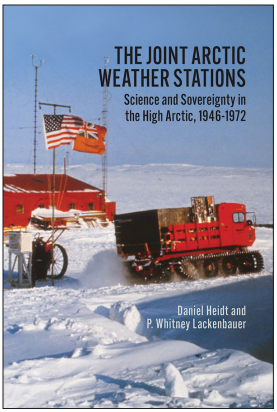

THE JOINT ARCTIC WEATHER STATIONS: SCIENCE AND SOVEREIGNTY IN THE HIGH ARCTIC, 1946–1972

by Daniel Heidt and P. Whitney Lackenbauer

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Introduction

> Cold waves, the periodic surge of Arctic masses into the main west-east flow of air in the temperate latitudes, emphasize the indispensable need of the meteorologist for data from Canada's remote northland. A day-by-day knowledge of changes in the Arctic is vital to the interpretation of changes in more temperate latitudes. The advancement of his profession and of the science depend to a large extent on an increased understanding of arctic meteorology.
>
> Andrew Thomson (1948)[1]

As controller of the meteorological division at Canada's Department of Transport (DoT), Andrew Thomson recognized the critical importance of Arctic data to meteorology and its myriad applications in the early Cold War world. Advancements during the Second World War turned Canada's northern reaches into an emerging — and essential — scientific frontier. "Almost a quarter of the Arctic cap is Canadian territory, an area second only to that controlled by the U.S.S.R.," he continued. "Canada thus carries an international obligation to roll back the meteorological frontiers of the Arctic, for the free exchange of weather data between nations of the northern hemisphere is no longer a courtesy but a scientific necessity."[2] This required precise instruments and the application of modern practices and methods that conformed to national and global standards. Gathering data in the High Arctic, however, would entail more than simply using

known techniques in a distant hinterland. It would necessitate improvisation, innovation, and adaptation to local conditions.

Meteorological technicians Monte Poindexter and Lowell Demond left the Eureka station barracks at 09:00 on a typical morning in January 1958. Round-the-clock winter darkness meant that the American and the Canadian walked across the station grounds with only artificial light to guide their path to the Inflation and Rawinsonde buildings. The weather was calm, with a light wind adding more snow to the already impressive drifts encroaching on the station's structures. Nevertheless, frigid temperatures complicated every task. While Poindexter readied the equipment that would track the radiosonde's flight and receive its telemetry and prepared the flight's balloon, Demond organized the radiosonde instrument package in a heated shed where temperatures hovered around freezing. When both men were ready, Demond released the balloon outside of the shed and hurried into the heated first floor of the rawinsonde building. Then, he began writing down the numbers Poindexter called out to him over the closed-circuit phone line. When the balloon burst after ascending to roughly 70,000 feet, the two men gathered on the first floor of the rawinsonde building to finish plotting their run, check for errors, and then encode their observations for transmission.

After completing this work, the duo returned to the rawinsonde building's radio room and passed their information on to John Gilbert, one of the station's radio operators. Using Morse code, Gilbert then transmitted this information to the Arctic weather program's hub station at Resolute. From there, the information was transmitted to Edmonton and then fed into teletype machines and disseminated to meteorological centres around the world, where staff aggregated the observations of dozens or hundreds of stations to produce daily or weekly forecasts. In turn, these forecasts informed bomber and interceptor forces, civilian pilots who wanted to avoid harsh weather, farmers who needed to know when they should begin planting or harvesting their crops, and urban dwellers deciding whether to bring their umbrella to work.[3]

Twice daily, for more than a quarter century, personnel at each of the five Joint Arctic Weather Stations (JAWS) repeated the upper air observations described in the anecdotal account above. These isolated stations in Canada's High Arctic, established by the American and Canadian civilian

weather bureaus in the decade after the Second World War, were jointly operated by both governments until the early 1970s. As transportation and communication hubs, the stations also opened the region to scientists and commercial resource surveys. The success of this binational scientific program throughout this period testifies to the commitment of the Canadian and American personnel who sailed, flew, or worked at the top of the world while navigating environmental, diplomatic, logistical, and interpersonal challenges so that both North America and the North Atlantic could benefit from accurate meteorological data.

Canada's Arctic Archipelago reaches north from mainland North America towards the North Pole. As early as 1906, Canadian explorer Albert Peter Low described the islands north of Lancaster Sound and Barrow Strait as a distinct geographical and geological region, including "the great islands of Ellesmere and North Devon, whose eastern sides front on Baffin bay and Smith sound; the Parry Islands — Cornwallis, Bathurst, Byam Martin, Melville, Eglinton and Prince Patrick — all on the north side of Barrow Strait; the Sverdrup Islands — Axel Heiberg, Ellef Ringnes, King Christian and North Cornwall — situated to the west of Ellesmere and to the north of the Parry islands."[4] Geographer Andrew Taylor, who helped to establish the Joint Arctic Weather Stations on these remote islands, observed in 1964 that "the structural elements of the land are largely laid bare and human geography in the commonly accepted sense is non-existent."[5] Lying literally "beyond the Inuit lands" (as the motto of the northernmost station in North America would later boast) until the High Arctic relocations of the 1950s,[6] the High Arctic came to occupy a particular space in the minds of Canadian and American planners as a frontier of field science and geopolitics during the Cold War.

