

Documents on Canadian Arctic Sovereignty and Security

LESSONS IN NORTHERN OPERATIONS:

CANADIAN ARMY DOCUMENTS, 1945-56

P. Whitney Lackenbauer and Peter Kikkert



Documents on Canadian Arctic Sovereignty and Security (DCASS)

ISSN 2368-4569

Series Editors:

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Lessons in Arctic Operations: The Canadian Army Experience, 1945-1956

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DCASS Number 7, 2016

Covers: Arctic Institute of North America, Operation Musk Ox photos z57e0002; z57e0004

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Lessons in Arctic Operations: The Canadian Army Experience, 1945-1956

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Introduction

P. Whitney Lackenbauer and Peter Kikkert¹

“Throughout the 20th century, Arctic capabilities within the Canadian Army (CA) have waxed and waned in response to a range of pressures,” the authors of *Northern Approaches: The Army Arctic Concept 2021* noted in 2013.² This observation, made at a time when the Canadian Armed Forces has renewed its focus on general Arctic training and equipment and is rebuilding its Arctic capabilities to meet the challenges of a changing Arctic security environment, acknowledges the oscillating cycles of interest and disinterest that have marked the military’s relationship with the North.³ Unfortunately, many of the lessons learned from these previous experiences have been long forgotten, forcing the Canadian Army to relearn how best to prepare for and conduct Arctic and Subarctic operations.

The documents in this volume provide insights into the Canadian Army’s previous attempts to secure a better knowledge of the characteristics of Northern operations from 1945-55. During this decade, the Army conducted an extensive series of Subarctic and Arctic training exercises designed to “improve army tactics, techniques, and procedures for living and fighting in the North.”⁴ Most of these exercises were small-scale, with short durations and limited aims, often “more in the nature of trials than tactical manoeuvres.”⁵ Nevertheless, they yielded valuable

¹ We wish to thank undergraduate research assistant Corah Hodgson for her methodical transcription work and Dr. Ken Eyre for allowing us to build this introduction around our co-authored chapter on “Lessons in Arctic Warfare: The Army Experience, 1945-55” forthcoming in *Canadian Armed Forces Arctic Operations, 1945-2015: Historical and Contemporary Lessons Learned*, edited by Adam Lajeunesse and P. Whitney Lackenbauer. We also wish to recognize the support of the Social Sciences and Humanities Research Council of Canada (SSHRC) Insight Grant No. 435-2015-1140 on Canadian-American Relations in the Cold War Arctic, 1946-72 that facilitated research for this document collection.

² *Northern Approaches: The Army Arctic Concept 2021* (Kingston: Canadian Army Land Warfare Centre, 2013), 6.

³ On the deterioration of military capabilities in the 1990s, for example, see Canadian Forces Northern Area, *Arctic Capabilities Study* (2000).

⁴ Godefroy, *In Peace Prepared*, 85.

⁵ “Guide to Planning and Execution of Operations in the North,” Department of National Defence (DND), Directorate of History and Heritage (DHH), 122.3M3 (D2), ii. The Army’s operational experiences in the early Cold War period were inextricably linked to the joint research conducted at Fort Churchill, which also served as a hub for many of the exercises. As an American report noted, the activities at Churchill provided both armies with the experience,

“lessons learned” that informed the planning, training, and equipping of the Army for Northern missions in the Cold War era. While specific Arctic equipment, anticipated combat roles (and those in support of other government departments and agencies), and surveillance and control functions have changed, the challenges encountered in Arctic operations, the questions raised, and the lessons observed remain remarkably consistent with those experienced during Northern deployments over the last decade.

The Army’s current Arctic concept notes that although “the first aspect of the environment that comes to mind may be the extreme winter temperatures, that is but one aspect of the many challenges Canadian troops encounter in the Arctic.” Other factors include the wide range of temperatures; unpredictable ice conditions; difficulties of ground transportation over tundra, muskeg, ice and water obstacles, mountains, beaches, and the transitions to and from fresh and salt water bodies; the lack of flora and the presence of carnivorous fauna (and insects); and little critical infrastructure or sustainment capacities.⁶ Indeed, the significant challenges posed by the climate, geography, distance, and sparse population and infrastructure in remote Northern areas were well documented in the post-exercise reports from the 1940s and 50s. While participants in Northern exercises in the winter fixated on the extreme cold, high level planners recognized that the most significant military characteristics of the Arctic and Subarctic – for operations in all seasons – were isolation, the vast distances involved, the lack of transportation infrastructure, and the limits these variables imposed on military mobility.⁷

