains counted as much as brawn, and the field represented an area where the defence establishment in Ottawa could wield considerable influence in Washington.

Lindsey was particularly effective as a Canadian voice against the American determination to place radar stations in southern Canada.\(^\text{49}\) He articulated clearly that Canadian security interests were distinct from those of the United States. His most significant contribution to the debate of 1952 was a report that examined the implications to Canada of the proposed North American air defence system, in which he emphasized the strategic issues of Canadian geography. In the event of a Soviet air attack, the orientation of an air defence network would determine the pattern of any resulting devastation. To avoid substantial destruction near highly populated Canadian areas, Lindsey recommended that construction of radar lines take place


farther north than had originally been proposed by the Americans. Lindsey was firm on this stance. According to one report from the Defence Research Board, he injected a strong “sense of reality into the assessment of the capabilities of highly mechanized equipment” for Canada’s contribution to continental air defence, and “without his work Canada would almost certainly have been drawn into participation in a more complex, expensive, and less effective air defence system.”

The involvement of the Defence Research Board in continental air defence initiatives extended beyond strategic and technical assistance with radar. Prior to the Second World War, the aeronautical laboratories of the National Research Council conducted the majority of aviation research undertaken in Canada. As the aviation industry expanded after the war, defence officials in Ottawa realized that the existing aviation infrastructure of the NRC was incapable of meeting the high demand for Canadian-built military aircraft. In January 1951, the federal government responded by creating the National Aeronautical Establishment and establishing a formal committee to direct aviation policy in Canada. The committee included the president of the NRC, the chairman of the DRB, the Chief of the Air Staff, and the chairman of the Air Transport Board. The National Research Council maintained operational responsibilities for the research and development facilities of the NAE, which consisted of the former Ottawa Aeronautical Laboratories and the Arnprior Flight Research Section of the NRC.

The creation of the NAE sparked a concerted interest in Canadian aviation, and a number of NRC divisions became actively involved in defence research projects. Employees with the Radio and Electrical Engineering Division, for instance, became vital to research and

development projects for the Canadian radar program carried out by the DRB. The pattern of outsourcing defence research within government often mirrored methods used by the Defence Research Board when outsourcing to industry. While the DRB exercised general coordination and financial supervision over the research and development programs of the armed forces, it did not have full control in each case. According to DRB records, the placement of military R&D projects with other government agencies and in industry was often the responsibility of the three services.\(^{52}\) Indeed, major projects such as the development of the CF-100 fighter and the Orenda engine began before the DRB assumed control over research and development for the armed forces. Nevertheless, officials with the Defence Research Board wielded considerable influence on the direction and scope of military R&D in Canada. In addition to work on fighter aircraft and radar, the DRB’s Arctic projects also included, amongst other initiatives, development of over-snow vehicles and a synthetic rubber for use under low temperatures in high latitude environments.

Atomic warfare was another field in which the Defence Research Board became actively involved. Intelligence reports on Soviet technology increased in regularity during and after the Korean War, and the DRB responded by furthering its commitment to weapons research. In a 1954-55 fiscal report prepared for the Privy Council, the DRB confirmed its willingness to support the joint continental air defence efforts of Canada and the United States in an official research capacity.\(^{53}\) The report was a direct response to the increasing atomic threat, and suggested the DRB was in an ideal position to provide strategic analysts and research teams to study the position of radar and develop the related communications systems to improve early

\(^{52}\) Ibid., 19.

warning systems. Expert scientific advice was particularly relevant to the RCAF, which required assistance to facilitate the transition from research and development to production and use. The fiscal report also confirmed the DRB’s official stance on atomic research at home: “It is felt that all agencies concerned with the defence of Canada should give top priority to improving Canada’s capabilities in the field of atomic warfare.” The report noted the special contribution of the DRB in fields directly related to the armed forces, including protection of Canada against atomic attack and the indoctrination of troops in actual conduct of atomic warfare. In particular, the DRB proposed to initiate a program for “the production of atomic power for industry which could also lead to the provision of atomic weapons for the Canadian Services should the need arise.” The DRB based its proposal on the results of a preliminary study that indicated the urgent need in Canada for a sophisticated atomic research program. With deep research ties to industry and other government agencies, officials with the DRB considered the organization ideally positioned to facilitate applied research at the fore of Canada’s national atomic effort.

Concerns over Cold War weaponry were not confined to the atomic sphere, however. As historian of science Donald Avery has shown, the outbreak of the Korean War produced an intensified interest in Canada’s biological warfare program. In response, the Defence Research Board sought the professional expertise of Guliford Reed, a prominent bacteriologist from Queen’s University. The DRB asked Reed to provide a detailed update of the major scientific and technical developments that had occurred in the field of bio-warfare. Based on open and unclassified sources, Reed concluded that Canadian biodefence measures were insufficient to

---

56 Ibid.
meet the challenge of a potential Soviet biological weapons attack. He recommended the DRB increase its efforts in the field and encourage the training of specialists to develop Canada’s capacity to detect and immunize against biological agents. In April 1953, the DRB appointed Reed as the full-time superintendent of the newly established Defence Research Kingston Laboratory (DRKL). Operating in response to anxieties over the perceived Soviet threat, the establishment of DRKL reflects the diverse and evolving research agenda of the Defence Research Board.