The Joint Arctic Weather Stations (JAWS), constructed at Resolute, Eureka, Mould Bay, Isachsen, and Alert between 1947 and 1950, were situated according to southern and global requirements but projected a pioneering and permanent scientific presence into Canada's High Arctic. This book provides the first systematic account of this binational program that profoundly shaped subsequent state activities and scientific inquiry in the Arctic Archipelago. Through this study, we seek to better understand the intersections between state planning and diplomacy, sovereignty, and

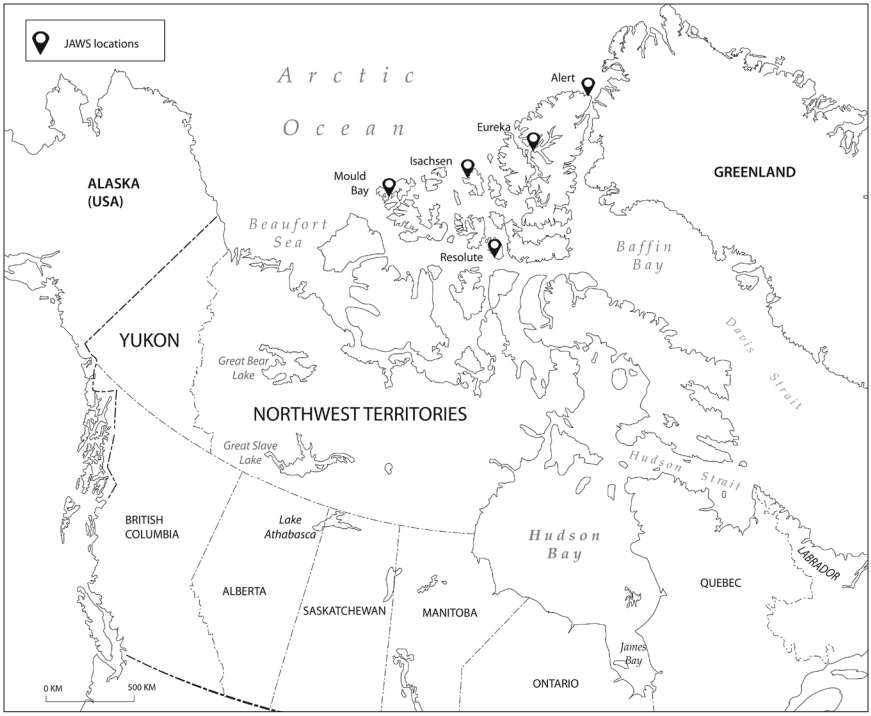

Figure 0-1. The Joint Arctic Weather Stations. Jennifer Arthur-Lackenbauer

science during the Cold War. We are equally intrigued by the people and practices at the stations, their adaptations to local environmental realities, and how these realities influenced each country's Arctic policies. Accordingly, we explore how the joint stations became *places* — distinct historical geographies with particular environmental and cultural characteristics. By exploring the full duration of the JAWS program on various scales, this book invites a reconsideration of traditional assessments of the program, explores Canadian-American relations beyond the corridors of high-level diplomacy, and reveals a particular binational approach to collaborative polar science in the North American Arctic.

From a state perspective, the JAWS program came at a moment when senior civilian and military decision-makers sought to transform relations between people and Arctic environments. In the wake of a global war that

projected into the North American Arctic for the first time, politicians and senior civil servants recognized that science was strategic. Access to reliable, continuous, and recently collected weather data from the High Arctic would facilitate global transportation networks, economic development, and national defence. Previously considered the remote realm of Inuit, the fur trader, the Mountie, and the missionary, the North American High Arctic now became vital meteorological and scientific space: not for local Arctic consumption and use, but to observe, record, and transmit weather data for southern forecasters discerning global weather patterns. As Chief of the United States Weather Bureau (USWB) Francis W. Reichelderfer noted straightforwardly when testifying to Congress in 1946, "reports from the Arctic Basin would help very much in weather forecasting."[7] Our intention is not to explore how this locally-generated knowledge was disembedded, de-territorialized, and globalized into generalizable meteorological data.[8] Instead, we seek to understand why weather data was sought from specific sites in the High Arctic, how the stations were created and sustained, how relationships were structured, and how this joint program shaped — and was shaped by — broad geostrategic considerations, national interests, departmental and scientific priorities, and particular Arctic environments.