Early postwar exercises also revealed the critical distinction between *winter* warfare and *Arctic* warfare – two concepts that commentators frequently conflated at the time (and often continue to conflate today).⁸ During the Second World War, the Canadian Army was extensively engaged in the study of the techniques of winter warfare, often in or on the fringes of the Subarctic. In the face of an emerging Soviet

materials and equipment they needed to function “on a front hitherto neglected and now of prominent significance – the Arctic.” “An Introduction to Churchill and Surrounding Area, by 7099th ASU,” U.S. National Archives and Records Administration (NARA), RG 156, Entry 646-A, File ,” “An Introduction to Churchill, Fort Churchill and Surrounding Area; 1st Lt. C.C. Moore, Unit Historical Report, 1 July 1948 to 30 June 1949, Headquarters, 7099th Area Service Unit, NARA, RG 319, Entry (NM3) 429, Box 4750, File Historical Report - 7099th ASU, 1st Arctic Test Detachment.

⁶ *Northern Approaches*, 20.

⁷ K.C. Eyre, “Custos Borealis: The Military in the Canadian North” (unpublished Ph.D. thesis, University of London - King’s College, 1981).

⁸ For this important observation, see for example MGen J.M.M. Hainse, Commander LFDTS Planning Guidance – Land Force Arctic Strategy, 25 May 2009, DND file 3500-1 (G3).

threat immediately after the war, the tendency for some analysts to simply equate winter operations to northern operations represented a fundamental analytic flaw.⁹ Ignoring the other seasons neglected an important range of problems that had to be identified and solved before the Army could claim to have a fully operational capability in the North. Furthermore, soldiers could not appreciate the full range of challenges associated with operating beyond the treeline, or even in remote Subarctic areas, without actually spending time in those areas. As practitioners discovered, preparing for winter warfare at military training areas in the provincial norths or near major transportation arteries did not readily translate into successful operations in Arctic or isolated Subarctic settings. Equipment, sustainment systems, command, control, surveillance, liaison, and planning all had to be tested on the ground in order to determine whether capabilities, concepts, and doctrine were appropriate to Canada's vast and diverse Northern expanses.¹⁰

While lessons were often grouped under the general banner of "northern" operations, the Army also recognized an important distinction between the Arctic and Subarctic regions. These zones can be delineated in several ways,¹¹ but the Army's 1956 "Guide to Planning and Execution of Operations in the North" – reproduced in this volume – simply explained that, "for military purposes, it is more convenient to use the tree line as the dividing line between the two." The Arctic – the barren region north of the tree line – "skirts the north coast of Labrador, crosses Northern Quebec, and stretches northwest from the coast of Hudson Bay, in the neighbourhood of Churchill, [Manitoba,] to near the mouth of the Mackenzie River." The Subarctic – the wooded, scrub-covered region below the treeline – encompassed northern Manitoba and Saskatchewan, parts of the Northwest Territories, the mountains of northern British Columbia, and Yukon. Within these general ecozones, tremendous topographical diversity shaped operational possibilities.¹²

⁹ Eyre cites the examples of Kendrick Lee, "Arctic Defences," *Editorial Research Reports*, Vol. 2, No. 5, 31 July 1946; "Arctic Push Button War 'Out': Winter Too Tough for Army," *Winnipeg Tribune*, 10 May 1949; and Lieutenant Colonel Joseph J. Peot, "The Arctic Can be Our Ally," *Military Review*, Vol. 31, No. 11 (February 1952). See Major K.C. Eyre, "Tactics in the Snow: The Development of a Concept," *Canadian Defence Quarterly* 4/4 (Spring 1975), 7–12.

¹⁰ See Andrew B. Godefroy, *In Peace Prepared: Innovation and Adaptation in Canada's Cold War Army* (Vancouver: University of British Columbia Press, 2014), 91, and contrast with Ken Eyre, "Custos Borealis," 161.

¹¹ See, for example, Robert Bone, *The Canadian North: Issues and Challenges*, 4th ed. (Don Mills, ON: Oxford University Press, 2012), 2–4.

¹² See also J. Tuzo Wilson, "Winter Manoeuvres in Canada," *Canadian Geographical Journal*, vol.32-33 (1946): 88-93, and Omond McKillop Solandt, "Exercise 'Sweetbriar'," 30 March

These geographical and physical realities remain highly relevant. Today, the Army's Arctic deployments are treated akin to expeditionary operations, designed to deliver "high-readiness Arctic-enabled sub-units" that are self-contained, "self-sufficient for an extended period of time, [and] appropriate to the unique circumstances of the different regions of the Arctic."¹³ This concept reflects an appreciation of the remoteness, isolation, and "hostile" climatic and topographical conditions in Canada's Northern regions that strongly influence how the Army can generate and employ forces. Furthermore, understanding how to train and equip soldiers to operate effectively requires an intellectual as well as a physical commitment to Arctic preparedness. *Northern Approaches* notes that "lessons gathered from the existing training of [Arctic Response Company Groups] and joint deployments for Sovereignty Operations will all contribute to the corporate knowledge essential" to equip commanders to solve challenges associated with Northern operations.¹⁴ That institutional knowledge should also be based on a more robust awareness of the historical lessons learned from the Canadian Army's Northern deployments extending back to the Second World War.

