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

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by

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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

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[1] LAC, RG24, vol. 10341, file Clippings March 1947 to November 1952, Cyril Bassett, "Science: Our Armed Forces $35 Million Fourth Arm," *The Financial Post* (Toronto), 16 February 1952.
[2] Ibid.
[3] Stephen Bocking, *Nature's Experts: Science, Politics, and the Environment* (New Jersey: Rutgers University Press, 2004), 17.

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

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[4] Ibid.
[5] Matthew Farish, "The Lab and the Land: Overcoming the Arctic in Cold War Alaska," *Isis* 104.1 (2013): 1-29.
[6] On the "military-industrial-academic complex" in the United States, see by date of publication, Peter Galison and Bruce William Hevly, eds., *Big Science: The Growth of Large-Scale Research* (Stanford: Stanford University Press, 1992); Stuart W. Leslie, *The Cold War and American Science: The Military-Industrial-Academic Complex at MIT and Stanford* (New York: Columbia University Press, 1993); Margaret Pugh O'Mara, *Cities of Knowledge: Cold War Science and the Search for the Next Silicon Valley* (Princeton, NJ: Princeton University Press, 2005); Audra J. Wolfe, *Competing with the Soviets: Science, Technology, and the State in Cold War America* (Baltimore: The John Hopkins University Press, 2013); Mark Solovey and Hamilton Cravens, *Cold War Social Science: Knowledge Production, Liberal Democracy, and Human Nature* (New York: Springer, 2012); Solovey, *Shaky Foundations: The*

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.[7] 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.[8] 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.[9] By comparison,

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Politics-Patronage-Social Science Nexus in Cold War America (New Brunswick, NJ: Rutgers University Press, 2013); Joy Rohde, *Armed with Expertise: The Militarization of American Social Research during the Cold War* (Ithaca, NY: Cornell University Press, 2013).

[7] Jonathan Turner, "The Defence Research Board of Canada, 1947 to 1977," (Toronto: Institute for the History and Philosophy of Science and Technology, University of Toronto, PhD Dissertation, 2012), 122.

[8] Captain D.J. Goodspeed, *A History of the Defence Research Board of Canada* (Ottawa: Queen's Printer, 1958), 109; Turner, "The Defence Research Board of Canada, 1947 to 1977," 122-123.

[9] For economic figures on the United States' commitment to defence-related R&D, see Daniel J. Kevles, "K_1S_2: Korea, Science, and the State," in *Big Science*, Galison and Hevly eds., 312-333; Leslie, *The Cold War and American Science*, 6-9.

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.[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.[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

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[10] The financial records amassed in the official history of the DRB cover the period 1947-57; see Goodspeed, *A History of the Defence Research Board*, 108-110. For the Canadian figures discussed here, which extend into the 1960s, see Turner, "The Defence Research Board of Canada, 1947 to 1977," 122-123. For a detailed analysis of postwar research and development in the United Kingdom, see Robert Bud and Philip Gummett, *Cold War, Hot Science: Applied Research in Britain's Defence Laboratories, 1945-1990* (London, UK: Science Museum, 2002).
[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."[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.[13] Moreover, as Turner correctly asserts, the paper trail for grants awarded by the DRB is sporadic at national and university archives.[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.[15] Under these two categories, the DRB applied several

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[12] Turner, "The Defence Research Board of Canada, 1947 to 1977," 123.
[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.
[15] LAC, RG24, vol. 2529, file 800-100-M91 vol. 3, "Proceeding of a Conference between the United States Air Force and Defence Research Board, 4 and November, 1957," Report No. DR 122, (Ottawa: Defence Research Board, Department of National Defence), January 1958, p. 3.

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.[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.[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:

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[16] Ibid.
[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.[18]

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.

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[18] LAC, RG24, vol. 2529, file 800-100-M91 vol. 2, DRBS 170-80/S6, "Defence Research Board Standing Committee on Extramural Research: Policy regarding the award of Grants-in-Aid of Research and Contracts," p. 2; acquired through the Access to Information and Privacy Act (ATIP).