At its core, this book grapples with canonical questions about the interaction of science and place in isolated stations.[9] "Place is essential to the generation of *knowledge*," David Livingstone reminds us. "It is no less significant in its *consumption*."[10] As he explains, historical geographies of science must interrogate the transmission and transformation of social relations and cultures of practitioners within varied local contexts. "Spatial arrangements and social practices are intricately interconnected, indeed are reciprocally constituted," he suggests. "Spaces are *produced* as well as *occupied*."[11] For a quarter century, teams comprised of four Canadians and four Americans made surface observations, flew weather balloons, ate, slept, and passed the time at the remote satellite stations for a year or more with only tenuous transportation and communication linkages to the outside world. Their jobs were arduous. The struggles of some Canadian and American personnel to attempt to conquer and, when that failed, adapt to harsh Arctic environments reveal both the limits of Western Cold War technology and the persistent power of the seasonal cycle in Northern life.

Personnel learned "on the job" how to work in extreme conditions, since neither the USWB nor the DoT provided significant Arctic training. In learning to live and work side by side, these men (the weather stations were only operated by men during the JAWS program) also negotiated the delicate terrain of Canadian-American relations. Furthermore, station personnel increasingly learned to work as hosts by making their airstrips, communications facilities, and accommodations hubs for scientists studying other more distant parts of the archipelago. Before departing the stations at the ends of their tours, these personnel passed on lessons learned to their replacements, perpetuating local cultures, leadership styles, and the importance of adhering to seasonal cycles.

While scholars have offered various interpretations of the negotiation and early establishment of the Joint Arctic Weather Stations, the program as a whole has attracted little scholarly attention. As early as 1954, R.W. Rae of the Defence Research Board of Canada touted it as "a splendid example of international cooperation" that generated "extensive meteorological and other scientific data" available to researchers around the world.[12] Similarly, in a study written in the 1970s and published only recently, historian Gordon W. Smith assessed the JAWS program "as one of the most important and successful examples of U.S.-Canadian joint endeavour in northern regions," offering "a striking illustration of successful international cooperation and collaboration."[13] In 1978, geographer William C. Wonders concluded that "the Joint Arctic Weather Stations programme was imaginative, venturesome and expensive at the time it was launched, which proved to be one of the most valuable investments made by the Canadian Government. It more than lived up to its expectations in its meteorological and climatological returns. It made it possible for a far-flung programme of even wider scientific value to be implemented." These stations, serving as "anchor points" for exploration and development in the High Arctic, had a profound influence on the region. In his short overview, Wonders observed that, despite the JAWS program's myriad contributions to science and its role in facilitating the transformation of the Canadian North, "surprisingly little note has been taken of it following the initial interest in the venture … [and] some fuller recognition is overdue."[14] This book takes up his call four decades later.

The State: Looking Down on JAWS

The JAWS program must be understood within the context of state expansion into polar exploration and science during the mid-twentieth century. During the preceding century, Europeans and North Americans "explored" the Arctic, claiming territory on behalf of their patron states, with research conducted on a transient, individual basis, with limited funding. "The heroic, expedition-based style of Arctic science, dominant in the first decades of the twentieth century, gave way to a systematic, long-term, strategic and largely state-funded model of research," an eminent group of historians of Arctic science recently observed.[15] This was an international trend towards more complex, coordinated, and permanent scientific footprints in the far north, motivated by a range of economic, political, military, and social factors. While the Soviet Union had a robust Arctic research program during the interwar years, the West lagged behind. After the Second World War imprinted the critical importance of Arctic meteorological information for military operations as well as weather forecasting more broadly, Canada, the United States, and the Nordic countries dramatically expanded their investments in an Arctic presence featuring permanent scientific research stations.[16] A similar burst of activity occurred in Antarctica, where isolation and extreme natural conditions required innovative logistics, communications, and engineering to construct and resupply permanent stations.[17] The JAWS program thus fits within a larger pattern of Arctic states investing in permanent infrastructure to support polar science, providing a window into this period of transition that both complements and challenges existing studies.

The JAWS case has also factored prominently in the Canadian historiography on Arctic sovereignty and security vis-à-vis the United States — a dominant approach to understanding Canada's Arctic interests that reflects the country's longstanding preoccupation with territorial ownership and control. Intersecting with the primordial debate about the Canadian-American relationship *writ large*, the interplay between Arctic sovereignty and security has precipitated two main schools of thought debating the costs and benefits of bilateral cooperation, compromise, and alleged coercion. During the Second World War, American-inspired (and largely American-built) defence projects in Northwestern Canada generated

official anxieties in Ottawa about potential sovereignty threats posed by the United States as it undertook bold action in the name of continental defence.[18] As the war progressed, American officials acknowledged that they had to respect their northern neighbour's chronic insecurities about sovereignty and ensure that their activities did not prejudice or undermine Canadian interests. Accordingly, Canada emerged from the war with its northern sovereignty intact, and senior decision-makers in Ottawa learned valuable lessons about the need to monitor and, ideally, actively participate in American-sponsored activities in Canada's Far North.[19]