Setting the Stage: The Second World War

The global nature of the Second World War generated a growing awareness in Canada that winter and northern warfare was no longer something that could be overlooked. In his landmark 1940 study on *The Military Problems of Canada*, historian C.P. Stacey dismissed any threat to the dominion from the north, thanks to "those two famous servants of the Czar, Generals January and February, mount guard for the Canadian people all year round."¹⁵ Within a year, however, the Russo-Finnish War and the German campaigns in Russia prompted professional soldiers to seriously consider the challenges of mounting military operations in winter.¹⁶ In response, Canada began to contemplate the problems of cold and mobility when it developed its first winter warfare training pamphlet on *Instructions for Winter and Ski Training* in 1941. The many problematic insights that it offered, such as directing soldiers to briskly rub frostbitten limbs with snow to restore circulation, reveal that Canada's

1950, *The Empire Club of Canada Addresses* (Toronto), 276-293, available online at <http://speeches.empireclub.org/62437/> data.

¹³ *Northern Approaches*, 24.

¹⁴ *Northern Approaches*, 40.

¹⁵ C.P. Stacey, *The Military Problems of Canada* (Toronto: Ryerson Press, 1940), 5.

¹⁶ For an introduction to Swedish, Russian, German, American, British, and Canadian interests, see Major K.C. Eyre, "Tactics in the Snow: The Development of a Concept," *Canadian Defence Quarterly* 4/4 (Spring 1975), 7-12.

“northern-ness” did not inherently translate into ready-made aptitude for Northern operations.¹⁷

As historian Kenneth Eyre has explained, worries over the capability of the Canadians and Americans to respond to an enemy attack in northern North America during the war prompted Canada to lead “her Western allies in the development of specialized equipment and techniques for winter warfare.”¹⁸ The Canadian Army opened a winter warfare school in Petawawa, Ontario during the winter of 1941-42, where it conducted experiments on the effect of snow and cold. Researchers tested power-driven toboggans and adopted adaptor kits to “arcticize” vehicles so that they could continue to operate at temperatures as low as -40°C. In 1942, the planning of Operation *Plough* inspired greater Allied interest in winter operations, and Canada continued to press on with various experiments even after that plan was scuttled.¹⁹ At Shilo, Manitoba, the Army experimented with vehicles and weapons in extreme cold, tested transportation capabilities across ice and snow and developed special clothing for both dry and wet cold. By the end of winter 1944, Eyre concludes, “the Canadian military had developed a substantial body of technical knowledge and special equipment related to winter warfare.”²⁰

By the winter of 1944-1945, the Western Allies realized that no special winter warfare skills would be required in order to win the wars in Europe or the Pacific. Accordingly, the U.S. Army’s interest in northern operations diminished. Nevertheless, Canada pressed on with developmental work and the Canadian General Staff proposed “collective and tactical winter warfare tests with skeletonized

¹⁷ Canadian Army Training Pamphlet No.6, *Instructions for Winter and Ski Training* (Ottawa: King’s Printer, 1941).

¹⁸ Eyre, “Custos Borealis,” 150. Prior to the Japanese capture of Attu and Kiska in June 1942, the U.S. Army did not consider the Arctic to be of primary importance and naively assumed that a mountain trained unit could operate in cold weather anywhere. The Japanese invasion, however, convinced the U.S. Army that it had to improve its arctic capabilities. Shortly after, the service established the Alaskan Department Development Board at Fort Richardson, where researchers worked to establish special clothing and equipment for wet-cold and dry extreme cold conditions. Headquarters, Army Arctic Indoctrination School, “Background of Cold Weather Training and Experimentation, NARA, RG 338, Entry 37042, Box 826, File Army Arctic Centre, Arctic Training Doctrine. Early during the war, U.S. Army interest in cold weather operations centred on Camp McCoy, Wisconsin, where units like the 10th Mountain Division trained in winter warfare.

¹⁹ See, Eyre, “Custos Borealis,” 150-151.