The International Geophysical Year

Although the advent of intermediate and intercontinental range ballistic missiles shaped the trajectory of defence in Canada and the United States, Canadian officials remained committed to the Commonwealth effort. In February 1956, the Defence Research Board hosted the Commonwealth Advisory Committee on Defence Science.\textsuperscript{57} Scientists from throughout the British Commonwealth gathered in Ottawa, Toronto and Fort Churchill to discuss collaboration in the application of science to military affairs. One of the important agenda items was long-distance radio communication. Geographically situated at an area of maximum aurora activity, Fort Churchill provided an ideal location for scientific study of magnetism and the upper atmosphere. The North Magnetic Pole was an occasional source of interference for ground navigation and radio communication equipment operated by military personnel while on winter training exercises, so the DRB invested heavily in communications research to find scientific solutions and to improve transmissions technologies. The Radio Physics Laboratory, one of two research units that comprised the Defence Research Telecommunications Establishment (DRTE)

at Ottawa, developed a technique to transmit messages over long distances by reflecting radio signals off tiny meteors at approximately sixty miles above the surface of the Earth. Despite the atmospheric issues known to affect regular methods for telecommunications, a team of DRTE scientists led by Peter Forsyth developed a technique called JANET that reportedly enabled the successful transmission of radio signals up to a distance of one thousand miles.58

In another area of research related to communications, scientists from the DRB and Cambridge University worked closely with associates and technical officers of the United Kingdom Ministry of Supply and the Royal Air Force on methods to improve aircraft signals. A team of research scientists from Cambridge had developed a system called Single Side Band, which enabled pilots operating high-speed aircraft to maintain reliable voice contact with a central control point over long distances ranging beyond one thousand miles.59 Researchers with the DRB assisted successful trials of the system on flights travelling between the United Kingdom, Ottawa and Vancouver with the DRB’s Shirley Bay site near Ottawa acting as a transmitter and receiving station.

British scientists were particularly keen to collaborate with Canadian colleagues as part of a large-scale contribution to the research activities of the International Geophysical Year (IGY) of 1957-58. The IGY was a celebration of global science that focused on the necessity of international co-operation in fields such as meteorology, oceanography, and studies of the upper atmosphere. Events ran between June 1957 and December 1958, and included participants from over sixty countries whose areas of research covered a range of environmental sciences. The global impetus behind the IGY was non-military, but governmental military research

58 Ibid.
organizations such as the Defence Research Board provided the personnel and funds required to plan, construct and operate much of the scientific and mechanical infrastructure that emerged from the IGY celebrations.\textsuperscript{60} Accordingly, historians of science point to the IGY to show the consequences of high technology and militarization during the Cold War.

As a new target for both geographic knowledge and military defence strategy, the North became a region entangled with developments in the geophysical sciences during the late 1950s. Ronald Doel’s research has shown that the American military sought the assistance of polar scientists whose expertise and international networks could benefit high-level discussions about the relationship of science and foreign policy.\textsuperscript{61} It is within this context that Richard Powell has analyzed the Canadian experience with the International Geophysical Year. Considering the emergence of new technologies such as intercontinental ballistic missiles and nuclear-powered submarines in relation to the Polar Continental Shelf Project, Powell argues the federal government attempted to “mobilize a pan-Canadian nationalism in response to perceived American and Soviet incursions upon territorial sovereignty during the IGY.”\textsuperscript{62} Powell’s argument illustrates tensions present in Canada during the IGY, especially between idealized notions of scientific globalism and strategic considerations for continental defence and territorial sovereignty.


While the launch of *Sputnik 1* and *Sputnik 2* in October and November of 1957 exacerbated Western concerns about the potential danger of the Soviet missile threat, the competitive tensions of the period were not limited to the superpowers. The International Geophysical Year brought widespread attention to scientific competition amongst middle powers, as is evidenced when considering Canada’s involvement. In fact, the Canadian research contribution to the IGY involved various studies conducted at seventy-six establishments. These research sites included twenty-six in the Canadian North, and each made significant contributions towards scientific knowledge of atmospheric physics, glacial ice, and magnetic interference in northern telecommunications. Notable amongst the Canadian activities and initiatives for the IGY was “Operation Hazen,” conducted by scientists of the Defence Research Board on northern Ellesmere Island. Researchers carried out glaciological and meteorological studies at the base of Lake Hazen as a supplement for wider studies into Arctic geology and archeology. In total, according to Trevor Harwood of the Defence Research Board, Canada’s research contribution to the IGY was proportionally larger than that of the United States and the Soviet Union. Yet the influence of the IGY on scientific practices in Canada remain largely ignored by historians.