The Arctic, as the most likely attack route between the strategic bomber forces of the United States and the Soviet Union, came into its own as a strategic theatre during the Cold War. Arctic defences became inextricably linked to American security and, almost immediately after the Second World War ended, the US military began to push for access to Canada's Arctic to build airfields and weather stations. Canadian officials grew apprehensive and cautious in authorizing new installations in the Arctic, and journalists began to talk about a looming sovereignty crisis. The sheer preponderance of American material and personnel unnerved many Canadians then and several historians since, who cite this process as evidence of American willingness to encroach on Canadian sovereignty to achieve US security objectives.[20] Historian Shelagh Grant emphasizes that "'paper guarantees' did not always translate into practice" as Americans violated Canadian laws or diplomatic agreements. Accordingly, she concludes that the result was "a compromise: optimum security with minimal, but perceived unavoidable loss of sovereignty."[21] A second school of scholarly interpretation highlights the close cooperative nature of these joint defence projects, contending that Canadian and American Arctic interests were generally compatible and that bilateral cooperation ultimately bolstered Canadian security and sovereignty interests. Quiet diplomacy and practical, bilateral problem solving allayed most of the Arctic "crisis" concerns that arose.[22]

Both of these schools of thought have mobilized the JAWS program as an example of the intersections between Cold War militarization, science, sovereignty, and geostrategic interests in the Arctic. Historical geographer Matthew Farish has studied extensively how the American and Canadian militaries employed scientific research and engineering to afford personnel

many of the comforts enjoyed further south and to convert hostile Arctic "wilderness" environments into a legible "frontier" that could, through "calm rationality," be integrated into strategic frameworks.[23] Building on these ideas, a recent study of American Cold War science in Greenland concludes that "the U.S. military 'colonized' geophysical research in the Arctic, which increasingly became subject to military directions, culture, and rules." The physical environmental sciences, including meteorology, acted as a "gateway" to the Arctic by facilitating military control and extending political control into foreign states.[24] Several historians suggest that Ottawa was "ever mindful of the importance of North American continental defense for Canadian security," when consenting to the construction and operation of weather and radar stations in its Arctic. They also recognize that Canadian leaders "continued to view sovereignty and natural resources as crucial Arctic issues" and employed scientific research to legitimize their claims.[25] Given that Canada's northern status was integral to its national self-image, historian of science Trevor Levere observed that it was natural for Canada to continue to see Arctic science as a tool "to establish and extend that sovereignty."[26]

The JAWS story suggests a need to distinguish between the militarization of Cold War science, which implies a co-opting of civilian- or academic-driven inquiry,[27] and the role of militaries in *supporting* science. As Roger L. Geiger notes, "how these issues are evaluated depends considerably upon where one chooses to look."[28] Few scholars, to date, have considered the civil motivations and inputs to the implementation and operation of the JAWS network. Instead, because the JAWS project was made possible by massive, modern military logistics, most scholars have assumed that JAWS was a military/defence project rather than a civilian weather project that produced data of obvious interest to militaries — alongside a plethora of civilian audiences. While military aircraft and naval vessels played prominent roles in the establishment and resupply of the stations, JAWS should not be understood as a primarily military program. Instead, we shift the focus to emphasize how modern military technology and logistics helped to extend and broaden the tentacles of state-supported civilian research, facilitating the collection of weather observations, as well as the establishment of transportation and communication hubs for other — generally civilian — scientific inquiries.

Experiencing JAWS: Views from Below

As noted earlier, scholars who have assessed the JAWS program have typically focused on high-level policy and government planning through security and sovereignty lenses.[29] During our research, we quickly realized that a fixation on senior decision-making overlooks significant dynamics in the actual *operation* of the JAWS program, in addition to what experiences in the field tell us about high-level assumptions and concerns over time.[30] Expert planners who conceived of the joint program and oversaw much of the negotiations and construction preparations had a particular way of seeing the world, and this book explores how their understandings of the North shaped the conception, negotiation, and planning stages of JAWS. It also tests how power dynamics played out at the stations. Given that JAWS was a joint Canada-US initiative, how did a shared command structure, with binational leadership, actually work in practice at isolated stations? Did the US, as a superpower, exercise de facto control of the program? How well informed were southern politicians and planners of local developments, and did their (mis)understandings influence government policies?

Remoteness, confinement, and Arctic environments are core variables in the JAWS story. Farish reminds us that "the 'how' of the Cold War is inextricable from its 'where.'" Broad views of geopolitics and scientific inquiry must be interrogated alongside "the finer perspectives" of "bodies moving across 'hostile' terrain." His work, and that of other recent polar scholars, tends to emphasize the *transiency* of non-Indigenous military and civilian personnel *traversing* the landscape, passing through field exercises or camps, training centres, or laboratories in their quest to make the Arctic legible and useful.[31] While scientists who used the JAWS stations as regional hubs to access field sites certainly fit this description, it does not adequately capture the sense of *place* that JAWS personnel created and experienced.