²⁰ Eyre, “Custos Borealis,” 152. See, for example, Wilson, “Winter Manoeuvres in Canada.”

formations of all arms and services.”²¹ These activities also attracted the attention of Canada’s primary allies, Britain and the U.S., who sent observers to the Canadian Army’s exercises that winter: the dry-cold exercise *Eskimo* in northern Saskatchewan, the wet-cold exercise *Polar Bear* in northern British Columbia, and *Lemming* in the barrens between Churchill and Eskimo Point, NWT.²²

Through these wartime exercises (documented in the reports reproduced in this volume), Eyre observes, the Canadian Army took “major steps forward in consolidating its knowledge and capability” for undertaking tactical manoeuvres in winter conditions.²³ Although these exercises were tough on men and equipment, the army had derived significant lessons about the feasibility of northern operations. These tests, coupled with technological developments, led defence planners to assert “that the inaccessibility of the Arctic is just another myth, and, providing supplies are ensured, operations on the barren grounds...can be as unhindered as operations on the Libyan Desert.”²⁴

The Exercise *Eskimo* report noted that 83% of Canadian territory was classed as Arctic or Subarctic, and suggested that any time invested in cold weather operations was well spent. All of the Canadian efforts to this point, however, had been devoted to the mastery of *winter warfare*, and the notion of northern operations only peripherally addressed. Furthermore, the wartime exercises had not exposed personnel to the extremes of climate typical in the far north. As a result, the Army concluded that none of the exercises could be considered “a final test of efficiency of the fighting

²¹ Eyre, “Custos Borealis,” 152. DHH, 112.352 (D7), *Exercise Eskimo*, “Briefing on Exercise Eskimo for Visiting Senior Officers from, U.K., U.S.A. and Canada” (henceforth Ex Eskimo Briefing), 21 January 1945, Appendix 17.

²² For an overview of the three exercises, see Hugh Halliday, *Recapturing the North: Exercises ‘Eskimo,’ ‘Polar Bear’ and ‘Lemming’ 1945*, *Canadian Military History*, Vol. 6, No. 2 (Autumn 1997), 29-38. For more details, see DHH, 746.009 (D17), Ex “Eskimo,” undated (probably summer 1945); Winter Warfare Research Programme, 1944-45 – Exercise Eskimo (Dry Cold), DHH, File 746.013 D2; DHH, 746.083 (D20), Canadian Army Operational Research Group Report 28, “Polar Bear,” 15 July 1945; Exercise Lemming, *Lessons Learned: Winter Exercises, 1945-54*, DHH 81/675; and Cold Weather Trials: *Exercises Ex Lemming CAORG Report No. 25*, 24 May 1945, DHH, 746.083.

²³ Eyre, “Custos Borealis,” 157.

²⁴ *Post-War Canadian Defence Interests in United States Defence Projects in Northwest Canada*, Preliminary Draft by Army Representatives on Joint Drafting Group, Working Committee on Post-Hostilities Problems, 6 July 1945, *DCER Volume 11, 1944-45*, 1582. On “the North African analogy, see Eyre, “Custos Borealis,” 157.

man under arctic and sub-arctic conditions.”²⁵

“Exercise *Musk Ox* straddles the hazy temporal boundary that marks the beginning of the Cold War,” Eyre notes. In historical context, it is best considered the culmination of the winter exercises that the Canadian army carried out during the war, but in contrast to *Eskimo*, *Polar Bear* and *Lemming* — which occurred as “world-shaping events played to their ultimate conclusions in Europe and Asia” and therefore received little publicity—*Musk Ox* was conducted in winter 1946 and subjected to “the full glare of national and international press coverage.”²⁶ The primary goals of the non-tactical exercise (to “study movement and maintenance in differing cold weather conditions”) were modest, but the proposed plan to move a mechanized force over 3,000 miles across northern Canada, relying chiefly on air resupply, caught the attention of Canada and the international defence community.²⁷ Canadian politicians also highlighted the civilian benefits of the exercise, and the participating troops were called upon to make magnetic and auroral observations, collect snow and ice data, and record the flora and fauna that they encountered along the way.²⁸

Work up training for the *Musk Ox* training was conducted in Shilo, Manitoba and then Churchill, which would serve as the launching point for the exercise itself. Soldiers qualified as snowmobile drivers and trained in navigation, shelter building, and other arctic skills during brief patrols into the Barrens around Churchill. After delays owing to poor weather and mechanical troubles, the Moving Force began its 3200-mile journey on 15 February 1946. Their route took them north to Eskimo Point and then west and north via Baker Lake and Perry River to Cambridge Bay. Here the force rested and explored for ten days before continuing on the Coppermine

²⁵ Exercise Sweetbriar, Vol. III, Report of Canadian Army, NARA, RG 409, Entry (NM3) 429, Box 3, File Exercise Sweetbriar Vol. III.