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.[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.[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.[21] 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."[22]

Upon further examination, it becomes clear that the DRB established its extramural program for three primary reasons.[23] 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

[21] For details on Canada's early Cold War financial commitment to defence research and development, see Solandt's annual report for the DRB for 1948: LAC, RG24, vol. 4116, file 1-0-140, "1948 Annual Report of the Chairman, Defence Research Board".
[22] W.H. Barton, "Defence research in the universities," reprinted from *Chemistry in Canada* (March 1951), article found in LAC, RG24, vol. 4133, file 4-901-43-2 vol. 1.
[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.[24] 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.[25] 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.[26] 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

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[25] I arrived at this conclusion after careful review of available primary sources and secondary literature. The Defence Research Board closely monitored and vetted the results of funded research prior to any publication, however. For details on the DRB's Directorate of Scientific Information, see LAC, RG24, vol. 4168, file 225-1-53-1 vol. 3, "Defence Research Board, Department of National Defence: Programme of Scientific Work for the Fiscal Year 1955-1956 – Prepared for the Advisory Panel of Scientific Policy of the Privy Council Committee on Scientific and Industrial Research," p. 16.

[26] Goodspeed, *A History of the Defence Research Board of Canada*, 90.

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.[28] 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.[29] 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.[30] 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.[31]

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[28] LAC, RG24, vol. 4168, file 225-1-53-1 vol. 3, "Defence Research Board, Department of National Defence: Programme of Scientific Work for the Fiscal Year 1955-1956 – Prepared for the Advisory Panel of Scientific Policy of the Privy Council Committee on Scientific and Industrial Research," 15.
[29] Turner, "The Defence Research Board of Canada, 1947 to 1977," 96.
[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.[32] 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.[33] 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

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[32] Goodspeed, *A History of the Defence Research Board of Canada,* 227-228; Alison I-Syin Li, *J.B. Collip and the Development of Medical Research in Canada* (Montréal: McGill-Queen's University Press, 2003).
[33] Turner, "The Defence Research Board of Canada, 1947 to 1977," 96.

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-

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[34] W.G. Bigelow, J.C. Callaghan and John A. Hopps, *Radio-Frequency Rewarming in Resuscitation from Severe Hypothermia* (Ottawa: Defence Research Board, 1952); W.G. Bigelow, *Cold Hearts: The Story of Hypothermia and the Pacemaker in Heart Surgery* (Toronto: McClelland and Stewart, 1984).
[35] Turner, "The Defence Research Board of Canada, 1947 to 1977," 98.
[36] For full details on the research, see in order of publication date, Don Gillmor, *I Swear by Apollo: Dr. Ewen Cameron and the CIA-Brainwashing Experiments* (Montréal: Eden Press, 1987); Harvey Weinstein, *A Father, a Son and the CIA* (Toronto: J. Lorimer, 1988); Christopher Hyde, *Abuse of Trust: The Career of Dr. James Tyhurst* (Vancouver: Douglas & McIntyre, 1991); Anne Collins, *In the Sleep Room: The Story of the CIA Brainwashing Experiments in Canada* (Toronto: Key Porter Books, 1997).

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.[37] 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.[38] 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.[39] 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.[40]

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[37] "Montreal woman seeks compensation in '50s brainwashing case," *CBC News*, 8 January 2007, accessed 18 January 2017, http://www.cbc.ca/news/canada/montreal/montreal-woman-seeks-compensation-in-50s-brainwashing-case-1.670151.
[38] Dene Moore, "Brainwashed 'guinea pig' seeks more damages," *Canadian Press*, 8 January 2007, accessed 18 January 2017, https://www.thestar.com/news/2007/01/08/brainwashed_guinea_pig_seeks_more_damages.html.
[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

[41] Turner, "The Defence Research Board of Canada, 1947 to 1977," 98; H.W. Melville, *The Department of Scientific and Industrial Research* (London: Allen & Unwin, 1962), 62.
[42] LAC, RG24, vol. 2425, file Speeches – Reporting etc. 1947 – March 1953 Volume 1, Dr. O.M. Solandt, *The Defence Research Board: The First Four Years*, Report No. DR 34, March 30, 1951.

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

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[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.

[44] The exact figures listed are $8,498,085 (total budget) and $667,022.08 (extramural research grants); see NARA, RG319, Box 854, *Annual Report of the Defence Research Board, 1 April 1949 – 31 March 950*, Report No. DR 22, "Department of National Defence, Defence Research Board Statement of Allotments, Expenditures and Unexpended Balances for fiscal year ending 31 March 1950," Ottawa, 26 May 1950.