In addition to its own scientific initiatives conducted in the Canadian North, the Defence Research Board became heavily involved in monitoring and tracking the scientific activities of the Soviet Union. When the Soviets launched *Sputnik 1*, a group of scientists at the Canadian

---

66 Ibid.
Radio Physics Laboratory undertook immediate development of equipment to track satellites.\textsuperscript{67} This resulted in Canada becoming one of the first countries to report accurately the orbital track of the artificial satellite, a fact that held value for senior officials in Ottawa who wanted to demonstrate Canadian technological capabilities at the onset of the Cold War space race. During the IGY, the DRB also hosted a series of rocket launches at Fort Churchill. Initiated through a bilateral cooperation program with the United States, the launches tested Canadian instrumentation on one Nike-Cajun rocket launched by a team of American scientists, and combined rocket/balloon (rockoon) instrument packages.\textsuperscript{68} Research teams also utilized the Fort Churchill site to launch sounding rockets and conduct earth-based observations in various scientific disciplines.

Canada’s active participation in the IGY was possible largely because of the resources made available for science through the Defence Research Board. Indeed, a substantial number of qualified scientists existed in Canada prior to and throughout the IGY. Scientists with the Defence Research Telecommunications Establishment participated in numerous specialized activities in addition to the rocket and satellites program at Fort Churchill, some of which furthered the international space efforts of the Western alliance. In 1958, for instance, Canada earned an appointment to the initial United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) and has served continually since.\textsuperscript{69} Furthermore, after the United States launched \textit{Explorer 1} in January 1958, Canada proposed the creation of a novel satellite with advanced transmitter/receiver technology. NASA accepted the proposal in early 1959 and \textit{Alouette 1} later launched successfully from Vandenberg Air Force Base near Lompoc, California.

\textsuperscript{67} Doyle and Skog, eds., \textit{The International Geophysical Year}, 33.
\textsuperscript{68} Ibid.
\textsuperscript{69} Ibid.
on 29 September 1962. The launch was a significant moment in Canada’s Cold War history. By demonstrating advanced technical capabilities then matched only by the superpowers, Canadian science surpassed all other Western nations except the United States.\footnote{For full details on Canada’s military space program, see Andrew B. Godefroy, \textit{Defence and Discovery: Canada’s Military Space Program, 1945-74} (Vancouver: University of British Columbia Press, 2011); information on the Alouette program is covered in Chapter 4, pp. 95-120.}

**The Demise of DRNL**

Following the IGY, Canada continued to pursue scientific work related to radio technology, the aura borealis, and satellite development. In 1959, Canadian scientists at the Fort Churchill rocket range conducted the first flight of a Black Brant rocket. Thereafter, rockets became increasingly important to the continued exploration of the constantly changing upper atmosphere. Rocketry research of this nature had civilian and military applications. Research into atmospheric magnetism and radio telecommunications was particularly significant for the air defence of Arctic North America, and the change in emphasis for DRB research put the future of the Defence Research Northern Laboratory in question.

As is perhaps evidenced by the various research activities undertaken by scientists of the Defence Research Board at the Fort Churchill rocket site, the scope and extent of Arctic research changed for the DRB during the mid to late 1950s. The DRB hosted more than 250 scientists from fifteen NATO nations in June 1955, when the Fifth General Assembly of the Advisory Group on Aeronautical Research and Development (AGARD) to NATO convened at the Chateau Laurier Hotel in Ottawa.\footnote{Defence Research Board Newsletter 1, no. 6 (June 1955).} Ralph Campney, Canada’s minister of national defence, hosted the delegates along with the Canadian AGARD council member J.J. Green. Shortly thereafter, sweeping changes occurred to the Arctic research activities of the DRB. The Arctic
Section of the Defence Research Board ceased to exist November 1955, when its duties and responsibilities transferred to the directorates of physical and engineering research. Within the Directorate of Physical Research, the DRB created a Geophysical Section to continue many of the duties of the disbanded Arctic Section. Trevor Harwood headed the new section, while Moira Dunbar and J.P. Croal joined his staff in a supporting role. Their research focused on fields such as geology, glaciology, ice physics and forecasting, oceanography, hydrography, meteorology and navigation. The remaining Arctic activities went to the mechanical and civil engineering sections of the Directorate of Engineering Research. Both sections focused on research and development in their fields of engineering. Mechanical assumed work on engines, vehicles, materials, fuels and lubricants, and civil on snow, ice, soil and permafrost, and survey and air photograph interpretation.

Although the Defence Research Board designated Arctic research away from a central overseeing body, officials still considered DRNL important to Canada’s defence structure in the North. Hartley Zimmerman assumed the chairmanship of the DRB from Omond Solandt in March 1956, and shortly thereafter the new chairman arranged an airborne tour of the Canadian North. The tour group consisted of officials from the United States and the United Kingdom, and the trip included flights over Canada’s northernmost islands, tours of the Mid-Canada and DEW Line radar sites, and visits to Fort Churchill and the RCAF station at Cold Lake, Alberta. Zimmerman also travelled overseas to witness joint British-Australian atomic weapons tests, and he worked diligently to maintain the close ties between Canadian and Commonwealth science organizations first established under Solandt’s leadership. He spent eleven years as chairman and