²⁶ Eyre, “Custos Borealis,” 157. Considerable publicity attended the completion of Musk Ox but the Canadian government made no attempt to capitalize on this national and international attention, and in fact, tended to play down the operation. The Minister of National Defence speaking in the House said, “There is nothing secret about this expedition; it is a very small one. *Debates*, 14 December 1945, 3552-3. Despite the “non-secretive” nature of the expedition, the exercise report was not classified as an open source until, at Eyre’s request, it was declassified on 25 November 1975. In some respects, it is surprising that Canada did not attempt to develop the sovereignty implications of the expedition. Certainly the government had often expressed concern over the extent of wartime America military development in the North and American long-term commercial designs on the region. No evidence could be found that would indicate that either the Canadian military or government considered this option. This makes the title of Hugh A. Halliday’s article “Exercise ‘Musk Ox’: Asserting Sovereignty ‘North of 60,’” *Canadian Military History* 7, no. 4 (2012): 37-44, rather peculiar.

²⁷ Ex “Musk-Ox,” DHH, 746.033 (D2).

²⁸ Eyre, “Custos Borealis,” 158.

and thence south through Port Radium, Tulita (Fort Norman), and Fort Simpson to the Alaska Highway at Fort Nelson. From Nelson, the Moving Force intended to press south along roads to the final destination at Edmonton but the dust storms stirred upon on the highway by the convoy led to continuous breakdowns. In Grande Prairie, Alberta, the vehicles were loaded onto a special train with five flat cars and carried to the provincial capital. There, after 81 days on the trail, the Musk Oxers received their final mission order to stand down, just one day behind schedule (6 May 1946).²⁹

“The public and military reaction to *Musk Ox* blew the solid research accomplishments of the exercise beyond reasonable proportions,” Eyre observes. “Commentators in Canada and abroad persisted in ignoring the often repeated Canadian government claims that *Musk Ox* was a small non-tactical exercise designed to work out several technical problems related to military operations in the winter and to support certain limited scientific experiments.”³⁰ From its onset, the exercise revealed the low tooth-to-tail ratio of northern operations, with a great disparity in size between the small group that made the voyage (a moving force of 40 people, including civilian scientists and foreign observers) and the large support elements that made it possible. The Royal Canadian Air Force (RCAF) formed a special squadron with nine aircraft to re-supply the exercise, and more than two hundred soldiers “man[ned] a base camp exclusively dedicated to providing support for a platoon-sized force operating in a non-tactical setting.”³¹ The exercise showed that, with existing technology, a joint army-air force effort “could supply and maintain a small ground force over the entire expanse of the Canadian Arctic,” historian Kevin Thrasher concludes. On the other hand, “Musk Ox did not show that there [were] any clear advantages to operating ground vehicles” over large stretches of Northern terrain.³²

²⁹ Kevin Mendel Thrasher, “Exercise Musk Ox: Lost Opportunities” (unpublished M.A. thesis, Carleton University, 1998). On Musk Ox, see Lieut. Colonel G.W. Rowley, “Exercise Muskox,” *Geographical Journal*, Vol. CE, No. 4-6, (October 1947): 175-185; J.T. Wilson, “Exercise Musk-Ox, 1946,” *Polar Record*, Vol. 5, No. 33 (December 1947): 14-27; Patrick Baird, “MuskOx Retold,” *North*, Vol. XXV, No. 5, (September/October 1978): 24-44; and Halliday, “Exercise ‘Musk Ox’”.

³⁰ Eyre, “Custos Borealis,” 160.

³¹ *Ibid.*, 158.

³² Thrasher, “Exercise Musk Ox,” 102, 110.

An Arctic Battleground?

For American defence planners, *Musk Ox* proved that military operations in the far north were possible – albeit unlikely.³³ Furthermore, the Americans understood that if they were slightly behind the Canadians in terms of Arctic capability, they were miles behind the Soviets, who had fought extensively in northern conditions during the Second World War. Given these considerations, strategists deduced that Soviet ground forces posed a limited threat to the Arctic approaches of North America in 1946. The problem of resupply in the Arctic environment made it unlikely that any formidable or sizeable force would attempt to operate in the region. While American planners worried about possible small scale incursions into the region, they did not consider it a “gateway to invasion.” Many areas in the Arctic were suitable for lodgment by specially-trained enemy units, however, which could be used to base long range weapons and airborne forces for strikes on the North American heartland. Soviet Tu-4 bombers, which lacked the range to strike at the United States on anything but a one-way mission, could use these bridgeheads as forward bases to refuel and rearm. Furthermore, the Soviets had the airborne forces, arctic-trained troops, and transport aircraft required to make this theoretical scenario at least possible,³⁴ and continental air defences were minimal before the Distant Early Warning (DEW) Line and the creation of the North American Air Defence Command (NORAD).³⁵ As a result, American defence planners concluded that Soviet air-transported forces posed a possible threat and the continent needed to be defended against them. This required immediate training, for the Americans still

³³ Headquarters, Army Arctic Indoctrination School, “Background of Cold Weather Training and Experimentation, NARA, RG 338, Entry 37042, Box 826, File Army Arctic Centre, Arctic Training Doctrine.