[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.[46] 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."[47] 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.[48] 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."[49] The remaining 60 per cent of the program supported a variety of fundamental research projects

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[46] LAC, RG 24, vol. 4168, file 225-1-53-1 vol. 3, "Defence Research Board, Department of National Defence: Programme of Scientific Work for the Fiscal Year 1955-1956 – Prepared for the Advisory Panel of Scientific Policy of the Privy Council Committee on Scientific and Industrial Research," 14.
[47] LAC, RG 24, vol. 4168, file 225-1-53-1 vol. 2, "Defence Research Board, Department of National Defence: Programme of Scientific Work for the Fiscal Year 1954-1955 – Prepared for the Advisory Panel of Scientific Policy of the Privy Council Committee on Scientific and Industrial Research," 9.
[48] Ibid.
[49] Ibid.

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

[50] LAC, RG24, vol. 4168, file 225-1-53-1 vol. 2, "Defence Research Board, Department of National Defence: Programme of Scientific Work for the Fiscal Year 1954-1955 – Prepared for the Advisory Panel of Scientific Policy of the Privy Council Committee on Scientific and Industrial Research," 8-9.

sanitation problems in the North.[51] 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.[52] 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

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[51] LAC, RG24, vol. 4168, file 225-1-53-1 vol. 3, "Defence Research Board, Department of National Defence: Programme of Scientific Work for the Fiscal Year 1955-1956 – Prepared for the Advisory Panel of Scientific Policy of the Privy Council Committee on Scientific and Industrial Research," 10.
[52] LAC, RG24, vol. 2425, file Speeches – Reporting etc. 1947 – March 1953 Volume 1, *The Bulletin*, No. 40 (Montréal: Canadian Industrial Preparedness Association), 6 November 1953.

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

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[53] Ibid.
[54] C.D. Howe, quoted in *The Bulletin*, No. 40 (Montréal: Canadian Industrial Preparedness Association), 6 November 1953; see LAC, RG24, vol. 2425, file Speeches – Reporting etc. 1947 – March 1953 Volume 1.

contribute to the military and industrial capacity of the NATO alliance.[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

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[55] LAC, RG 24, vol. 2425, file Speeches – Reporting etc. 1947 – March 1953 Volume 1, "Defence A Collective Project: No Nation of Free World in Position to Withstand Aggression Alone," in *The Bulletin*, No. 40 (Montréal: Canadian Industrial Preparedness Association), 6 November 1953, p. 9.

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.[56]

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.

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[56] Omond Solandt, quoted in *The Bulletin*, No. 40 (Montréal: Canadian Industrial Preparedness Association), 6 November 1953; see LAC, RG24, vol. 2425, file Speeches – Reporting etc. 1947 – March 1953 Volume 1.

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.[57] 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."[58]

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,

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[57] LAC, RG24, vol. 2529, file 800-100-M91 vol. 2, DRBS 170-80/S6, "Defence Research Board Standing Committee on Extramural Research: Policy regarding the award of Grants-in-Aid of Research and Contracts," p. 5.
[58] LAC, RG24, vol. 4155, file DRBS 106-0-323, A.L. Washburn, Executive Director, Arctic Institute of North America to O.M. Solandt, Chairman, Defence Research Board, 22 June 1950.

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]

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[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.[63] 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.[64] 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.[65]

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.[66] 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 Co-ordination 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