---

72 Defence Research Board Newsletter 1, no. 11 (November 1955).
73 The total trip covered nearly ten thousand miles of flight over sub-Arctic tundra, Arctic islands, and parts of Greenland. For a full and detailed record of the trip, see Defence Research Board Newsletter 2, no. 5 (May 1956).
saw through to fruition many research and development projects initiated under Solandt, including variable depth sonar for naval security in the Arctic Ocean and the integration of Canada’s rocket and satellite programs within the defence structure of the Western security alliance.\footnote{Information Canada, \textit{Defence Research Board}, 17.}

The Defence Research Northern Laboratory remained active during the transition from Solandt to Zimmerman. February 1956 was a particularly eventful month, as the staff at DRNL hosted government officials and scientists during the Fort Churchill sessions of the Commonwealth Advisory Committee on Defence Science.\footnote{Defence Research Board Newsletter 2, no. 3 (March, 1956).} Representatives from DRNL and other government agencies tied to the Defence Research Board presented research papers on topics pertaining to Arctic military problems, and the delegates in attendance toured the DRNL facilities to learn about the shift towards operations research at Fort Churchill. DRNL also hosted members of the Joint Intelligence Bureau that month. Headed by Ivor Bowen, the director of JIB, the group held sessions in the DRNL conference room before touring the Fort Churchill base and spending one day on the open tundra learning about northern defence.

The mid-1950s marked a culmination for Arctic research carried out on the ground in northern Manitoba. During 1955-56, the Canadian army assigned a full time test team to DRNL.\footnote{Ibid.} The commitment marked a milestone in research progress for the laboratory, because the test team served as “human subjects” for field and laboratory trials both for summer and winter tests. Records from the Defence Research Board claim the presence of the test team exemplified military cooperation and interest in the DRB’s Arctic program, despite the existing tensions between DRB scientists and military personnel (documented in Chapter 4).\footnote{Ibid.}
Nevertheless, the full time presence of the army test team enabled a marked increase in field research and laboratory studies at DRNL. The DRB considered this an extremely valuable contribution to defence science in Canada.

As the nature and scope of research and development activities changed for Defence Research Northern Laboratory, work at the Fort Churchill establishment was slowly phased out. DRNL scientists remained actively involved in Arctic research activities, however. As operations research received added interest after the Korean War, scientists from Churchill occasionally travelled to participate in Arctic research conducted farther north in Canada or in Greenland. Such was the case of D.I. Ross, an OR scientist for DRNL, who attended a United States army exercise held at Thule on Greenland. Exercise “Arctic Night” occurred in March 1956 and involved a battalion combat team in an airborne assault. Ross represented Canada on the exercise, and he briefed scientists and officials from DRNL, the Canadian army, and the air force on his return to Fort Churchill. Work at the Defence Research Northern Laboratory continued for the next decade, but during the early 1960s the facility increasingly became a transitory stop rather than a permanent location for laboratory work. The location closed its doors on 29 June 1965.\textsuperscript{78} The DRB continued to fund research into Arctic studies, but DRNL ceased to exist because scientists had fulfilled the requirements of the initial research agenda and the demands of National Defence no longer called for a permanent research establishment in the North.

\textbf{Conclusion}

Rearmament for the Korean War had immediate and lasting consequences for the Defence Research Board. The threat of Soviet aggression to international order translated Canada’s long-

term plans for defence and security into short-terms plans, which subsequently expanded the research and development program of the DRB while reducing the allotted completion time for both current and future projects. During the formative years of the DRB, the armed forces focused on postwar reorganization and showed little need for instant scientific advice. Accordingly, the DRB concentrated on establishing a strong internal research and development organization. Korea changed this approach to defence research. As the services actively rearmed and entered the conflict in support of the UN coalition forces, the DRB increased its capacity for operational research, reorganized and strengthened the exchange of scientific information for the services, and increased the size and activity of its scientific staff in Ottawa.

The Defence Research Board was only one government agency affected by the changes to Canada’s national defence effort. Indeed, the number of scientists working on defence research in other agencies also increased to meet the demands of Canadian defence. When scientists from other agencies began to devote the whole or part of their time to providing direct assistance to the armed forces, as project officers on development programs or as scientific and technical advisers on research problems, the DRB assumed more responsibility as scientific advisor to Canada’s national defence effort. The unique advisory function of the DRB came at a cost, however. In the United States and the United Kingdom, defence research organization operated as two relatively distinct but complete programs that were capable of covering nearly all of the military R&D needs of their respective armed forces. Military forces in both countries received scientific advice and assistance as a by-product of research. In contrast, Canada’s

79 LAC, RG 24, vol. 2425, file Speeches - Reporting etc 1947 - March 1953 Volume 1, Edmond Cloutier, Canada’s Defence Programme 1951-52 (Ottawa: Printer to the King’s most Excellent Majesty Controllers of Stationery, 1951), 5.
81 Ibid., 17-18.
limited research program did not allow the DRB to cover all of the needs of the Canadian armed forces. For this reason, the initial mandate of the DRB was dual-purpose: the organization as a whole concentrated on research where Canada could make a unique or special contribution and simultaneously ensured the armed forces had ready access to the best scientific knowledge from other countries.