³⁴ Intelligence Research Project, Intelligence Division, WDGS, Possibilities of Trans-Arctic Attack on the United States, 13 January 1947, NARA, RG 319, Entry (NM3) 82, Box 2894, File Project 3506 - Possibilities of a Trans-Arctic Attack, 1947; File Report on the Arctic, Atlantic Division, Air Transport Command NARA, RG 319, Entry (NM3) 82, Box 2975. On the “gateway to invasion” idea, see also Bernd Horn, “Gateway to Invasion or the Curse of Geography?: The Canadian Arctic and the Question of Security,” in *Forging a Nation: Perspectives on the Canadian Military Experience*, ed. Bernd Horn (St. Catharines: Vanwell Publishing Limited, 2002), 307-332.

³⁵ Sean Maloney, “The Mobile Strike Force and Continental Defence, 1948-1955,” *Canadian Military History* 2, no. 2 (1992): 77.

knew little about Arctic and Subarctic warfare despite having invested millions of dollars on wartime programs.³⁶

By contrast, historian Bernd Horn has argued that many Canadian officials considered the threat of a Soviet ground attack in the Arctic to be unrealistic. Canadian intelligence estimates often disagreed with the American assertion that the Soviets could seize objectives in Alaska, Canada, or Labrador from which they could launch strikes against targets in North America.³⁷ Army appreciations noted that the chance of enemy airborne attacks were slight because of the problems with resupply and re-embarkation, as well as lack of fighter support. On the other hand, *Musk Ox* and the wartime exercises in the Canadian North convinced some government officials that the northern approaches could become the focus of an attack by hostile ground forces. Even if the enemy launched a land assault as a diversion, the Canadians would need to mount some kind of response, requiring an Arctic operational capability. In May 1946 the Canadian Chiefs of Staff created the Inter-Service Committee on Winter Warfare and the Arctic Research Advisory Committee, and the Defence Research Board made Arctic warfare a major area of focus and effort.³⁸ Furthermore, the 1946 “Appreciation of the Requirements for Canadian-United States Security” and the “Joint Canadian-United States Basic Security Plan” called for mobile strike forces to counter any possible enemy incursion into the north.³⁹

The Canadians, however, did not act immediately to implement the mobile striking force concept, preferring to analyze and define the types of threat to which such a force would have to respond. In addition, before any specific role could be discussed for a mobile striking force, the Canadian and American militaries needed to evaluate their capabilities and requirements in the northern regions.⁴⁰ Defence

³⁶ Headquarters, Army Arctic Indoctrination School, “Background of Cold Weather Training and Experimentation,” NARA, RG 338, Entry 37042, Box 826, File Army Arctic Centre, Arctic Training Doctrine.

³⁷ Lt. Col. Bernd Horn, *Bastard Sons: An Examination of Canada’s Airborne Experience, 1942-1955*, (St. Catharines: Vanwell Publishing Limited, 2001), 75.

³⁸ Alfred James Tedlie, “‘Winter and Rough Weather’: Fort Churchill 1946-1964 in Defence of Northern Canada,” (unpublished M.A. thesis, University of Victoria, 1986), 60. The Canadians started a northern research program at Churchill in the spring and summer of 1946, with the summer research consisting mostly of equipment and weapons tests.

³⁹ Memorandum by Joint Canadian-United States Military Cooperation Committee, 23 May 1946, *DCER Volume 12, 1946*, 1615-23.

⁴⁰ Andrew Iarocci, “Opening the North: Technology and Training at the Fort Churchill Joint Services Experimental Testing Station, 1946-64,” *Canadian Army Journal* 10, no. 4 (Winter 2008), 75.

planners understood that the *environment* of the Canadian North could be as much an enemy as any Soviet paratrooper and wanted to find ways to minimize the non-battle casualties that so often occurred in northern operations. If a mobile striking force was to ever take flight, military equipment had to be modified for northern conditions, operational and tactical doctrines worked out, and Canadian troops taught to live, work, and fight in the Arctic.