We emphasize that the lives of JAWS personnel must be positioned *within* Arctic spaces, where men were intensely and intimately engaged with local Arctic environments. Given the isolation and potential for "cabin fever" among station personnel, leadership and fellowship were integral to successful station cultures. "The importance of ensuring a balanced

team, promoting harmony by only taking 'good chaps', is easily visible in discussions of polar expeditions and mountaineering trips," historian of science Vanessa Heggie observes, "but is far less considered in connection with scientific research teams."[32] Science and technology scholars frequently acknowledge that "field scientists often depend on local assistants whose knowledge of and commitment to the goals of research are partial at best,"[33] but (with the notable exception of their analysis of amateur contributions to scientific knowledge[34]) they rarely investigate how diverse practitioners affect and shape the collection of scientific data, station cultures, and other aspects of station life.

Rather than producing a triumphalist narrative about the ability of states to project and implement "modern" plans that promised to negate local environmental conditions, we are fascinated by the limitations imposed by environmental constraints, distance and isolation, and human reactions to these realities. Without ready access to Indigenous knowledge holders given JAWS' remote locations far removed from Inuit communities (at least until Inuit families were relocated to Resolute Bay and Ellesmere Island in the 1950s), the stations' personnel had to overcome challenges through their own observations and responses to the environment. As oral histories and archival research reveal, station cultures were shaped by everything from particular scientific practices to seasonal cycles to ways of knowing and behaving within these environments. Station personnel grappled with preconceptions, southern requirements, inadequate equipment, and environmental realities to produce local knowledge — relating to both scientific and everyday life — that successive teams accumulated and passed on to their replacements. While implicit, the four domains of community life identified by Sharon Traweek in her landmark ethnographic study of high energy physicist communities frame our analysis: ecology (the group's means of subsistence, the environment that supports it, and the tools and other artifacts used by the group); the social organization (how the group structures itself); developmental cycle (how the group transmits to novices the skills, values, and knowledge that constitute a sensible, competent person); and cosmology (the group's system of knowledge, skills, and beliefs). By providing a "thick description"[35] of everyday station life and exploring how mundane tasks influenced the program's development, this book follows the examples of P. Wenzel Geissler and

Ann Kelly in analyzing remote stations as "sites of scientific work, beacons of political power and spaces of everyday life … enmeshed in the routine and rhythms of everyday domestic life, and in longer cycles of habitation, wear, and repair."[36]

To accomplish these diverse goals, we adopt a mixed methodology. Government archives in Canada and the United States yielded rich material on the official purpose, planning, resupply, and operation of the JAWS stations. These records are also essential to understanding the diplomatic exchanges between Ottawa and Washington, as well as inter-service and interdepartmental negotiations, consultation, and cooperation that took place throughout the duration of the program. They reveal comparatively little, however, about the day-to-day operation of the stations, leading us to augment our resource base with station logs, official reports from archives across North America, popular media stories, and unpublished personal memoirs. We also rely heavily upon oral histories — what James C. Scott appropriately identifies as "hidden transcripts"[37] — of former JAWS employees to understand the program as a "lived" experience. By putting these diverse sources into dialogue with each other and with scholarship concerning Canadian-American relations, the environment, field science, and isolation, this history of the JAWS program corrects misperceptions and yields fresh insights into how station personnel perceived the High Arctic and forged a distinctive community dedicated to collecting and disseminating data in support of scientific knowledge.

In some respects, the JAWS story may seem anachronistic or unfashionable, focusing on all-male, non-Indigenous scientific outposts in the Canadian Arctic. In the Canadian case, nearly all academic scholarship (including much of our own work) now focuses on themes related to state-imposed colonial systems on Indigenous peoples in their homeland. By contrast, the JAWS case study points to the production and habitation of the High Arctic as a North American space largely outside of the politics of Indigenous-Settler relations. By looking at weather stations populated by *qallunaat* (non-Inuit), it deviates from Ken Coates' observation that "Northern regions are generally characterized by tensions between indigenous and non-indigenous peoples."[38] While we expected to find more interaction between weather station personnel and Inuit, the latter are conspicuously absent in the archival record and oral histories of

the stations. Accordingly, this "thick" description of JAWS suggests that examining the heterogeneity of cultural geographies in the Circumpolar North and the Canadian Arctic[39] can help to explain the production of space and place in specific times and contexts.