When national priorities for defence changed in response to the events in Korea, the dual-purpose mandate of the Defence Research Board was fundamentally challenged. The DRB was unable to increase its capacity as scientific advisor while maintaining an active and growing commitment to laboratory research. Unfortunately, for staff at facilities such as the Defence Research Northern Laboratory in Fort Churchill, fieldwork and laboratory research drew the short straw. The economic and political circumstances of the period were too much to overcome, and the DRB began to transition towards efficient research and development projects required to serve the immediate needs of the armed forces. While northern defence remained a high priority item, technological advancements of the 1950s altered the strategic threat to Canada and the R&D program of the DRB evolved to meet the challenge. Canada’s commitment to European security and international order also created new difficulties for the DRB to overcome. Given the available information on the role and structure of research to Canada’s national defence efforts during the late 1950s and early 1960s, it seems safe to conclude that the gradual phase out of DRNL was a mere by-product of extenuating circumstances. We must also consider general cuts to Canada’s federal budget when assessing the circumstances that led to the closure of DRNL. In 1962, the Diefenbaker government adopted austerity measures designed to address Canada’s worsening economic situation. The measures reduced federal spending, increased tariffs on
imports, and enabled the government to obtain large financial loans from foreign banks. Money for defence, which had accounted for the largest portion of the federal budget, began to decline in 1964. As the budget for defence declined, the DRB could no longer afford the costs associated with maintaining an effective research program in the North. The extenuating circumstances around the closure of Defence Research Northern Laboratory say more about the reaction of government officials to the Cold War, and the reality of budgetary constraints, than they do about the internal priorities of the DRB. In other words, the Defence Research Board moved away from laboratory research in the North as part of a wider effort to maintain relevance within the Canadian defence and military establishment.

---

82 For a detailed historical account of Canadian economy in this period, see Bruce Muirhead, *Dancing Around the Elephant: Creating a Prosperous Canada in an Era of American Dominance, 1957-1973* (Toronto: University of Toronto Press, 2007).
Conclusion

Canada’s historical scholarship lags behind in both rate of production and volume of work addressing science and its relation to the state during the Cold War. Widely considered a middle power in the multifaceted struggle that shaped world affairs during the second half of the twentieth century, scholars have paid scant attention to the scientific and technical aspects of Canada’s Cold War experience. Only recently have historians begun to pull back the layers of Canadian science and Cold War defence, as evidenced by studies about the complex and understudied history of the Defence Research Board.¹ Yet, while the current body of scholarship on the DRB covers the institutional history of the government agency, the intricacies of the topic deserve wider attention.

We now have the sources required to delve deeper into the consequences of Canada’s material and monetary investment in defence-related science. Insights from institutional histories of the Defence Research Board provide a strong foundation for studies of applied science in Cold War Canada, which means exploring, for the first time, the boundaries between politics, scientific inquiry and defence research. Did Canada feel the need to keep up with or ahead of the Soviet Union? If such a need existed, did it provide the catalyst for political, institutional, financial and moral support for defence science? What layers existed between civilian and military scientific activities? What impact did defence science have on the wider public? Such questions have sparked a wealth of international scholarship on the militarization of the social

---

and physical sciences.² It seems pertinent to suggest that scholars of Cold War Canada explore similar themes while also posing new questions to challenge dominant interpretative frameworks and extend our investigative reach.

One of the more exciting trends to have captured the attention of international scholars engaged in the exploration of the Cold War sciences is environmental history and historical geography. Investigating the application of science in the “field” as an extension of the conception of science in government has brought focus to earthly contexts that remained unexamined for many years. As J.R. McNeill and Corinna Unger note in a novel collection of environmental histories of the Cold War, the period “enlarged the human experience of the biosphere by encouraging research and explorations in previously neglected nooks and crannies, such as the polar regions, the ocean floors, and the upper atmosphere.”³ Canada may not have endeavored to intervene in the workings of the biosphere, but the federal government did support and encourage a wide range of environmental scientific research.⁴

Concurrently, the history of postwar defence research in the Canadian North serves as a warning against definitive statements about the impact of the Cold War in Canada. Whether social or environmental, the consequences of Cold War military science resulted from multiple and complex factors that resist generalization. Indeed, as Polar historian Adrian Howkins

explains, “the history of the Cold War reveals that the nature of the environment alone does not determine political or military histories.” 5 That the Arctic became an unparalleled battleground of Cold War activity resulted only in part because of its geography and perceptions of its harsh, barren and scientifically challenging environment.

Reconnaissance of the Cold War Canadian North need not be restricted to military topics. Although the “systematic consolidation of nature as a military entity” certainly took place in Canada, as evidenced by the northern scientific activities of the Defence Research Board, government-supported science also sought solutions to non-military and non-strategic problems. 6 If we are to accept Joy Parr’s process of “corporeal embodiment,” then all human interactions with sciences and technologies are inherently environmental. 7 Where Canada’s experience with defence research is concerned, that the science occurred in the Cold War does not mean that it was Cold War science. The research activities of the DRB deserve attention on par with wider perceptions of civil-state relations and science in the postwar years. We must also keep in mind that Arctic research served to advance the individual professional careers of participating scientists, engineers and doctors while also meeting the needs of bureaucrats and officials in the Canadian defence and military establishment. Researchers received financial support, published findings and took up both academic and government positions, while in turn, the federal government learned much about the Canadian North and postwar modernization. While the complexities of defence research are often difficult to discern, the integration of military,

---

6 To read more about the militarization of Canada in the Cold War, see P. Whitney Lackenbauer and Matthew Farish, “The Cold War on Canadian Soil: Militarizing a Northern Environment,” Environmental History 12, no. 4, Special Issue on Canada (2007): 920-950.
industrial and academic institutions provides important lessons for understanding the residual consequences of the Cold War in Canada.