The chief component of this effort was the Joint Experimental Testing Station at Fort Churchill. This location, accessible year-round by plane and rail,⁴¹ boasted ideal terrain and climate to mimic the arctic conditions in which the army would have to operate. To the north of the town was the tundra of the Arctic, while to its south lay the kind of wooded areas in which troops would have to operate in Subarctic deployments.⁴² The Joint Experimental Testing Station focused on land operations, with Canadian and American personnel conducting independent experiments until 1950-1951.⁴³ Exercise *Musk Ox* provided a long list of problems to address. The first couple of winters were spent seeing if soldiers could live for long periods in the Arctic and if their equipment could withstand the cold. These studies highlighted that in the Arctic the soldier needed almost 90% of his time just to stay alive and could devote only 10% to fighting.⁴⁴ A main goal of the staff at Fort Churchill was to even out these percentages. The first step was improving winter clothing and personal equipment, which was deemed very poor. The researchers struggled to find clothing that would keep the body warm while at rest, but not cause overheating during action.⁴⁵ A long-term program was initiated to determine the best type of clothing for troops operating in Arctic and Subarctic conditions. Furthermore, researchers

⁴¹ An Introduction to Churchill and Surrounding Area, by 7099th ASU, NARA, RG 156, Entry 646-A, Box A764. According to Andrew Iarocci, "Most significant was its geographic location at an ecotone, a transitional zone between two ecological systems: the arctic barrens to the north and the boreal forest to the south. As such, the terrain around Churchill broadly represented the character of arctic lands across the north." Iarocci, "Opening the North: Technology and Training at the Fort Churchill Joint Services Experimental Testing Station, 1946-1964," *Canadian Army Journal*, Vol. 10.4 (Winter 2008), 76.

⁴² The Combined Experimental and Training Station, Fort Churchill, DHH 91/171. The railroad, port and town at Churchill were located at the mouth of the Churchill River, while the military camp was about 5 miles eastwards along the coast of the Bay. On 1 October 1946 the site was officially passed from the Department of Transport to the Canadian Army, which quickly re-named it Fort Churchill.

⁴³ Tedlie, "Winter and Rough Weather," 41.

⁴⁴ "No Big Arctic War Believed Possible: Extensive Tests Said to Show Weather Prevents Use of Armies or Even Brigades," *New York Times*, 10 May 1949.

⁴⁵ The Combined Experimental and Training Station, Fort Churchill, DHH 91/171

prioritized finding ways to lighten the load of soldiers.⁴⁶ Men were far too bogged down by the equipment needed to stay alive in the Arctic to operate effectively, and the facility at Fort Churchill grappled with this constraint – albeit with limited success.

In the winter of 1946 and 1947, the Canadian Army used the lessons learned from the four previous northern exercises, as well as the findings of the first months of work at Fort Churchill, to create a two-week indoctrination course to familiarize personnel with operating in Arctic conditions. Only one captain and a sergeant could be found with sufficient northern experience to lead the course.⁴⁷ Participants in the first course spent nearly 90% of their time indoors acquiring theoretical instead of practical knowledge, and only ventured outdoors for a few short marches. When the initial course failed to prepare troops for the rigours of outdoor activity in the North, the Army revised the syllabus to allow for the equivalent of 3.5 days or 84 hours on the land. Soldiers spent 64 of these hours on exercises which required them to remain in the open for two days and two nights, providing them with an opportunity to apply the theoretical instructions given them in the classroom. Subjects covered in the revised course included bushcraft, clothing, shelter building, sanitation, cooking, equipment maintenance, load lashing, first aid, and the use of sleds and stoves. While it seemed an impressive list, the Army's report on the indoctrination program concluded that a two-week course was inadequate to equip a soldier with sufficient knowledge and capability to survive in the Arctic. The course had allotted only 2.5 hours, for instance, to navigation, a major source of difficulty for those inexperienced in northern travel.⁴⁸ Trainees required far more experience with practical outdoor work and the Army lengthened the Arctic indoctrination course to four weeks.⁴⁹

As the work at Fort Churchill slowly started to build momentum, strategists and media commentators continued to devote considerable attention to the probable scale of conflict in the North. With the enunciation of the Truman Doctrine in the President's speech to Congress in March 1947, the "Cold War" (as it was labelled by American journalist Walter Lippmann) became an accepted reality, prompting open

⁴⁶The normal maintenance requirement for a Canadian Armoured Division in the field during the 1944-45 northwest Europe campaign was 45.7 pounds per man and increased to 90 pounds per day during fighting. On *Musk Ox*, where no ammunition was used, the figure was 115 pounds per man per day. Tedlie, "Winter and Rough Weather," 118.

⁴⁷ The Combined Experimental and Training Station, Fort Churchill, DHH 91/171

⁴⁸ Extracts from the Report of the Training Wing, Fort Churchill and The Combined Experimental and Training Station, Fort Churchill, DHH 91/171.