In their work on Antarctic colonialism, Christy Collis and Quentin Stevens suggest that:

> Antarctica is a unique space: it lacks indigenous inhabitants. Hence, unlike every other colonial space, it is not defined through invasion and loss; in Antarctica 'colonialism did not have to be a "dirty" word.' The popularity of intercultural exploitation as a focus for colonial and postcolonial studies can blind us to the fact that intercultural relations are not always the defining aspects or the spatial function of a colony.… Antarctica's lack of indigenes does not, therefore, render Antarctican colonies any less colonial; rather, it signals a defining and a unique aspect of Antarctican colonial spatialities.… Antarctican stations are colonial spatialities of territorial control, science, and possession, but not of dispossession. What we are looking at are unique, contemporary forms of modern colonial spatiality.[40]

Many of these assumptions and themes seem to resonate with the Joint Arctic Weather Stations story — perhaps even calling into question the inherent "Antarctic exceptionalism" implicit in most scholarship on polar colonialism and scientific practice. This Arctic case study might also be framed as a work of critical geopolitics, not simply seeing space "as a neutral, universally legible entity over which various states struggle" but, as Klaus Dodds tells us, as a "contest to give spaces specific meaning."[41] While there are elements of a "contest" in parts of the story that follows, our research suggests that complementary rather than competing spatialities also explain the enduring collaboration between Canada and the US in the JAWS program.

Overview of the Book

Chapter 1 provides a broad historical overview to introduce readers to the phases of exploration in what became Canada's High Arctic, the evolving science of meteorology, and the emergence of the Arctic as a strategic frontier. The applications of reliable weather knowledge grew with the development of aviation, advances in communication technology, and the extension of observing networks (both surface and upper air) into more remote regions. The Second World War brought to the fore the need for longer-range and more accurate weather forecasts, drawing upon past weather data as well as the daily collection and evaluation of surface and upper air weather observations from around the globe — including the High Arctic. The war also led to the formalization of the Canada-United States military partnership, while arousing concerns in Canadian circles about the implications of American continental defence agendas for Canadian sovereignty.

Early negotiations embodied Canada's postwar anxieties of dealing with a superpower interested in the northern approaches to North America. Chapter 2 reexamines the place of JAWS within the bilateral negotiations immediately following the end of the Second World War. The received version of the origins of JAWS is that this was an American continental defence program foisted upon the Canadians, who eventually acquiesced and placed what was essentially a military program under "civilian cover."[42] Charles Hubbard, the primary promoter of the Arctic weather station program, has been portrayed as "an ambitious, self-confident engineer and polar explorer seeking a new postwar role" who "lacked an appreciation of smaller states' sovereignty, which was vital to understanding … Canada's desire to control its Arctic territory."[43] Our reassessment reveals a different understanding of Hubbard and his vision. The USWB conceived the JAWS program as a component of a postwar effort to gather sufficient meteorological observations for producing accurate long-term continental weather forecasts. The same forecasts were, naturally, also of interest to the American military after the Second World War as both superpowers increasingly looked to the Arctic as a potential future theatre of war. Hubbard and the USWB recognized that the emerging continental security concerns were a window of opportunity to secure military support for several programs — including JAWS. This strategy backfired, at least

temporarily. While it helped the USWB to secure funding from Congress for the stations, the strategy also subsumed the civil stations within broader American-Canadian continental defence talks. Canada, trying to fit the weather stations into its broader science, sovereignty, and security considerations, mistook American pressures that were informed by budgetary, security, and logistical imperatives: it worried that the weather stations were a prelude to much larger military projects in its Arctic. Prime Minister William Lyon Mackenzie King and his cabinet colleagues insisted on treating the joint weather station proposal as a defence project among several others. It is ironic that Canadian politicians, however anxious to promote the civilian side of JAWS in public messaging, did not fully grasp its civilian nature in private. The USWB and the Canadian DoT, however, envisioned the program as a civilian enterprise supported logistically by the armed services, with sweeping civil and military benefits. By securitizing and politicizing what the Americans saw as a primarily civilian endeavour, the Canadians delayed the implementation of the JAWS program.

On 4 March 1947, cabinet minister C.D. Howe publicly announced that the Canadian government planned to establish nine Arctic weather stations in three years "with the assistance of the USWB." This spin on bilateral plans was misleading. Although JAWS was a "joint" program, and the Canadian and American meteorological departments would each supply half of the personnel to operate each station, the US military shouldered nearly all of the responsibility for building and supplying the weather stations at the onset. At the time, Canada lacked the resources to contribute meaningfully to this work, and instead satisfied itself with assembling teams of observers from interested government departments who reported on the best techniques and technologies for the coming expansion of Canada's Arctic infrastructure.