The scientific and technical activities of the Defence Research Board are particularly useful for learning about the complex interplay between state and scientific authorities, and the federal solutions to the unique issues resulting from the Cold War circumstances facing the Canadian security state. Highly acclaimed scientists from a number of academic institutions in Canada, the United Kingdom, and the United States received monetary assistance to travel to northern Canada and investigate such problems as cold-weather survival, movement of sea ice, over snow travel, and the impact of magnetism on technical communications and equipment. The stated aim of this research was the development of methods and techniques to reduce and overcome impediments to military personnel and equipment operating in the harsh environment of the Canadian North, but the agenda behind government science in the North was much more complex.

During the Second World War, military officials with the Canadian government realized the need to involve scientists and engineers in preparations for postwar national defence. The rapid pace of scientific and technological change demanded a concerted response from the Canadian defence establishment, or so was the belief of the senior officials who championed the apparent necessity to involve scientists in policymaking for the North. A strong belief in the power and authority of science (and personal connections) meant that Omond Solandt received autonomy and political influence as the founding chairman of the Defence Research Board. In his position, Solandt was a member of the Cabinet Defence Committee and made key decisions that outlined the role and structure of the agency under his direction. He trained as a civilian in medicine but once in government used his position to advance science on the federal agenda.
Indeed, Solandt was a pioneer of Canadian science and he made important contributions that strengthened Canada’s international position among research partners in the Western security alliance. His efforts also developed working relations among government, industrial, and academic scientists and their institutions. He helped convince the federal government to fund science, which proved beneficial to practitioners in and outside government. Yet the circumstances and structures that enabled Solandt to further science in Canada also created the conditions for the unintended consequences of defence research documented here.

It would be disingenuous and trivial to suggest that science alone deserves blame for the consequences of Cold War defence research in Canada. The scientist, broadly speaking, represented one voice and one position among varying interests. Multiple actors, including both government officials and state-sponsored civilian scientists, made important decisions in response to the difficult (and at times advantageous) circumstances of the period. This dissertation has attempted to explore and explain, rather than blame or condone, the persons and actions described. Nevertheless, important lessons stem from the critical appraisal of the Cold War sciences. A select group of scientists in postwar Canada received enough position, power and resources to negotiate, design, implement and oversee self-serving research initiatives. The sweeping changes introduced to government because of the Glassco Commission stemmed from a critical review process that identified scientific management structures as flawed. Despite the establishment and growth of a largely successful defence research program, business and public administration models prevailed.

The demise of the Defence Research Board began prior to the Glassco Commission, however. As the science-state relationship developed over the course of the early Cold War, the DRB responded to changes in the organization and operation of the broader Canadian defence
establishment. Whereas the period between the late 1940s and early 1950s marked the largest expansion of scientific and technical research in Canadian history, this growth stopped after the Korean War and the federal defence budget entered a period of decline. The perceived value of science to defence remained, but shifting priorities concerning the role of Canada internationally pushed the DRB from support for fundamental to applied research. The strategic significance of the North also shifted in considerations of Canadian defence. Scholarship on the postwar North illustrates the open and dynamic contexts of space, where constructed identities of place transform within wider networks of social relations and knowledge exchange.\(^8\) The many identities of the North as both a social and physical place are present in the documentary record of the Defence Research Board. Both imaginatively and materially, the DRB envisioned and created a northern space in the name of science and military necessity. This history helps to explain the power of ideas in shaping and perpetuating the Cold War.

Where the Defence Research Board and northern science in the early postwar period is concerned, ideas of progress and dominance outpaced the creation of adequate and objective administrative oversight structures. Knowledge production held value to a Canadian defence establishment in search of solutions to military, political and economic problems. In an atmosphere of high anxiety, the potential benefits of science outweighed significantly the dangers of inactivity.

The consequences of the circumstances, attitudes, and decisions that contributed to the creation and growth of defence research deserve our full attention. While additional research is required to elucidate the deep consequences of postwar defence research in Canada, this is a field

critical to both Canadian history and the history of the Cold War sciences. Canadian defence research in the North offers particularly useful insights for considering Canada’s international relations during the early Cold War. Although the Defence Research Northern Laboratory was a relatively small facility, the Fort Churchill base supported a diverse and extensive scientific research program between 1947 and 1965 that attracted military representatives, high-ranking politicians, and senior security officials from the North Atlantic Alliance. In the face of increasing scientific activity on the Soviet side of the Pole, the United States and the United Kingdom were particularly interested in furthering Western science in the North as a preparatory measure. Churchill’s geography made it an ideal location for northern scientific and technological research in both summer and winter conditions, and the Canadian defence establishment used the full extent of its diplomatic capital to benefit from providing in Churchill an essential and unique resource to the Western security alliance. The base at Churchill also served as an access point to more remote northern locations, and gave the federal government a tangible geostrategic asset to leverage Canada’s sovereignty and security interests in the Arctic.