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[63] LAC, RG24, vol. 4155, file DRBS 106-0-323, JIC 1-10-2, Privy Council Office, The A/Director of Scientific Intelligence, Defence Research Board, "Grants-in-Aid – Arctic Institute of North America," 8 December 1948. For information on Nicholson's wider involvement with RCMP security investigations, see Whitaker and Marcuse, *Cold War Canada*, 223, 419-420; Whitaker Kealey, and Parnaby, *Secret Service*, 215-216, 256.
[64] LAC, RG24, vol. 4155, file DRBS 106-0-323, R.H. Macdonald, A/Directory of Scientific Intelligence to The Secretary, Joint Intelligence Committee, 17 November 1948.
[65] LAC, RG24, vol. 4155, file DRBS 106-0-323, A.J.G. Langley, Director, Scientific Intelligence [DRB] to Commissioner, Royal Canadian Mounted Police, "Attention: Director of Criminal Investigation," 19 January 1949.
[66] The DRB originally produced a draft of the priority system in May 1951. For the original document, see LAC, RG24, vol. 4243, file DRBS 5260-0-267-1, DBRS-5001-0-240, "Defence Research Board, Ottawa: Standard Priority System DND Research and Development," 9 May 1951. For the revised document from 1952, see LAC, RG24, vol. 4243, file DRBS 5260-0-267-1, Memorandum by Omond Solandt, "Defence Research Board, Ottawa: Priority System for Research and Development Projects," 4 March 1952.

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.[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.[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.[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

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[67] Ibid.
[68] LAC, RG24, vol. 4243, file DRBS 5260-0-267-1, "Defence Research Board, Ottawa: Priority System for Research and Development Projects," 29 February 1952, p. 1.
[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

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[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."[72] 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."[73] 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.[74]

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

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[72] LAC, RG24, vol. 4243, file DRBS 5260-0-267-1, "Defence Research Board, Ottawa: Priority System for Research and Development Projects," 29 February 1952, p. 20.
[73] Ibid.
[74] LAC, RG24, vol. 4243, file DRBS 5260-0-267-1, DBRS-5001-0-240, "Defence Research Board, Ottawa: Standard Priority System DND Research and Development," 9 May 1951.

distributed $34.4 million annually to scientists, engineers, and industry leaders.[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.[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.[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.[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.[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.[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

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[75] Eggleston, *National Research in Canada*, 444.
[76] Ibid.
[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, *Science Forum* 1, No. 2: 3-5.
[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.
[79] University of Toronto Archives and Records Management Services, Omond McKillop Solandt fonds, vol. B93-0041-033, file B93-0041-033-03, "DRB Personnel Strength (Including JIB [Joint Intelligence Board])," 29 December 1955.
[80] See W.H. Barton, "Defence research in the universities," reprinted from *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 Word War when he investigated the business practices of

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[81] Ibid.
[82] Turner, "The Defence Research Board of Canada, 1947 to 1977," 210-215.
[83] Government of Canada, *The Royal Commission on Government Organization. Vol. 1: Management of the Public Service* (Ottawa: Privy Council Office, 1962), accessed 25 November 2016, http://publications.gc.ca/site/eng/471934/publication.html.

Eldorado, Canada's national uranium company.[84] 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.[85] 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.[86]

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

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[84] For full details on the history of Eldorado, see Robert Bothwell, *Eldorado: Canada's National Uranium Company* (Toronto: University of Toronto Press, 1984).
[85] Canada, *The Royal Commission on Government Organization. Vol. 1*; Turner, "The Defence Research Board of Canada, 1947 to 1977," 211.
[86] Canada, *The Royal Commission on Government Organization. Vol. 2: Supporting Services for Government* (Ottawa: Privy Council Office, 1962), accessed 25 November 2016, http://publications.gc.ca/site/eng/9.699799/publication.html.

declined by approximately one-third during the period 1947 to 1957.[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.[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 co-ordinate all defence programmes for applied research and development, including the new "development-sharing" programme, and to provide an effective environment for the conduct.[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

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[87] Canada, *The Royal Commission on Government Organization. Vol. 4: Special Areas of Administration* (Ottawa: Privy Council Office, 1962), 68-72, accessed 25 November 2016, http://publications.gc.ca/site/eng/471952/publication.html.
[88] Ibid., 204-205.
[89] Canada, *The Royal Commission on Government Organization. Vol. 4: Special Areas of Administration* (Ottawa: Privy Council Office, 1962), 209-210, accessed 25 November 2016, http://publications.gc.ca/collections/collection_2014/bcp-pco/Z1-1960-4-4-2-eng.pdf.

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."[90] 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.[91] 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.[92]

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[90] Ibid., 211.
[91] Turner, "The Defence Research Board of Canada, 1947 to 1977," 213.
[92] For full details on the Glassco Commission and the Defence Research Board, see Turner, "The Defence Research Board of Canada, 1947 to 1977," 210-215.

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 ascendance 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.