Paper plans and aspirations were one thing. Implementing the program in the High Arctic was another. Chapters 3 and 4 examine developments during the construction of the stations and their initial operation (1947 to 1950). The planning, establishment, and operation of the first stations fell to Hubbard's oversight, as director of the USWB's Arctic Operations Project, and to D.C. Archibald of the Meteorological Branch of Canada's Department of Transport. In April 1947, men and equipment were airlifted from Thule to Slidre Fiord on southwestern Ellesmere Island

to build a satellite station (Eureka). That year, as chapter 3 recounts, heavy ice foiled summer plans to establish the main station at Winter Harbour on Melville Island, and American Naval Task Force 68 had to satisfice with a more accessible site at Resolute Bay on Cornwallis Island.

Resolute became the main and largest station, serving as a hub for the construction and resupply of outlying satellite stations as well as collecting and relaying to the south weather information that it received from the other stations. Chapter 4 charts the establishment of three additional satellite stations at Mould Bay on Prince Patrick Island, Isachsen on Ellef Ringnes Island, and Alert on Ellesmere Island, as well as resupply operations from 1948–50. Despite minor oversights, missteps, and miscommunications on both sides that resurrected high-level concerns about sovereignty, officials derived important lessons from these naval and air missions and applied these learnings to subsequent resupply activities, setting the course for smooth operational relationships. Although Hubbard lost his life in the crash of a Royal Canadian Air Force (RCAF) Lancaster on 31 July 1950, his general vision for JAWS became a reality.

The funding to construct the five additional stations initially envisaged did not materialize after 1950. Instead, the JAWS network shifted to a purely operational phase. Consistency, sustainability, and the facilitation of further scientific research on the archipelago, punctuated by occasional technological or capacity improvements, propelled the program forward. Because a chronological narrative of the five stations would be repetitive and redundant, the remainder of the book adopts thematic lenses to characterize the diverse experiences of JAWS personnel and their scientific practices, explain the successes of the program, and situate its achievements in broader contexts.

The joint nature of the program required each country to provide half of every station's personnel. Chapter 5 examines which staff/workers/technicians the stations needed to operate effectively and the motivations and networks that led volunteers to answer the call. In so doing, it reveals a shift from an initial reliance on heroic-era approaches[44] to more modern advertisement- and departmental-based recruiting initiatives. We explain why Canadians and Americans volunteered to work at these northern outposts, and the qualities and skillsets that the USWB and DoT sought and cultivated to fill specific positions within the stations. Different

understandings about the Arctic and Antarctica explain why DoT and the USWB provided less elaborate training regimes than those offered to personnel bound for Antarctica. In so doing, the chapter establishes the groundwork for subsequent analysis of how the backgrounds of personnel shaped station operations and cultures.

Recent research on the history of field research and scientific cultures has benefitted from attempts to situate scientific inquiry in specific places. While laboratories are designed to be "placeless" settings where scientists can control environmental variables that would otherwise corrupt the results of experiments,[45] field scientists are exposed to the elements and cannot control or compensate for all environmental conditions. Along these lines, chapter 6 examines the stations as scientific places, showing why and how meteorological technicians and other station personnel fought to maintain their extensive observation regime under all weather conditions. Although most scholarly studies of field science focus on university-trained scientists, our work considers the place and culture of technicians in accumulating field science data.[46] Unlike visiting scientists who often came to the stations aspiring to explain environmental phenomena by performing experiments designed to overcome the elements, JAWS personnel expected to collect their scientific observations by applying southern ideals and improvising locally-developed adaptations in light of local conditions and exigencies that complicated or disrupted standard practices.[47] As "a domus of a very particular kind," historians Wenzel Geissler and Ann Kelly note, isolated field stations produce "zones of shared living between humans and landscape, … triggering new and unpredictable forms of contact between humans and their surroundings" that speak "to a mode of domestication that is premised not on control but cohabitation."[48] Through adaptation and persistence, JAWS personnel established bastions of scientific culture in the Canadian High Arctic where meteorological observations — the program's *raison d'être* — shaped the daily rhythm of work and play.

Most of the stations also hosted small posts to gather ionospheric, seismic, or other observations. Given their locations, they also facilitated access to Arctic "wilderness," thus serving as "bridgeheads into the unknown" for visiting scientists,[49] including those from the Polar Continental Shelf Project (PCSP). Chapter 6 explores how transient scientists taxed

station resources and led JAWS personnel to differentiate themselves from their guests, while also welcoming the companionship of scientists who offered relief from routines and new voices to engage.

Despite the high modernist aspirations of the programme's founders to mobilize technology to overcome Arctic environments, environmental realities ultimately constrained activities at and around the stations. Radically different in character and duration from temperate areas, the seasons in the High Arctic fundamentally influence the lives of humans in the region. Although there has been extensive research on how Indigenous peoples followed (and continue to follow) seasonal cycles, polar scholars seldom interrogate the pervasive impact that seasonal changes had on station activities and typically confine their discussions to winter and work seasons. In the process, spring and fall are often amalgamated into a busy summer season of activity when southern construction crews and scientists buzz around the stations. Consequently, the ways that all four seasons shaped construction, hobbies, resupply, and other aspects of station life remain underappreciated.