The history covered in this dissertation is also valuable to modern considerations in the development of policy for science, security, and defence in the North. As climate change and environmental degradation provide increasing access to the Arctic, and competition for northern resources grows among government and non-state actors, Canada will need to develop new policies to protect northern residents and Canadian interests in the Arctic. During the period examined here, policymaking for the North was too limited. Although the federal government utilized a whole-of-government approach in the North, the development of Canada’s postwar Arctic defence policy empowered scientists and senior officials to impose their will on a range of policies that had unintended consequences for military personnel and civilians exposed to
scientific defence research. Effective policymaking requires open and collaborative dialogue among government and civilian representatives. This lesson becomes poignantly clear when we examine the history of Canadian defence research in the North during the early Cold War.
Appendix A


Figure A.F2: Types of Arctic clothing tested during Sun Dog One (left to right: American, Canadian X50, camp issue, British); (LAC, RG 24, vol. 2484, file HQS-726-40-39-7, Brief on Exercise “Sun Dog One,” 25 February 1950).
Figure A.F3: Defensive position during indoctrination training on exercise Sun Dog One. (LAC, RG 24, vol. 4206, file 270-0-89-6, Winter Exercise “Sun Dog One”).

Figure A.F4: V-test apparatus for Mackworth’s tactile discrimination test. (Mackworth, “Finger Numbness in Very Cold Winds,” 534).
Figure A.F5: The V-test as pictured at Fort Churchill. The “test subject” indicates when he first feels the two edges as one, the width of the gap becoming the discrimination score to be charted on the “numbness index.” (LAC, RG 85, vol. 299, file 1009-2[5], M.F. Coffey, “Results of a Test for Changes in Skin Sensitive after a Period of Acclimatization to the Cold,” DRNL Technical Paper No. 16, November 1953).

Figure A.F6: “Snowhouse” construction at Fort Churchill as part of indoctrination training. (LAC, RG 24, vol. 4206, file 270-0-89-6, Winter Exercise “Sun Dog One”).
### Appendix B

Table A.T1: Effect on Skin Temperature and Insulation Index of Immersion of Right Hand and Forearm in 5°C Waterbath

<table>
<thead>
<tr>
<th></th>
<th>Control Period</th>
<th>Immersion Period</th>
<th>Recovery Period</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average Skin Temperature °C</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td>31.52</td>
<td>31.10</td>
<td>30.87</td>
</tr>
<tr>
<td>Eskimos</td>
<td>31.53</td>
<td>31.21</td>
<td>31.00</td>
</tr>
<tr>
<td><strong>Insulation Index</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td>0.5445</td>
<td>0.5778</td>
<td>0.5990</td>
</tr>
<tr>
<td>Eskimos</td>
<td>0.5392</td>
<td>0.5711</td>
<td>0.6097</td>
</tr>
<tr>
<td><strong>Insulation Index of Trunk</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td>0.2426</td>
<td>0.2093</td>
<td>0.2022</td>
</tr>
<tr>
<td>Eskimos</td>
<td>0.1986</td>
<td>0.1667</td>
<td>0.1752</td>
</tr>
</tbody>
</table>

Table A.T2: Average Temperature During Second Half-Hour of Immersion of Hand and Forearm in 5°C Waterbath

<table>
<thead>
<tr>
<th></th>
<th>Controls °C</th>
<th>S.E.</th>
<th>Eskimos °C</th>
<th>S.E.</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Skin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toe</td>
<td>23.91</td>
<td>0.12</td>
<td>23.71</td>
<td>0.07</td>
<td>0.20</td>
</tr>
<tr>
<td>Calf</td>
<td>29.51</td>
<td>0.12</td>
<td>30.43</td>
<td>0.14</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Thigh</td>
<td>31.25</td>
<td>0.08</td>
<td>31.67</td>
<td>0.01</td>
<td>&lt;0.02</td>
</tr>
<tr>
<td>Abdomen</td>
<td>32.88</td>
<td>0.08</td>
<td>35.07</td>
<td>0.04</td>
<td>0.01</td>
</tr>
<tr>
<td>Chest</td>
<td>32.69</td>
<td>0.17</td>
<td>33.25</td>
<td>0.06</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Lumbar</td>
<td>35.40</td>
<td>0.04</td>
<td>35.48</td>
<td>0.03</td>
<td>0.10</td>
</tr>
<tr>
<td>Scapula</td>
<td>36.03</td>
<td>0.07</td>
<td>35.49</td>
<td>0.06</td>
<td>0.01</td>
</tr>
<tr>
<td>Shoulder</td>
<td>28.63</td>
<td>0.32</td>
<td>30.45</td>
<td>0.06</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Forearm</td>
<td>32.09</td>
<td>0.14</td>
<td>28.01</td>
<td>0.11</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Hand</td>
<td>26.15</td>
<td>0.19</td>
<td>23.15</td>
<td>0.31</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td><strong>Muscle</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calf</td>
<td>31.55</td>
<td>0.17</td>
<td>28.43</td>
<td>0.07</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Thigh</td>
<td>34.83</td>
<td>0.04</td>
<td>34.41</td>
<td>0.05</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Forearm</td>
<td>34.07</td>
<td>0.07</td>
<td>33.09</td>
<td>0.04</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td><strong>Rectal</strong></td>
<td>36.99</td>
<td>0.05</td>
<td>37.09</td>
<td>0.04</td>
<td>0.20</td>
</tr>
</tbody>
</table>
ARCHIVAL SOURCES (CANADA)