By observing a full cycle of routine annual activities, chapter 7 presents a more fulsome picture of the wide range of actions associated with life at JAWS stations and how these were shaped by environmental realities. Seasonal conditions determined patterns of resupply, for example, with the winter and shoulder seasons imposing physical limits on when ships and aircraft could reach the stations. The number of visiting scientists and other visitors peaked during summer, creating a bustle not seen during the rest of the year. The performance of essential tasks, from waste disposal practices to water collection, reflected the seasonal cycle. Even construction, a task often associated with summer, had to be differentiated and timed to coincide with optimal environmental conditions during the spring, summer, and fall.

This chapter also differentiates between the hub station and its satellites, reinforcing the importance of specific places and the danger of over-homogenizing the JAWS experience. Resolute boasted the most developed airport and the most extensive suite of communications equipment, which afforded personnel stationed there a degree of connectivity to the south that was unavailable at the other stations. Furthermore, Resolute and Eureka were resupplied via sealift and airlift while the remaining

stations continued to be resupplied by air. Landing and communications facilities at Resolute also led other federal departments to construct their own hub facilities, which created infrastructure that contrasted dramatically with the comparatively "remote" satellite stations. Aside from the occasional addition of a few scientists, the satellite stations lacked this broader community atmosphere, and they consequently developed distinct cultures. Furthermore, Resolute was the only station with a neighbouring Inuit community after the High Arctic relocations began in 1953 — although this had surprisingly little impact on the JAWS program.

After examining the types of individuals who ran the weather stations, their work, and seasonal adaptations, we investigate how Canadian and American personnel coped on a daily basis in these isolated and confined stations — and with each other. Men seeking to escape from irritating co-workers could only walk a few kilometres from camp (and then return), take up a hobby, or go to another room. While isolation and confinement were more intense at the satellite stations than at Resolute, our research indicates that nearly all personnel struggled against these stresses, exhibiting tell-tale symptoms including fatigue, anger, sadness, and even depression. Social scientists have studied these symptoms among Antarctic personnel and contend that leaders cannot rely on military-style regimentation and discipline to manage struggling personnel.[50] Therefore, chapter 8 leverages wider polar research to frame and analyze the strategies that JAWS personnel adopted to live and work together. By exploring pastimes, diets, hobbies, gender, sexuality, and leadership, this chapter explains how the vast majority of personnel cohabited these remote and confined outposts with few altercations. By investigating stress management techniques and command structures, this chapter also demonstrates that the stations reflected a thoroughly *civilian* character, thus belying suggestions that the stations were a "civilian cover" for American military goals. The evidence also reveals that close cooperation between Canadian and American leaders at the stations and in stakeholder departments was predicated on mutual respect and ensured that sovereignty concerns did not impede the effective functioning of these scientific outposts.

In hindsight, it is surprising that many politicians and senior bureaucrats in Ottawa (obviously not attuned to the successful working relationship forged by American and Canadian JAWS personnel on the ground)

remained suspicious of the American presence at the joint stations and its concomitant implications for Canadian Arctic sovereignty. During the 1950s, government officials contemplated "Canadianizing" the logistical support and personnel associated with the JAWS project. Chapter 9 highlights the varied perspectives that informed these debates and analyzes when and why political pressures for Canada to assume responsibility for American contributions succeeded or failed. In the end, the United States did not withdraw from the JAWS program until the early 1970s with the final flag lowering ceremony at Resolute in 1972. Since that time, historians, commentators, and several former JAWS personnel assumed that Canada terminated American involvement in response to the Canadian nationalist reaction to the voyages of the SS *Manhattan* oil tanker through the Northwest Passage in 1969–70. This chapter proves that USWB budget constraints, rather than Canadian sovereignty concerns or pressures, led the Americans to withdraw from what they considered to be a highly successful joint program.

For Poindexter, Demond, and Gilbert, playing their respective roles at the Eureka station in January 1958, all of this future remained unknown. Instead, their preoccupations were intensely local: trekking out into the cold to complete their daily routines, encoding and transmitting their observations south, keeping their station in top condition, and busying themselves with hobbies to relieve the emotional weight of isolation and confinement. Their interactions with the environment generally required adapting to local conditions rather than trying to conquer the environment. Most JAWS personnel gleaned these insights from reading about Inuit lifeways and past Arctic explorers. Their very presence in a remote outpost in the High Arctic was enabled by more than a century of exploration that had slowly revealed the outlines of the archipelago extending from the North American mainland into the Arctic Ocean. It was also spurred by advances in the science of meteorology, tightening Canada-US relations during the Second World War, and a perceived urgency to gather Arctic weather data to serve the postwar world. In this distant place, just 1,100 km south of the North Pole, JAWS personnel were not only collecting valuable information on the Arctic environment — they were also being shaped by it.