Canadian War Museum (CWM), Ottawa, Ontario
Archives, Textual Records
Library
Sound Recordings

Churchill Public Archives, Churchill Public Library, Churchill, Manitoba

Dalhousie University Archives, Halifax, Nova Scotia
Dalhousie University Reference Collection

Directorate of History and Heritage (DHH), Ottawa, Ontario
George Lindsey fonds
Joint Staff fonds

Laurier Military History Archive – Laurier Centre for Military, Strategic and Disarmament Studies (LCMSDS), Waterloo, Ontario
George Lindsey fonds

Library and Archives Canada (LAC), Ottawa, Ontario

Manuscript Groups (private papers)
G. Malcolm Brown
Brooke Claxton
James Patrick Croal
Omond M. Solandt

Government Record Groups

External Affairs, RG 25

Medical Research Council, RG 128

National Defence, RG 24

Northern Affairs Program, RG 85

Privy Council Office, RG 2

Queen’s University Archives, Kingston, Ontario

Robert James Uffen fonds

University of Saskatchewan Archives and Special Collections, Saskatoon, Saskatchewan

John G. Diefenbaker fonds

University of Toronto Archives and Records Management Services, Toronto, Ontario

Omond McKillop Solandt fonds

ARCHIVAL SOURCES (UNITED STATES)

National Archives and Records Administration (NARA), College Park, Maryland

Record Groups

Army Staff, RG 319

Defense Intelligence Agency, RG 373

National Security Archive, Washington (digital records)
GOVERNMENT PUBLICATIONS


Canada. Cabinet Committee on Research and Defence. Ottawa.

—. Cabinet Defence Committee. Ottawa.

—. Chiefs of Staff Committee. Ottawa.

—. Defence Research Board. Ottawa.

—. Department of Foreign Affairs, Trade and Development. Ottawa.

—. Department of National Defence. Ottawa.

—. *Documents on Canadian External Relations (DCER)*. Ottawa.


—. House of Commons Canada, *Special Studies, Committee Reports*. Ottawa.

—. Joint Intelligence Committee. Ottawa.

—. Privy Council Committee on Scientific and Industrial Research. Ottawa.

—. Privy Council Office. Ottawa.


—. Senate. Committee Reports. Ottawa.


—. *Canada’s Defence Programme 1951-52.* Ottawa: Printer to the King’s most Excellent Majesty Controller of Stationery, 1951.

Cooper, George T.H. *Opinion of George Cooper, Q.C., Regarding Canadian Government Funding of the Allan Memorial Institute in the 1950’s and 1960’s*. Ottawa: Department of Justice, 1986.


Smith, Gordon. *Ice Islands in Arctic Waters*. Ottawa: Department of Indian and Northern Affairs, 1980.


**INTERVIEWS**

William Erickson, 3 August 2016.


**NEWSPAPERS, MAGAZINES, AND BULLETINS**

*The Bulletin*

*Canadian Geographic*

*Canadian Press*
Chemistry in Canada

The Daily News (St. John’s, Newfoundland)

The Financial Post

The Globe and Mail

The Journal (Ottawa, Ontario)

National Post

New York Times

Ottawa Citizen

Science Forum

Toronto Daily Star

THESES


OTHER SECONDARY SOURCES


—. “Frontier engineering: from the globe to the body in the Cold War Arctic.” *The Canadian Geographer* 50, no. 2 (2006): 177-196.


Hounshell, David A. “Epilogue: Rethinking the Cold War; Rethinking Science and Technology in the Cold War; Rethinking the Social Study of Science and Technology.” Social Studies of Science 31, no. 2 (2001): 289-297.


—. *De-icing required!: the historical dimension of the Canadian Air Force’s experience in the Arctic*. Ottawa: National Defence and the Canadian Forces, 2012.


—, and Matthew Farish, “The Cold War on Canadian Soil: Militarizing a Northern Environment.” *Environmental History* 12, no. 4, Special Issue on Canada (October, 2007): 920-950.


Stairs, Denis. “Canada and the Korean War Fifty Years On.” *Canadian Military History* 9, no. 3 (Summer 2000): 49-60.


—. *Warming Up to the Cold War: Canada and the United States’ Coalition of the Willing, from Hiroshima to Korea*. Toronto: University of Toronto Press, 2009.