⁴⁹ Abstract of Reports on Canadian Army Training, Trials and Tests, Winter 1948-1949, Canadian Army Headquarters, June 1949, University of Toronto Archives, B93-0050, Box 51, File 09.

projections of a massive Soviet invasion of North America.⁵⁰ Sensibly, military and political leaders in Canada and the United States never accepted this extreme position. Most experts, however, considered the massive invasion scenario to be highly unlikely. When asked in July 1947 “about Alberta’s probable role in the event of an enemy attack across the Arctic,” Lt. General Charles Foulkes “decried all the poppycock that has been given out regarding such a possibility.” He went on to highlight: “fifty-Seven pounds of freight to maintain a single man. Can you imagine how many aircraft would be needed to keep an enemy force going in the Arctic. The Arctic wastes are our strongest defence.”⁵¹ “Considering that the distances involved are measured in thousands of kilometres, these represented sound conclusions,” Eyre suggests. “Even in the northwest, which boasted the Alaska Highway, the thought of an adversary invading the most powerful nation in the world by relying on a single road for supply and advance was ridiculous. Credible fears of a massive invasion were laid to rest when military planners of Canada and the United States became familiar with the realities of northern terrain and climate, and its effect upon military manoeuvre.”⁵²

While the threat of a full-scale invasion seemed far-fetched, the Soviet lodgment scenario—with bombers flying over the pole to strike at the North American heartland, and airborne troops seizing airbases in the Canadian North so that the bombers could refuel and re-arm—seemed more plausible.⁵³ As technology advanced and intercontinental bombers improved in the 1950s, the Canadian military envisioned new scenarios where enemy airborne forces assaulted radar stations to disrupt Canadian-American early warning systems. In theory, at least, these threat assessments provided a pretext for scenarios upon which northern exercises could be designed. Thus, while discussions about the likelihood of Northern ground combat operations, and their scale, rumbled in political speeches, staff colleges, professional military journals, and letters to the editor columns of newspapers, the Canadian Army quietly went about the business of learning and practicing how to live and fight in the Arctic and Subarctic.

⁵⁰ See, for example, Eyre, “Custos Borealis,” 165.

⁵¹ *Calgary Herald*, 3 July 1947

⁵² Eyre, “Custos Borealis,” 166. *Halifax Herald*, 9 May 1949.

⁵³ Eyre, “Custos Borealis,” 168. See Horn, *Bastard Sons*; and Horn, “Gateway to Invasion or the Curse of Geography.”

Learning Lessons from Early Cold War Northern Exercises

The training, experiences and experiments conducted at Fort Churchill between 1946 and 1947 assisted in the development of tactical doctrine for northern operations, which the Army soon put to the test through a series of small-scale exercises. Between 21 January and 31 March 1947, for instance, a company from the PPCLI conducted Exercise *Haines*, a winter training exercise in the Whitehorse area in which 50 men of all ranks tested equipment, trained on snowshoes and practiced patrols in the harsh conditions.⁵⁴ A year later, *Haines II* had 150 men conducting training patrols in the same area. Meanwhile, the barren lands surrounding Fort Churchill hosted Exercises *Moccasin* (1947-1948), which tested vehicles in extreme cold conditions, and *Sigloo* (1948-1949), during which signals personnel evaluated communications and associated equipment.⁵⁵

The Canadian Army also sent observers to some of the American exercises held in Alaska (particularly to Big Delta, where the U.S. Army set up its Arctic indoctrination school). For example, eleven Canadian observers attended Exercise *Yukon* in the winter of 1947-1948, and their reports assisted in the formation of tactical doctrine and in the planning of new exercises in Canada.⁵⁶ The U.S. military held other large-scale exercises in Alaska and the Aleutian Islands, involving up to 1500 soldiers, and provided the Canadian military with access to their post-exercise reports.⁵⁷ The lessons learned from these early Canadian and American postwar exercises highlighted that indoctrination training had to be provided to every individual selected for service in the Arctic.

By 1949 very few Canadian personnel had received any such indoctrination training or had any on the ground experience in the Arctic or Subarctic. Looking back on the situation in the 1960s, Dr. J.A. Easterbrook, a scientist posted to Fort Churchill, reflected that “both individually and institutionally, Canadians were ignorant about the North country and how to conduct military operations in it.”⁵⁸ By this point, the three regular infantry battalions of the peacetime Canadian Army had

⁵⁴ Exercise Haines, Whitehorse, December 1947, DHH 91/285.

⁵⁵ Abstract of Reports on Canadian Army Training, Trials and Tests, Winter 1948-1949, Canadian Army Headquarters, June 1949, University of Toronto Archives, B93-0050, Box 51, File 09.

⁵⁶ Minutes of the Permanent Joint Board on Defence, 1947, NARA, RG 59, Entry 1181, Box 15, File 1947; Conclusions Reached as a Result of the Experience During Exercise Yukon, NARA, RG 337, Entry (NM5) 28, Box 381, File 401-410, Arctic Program

⁵⁷ Headquarters, Army Arctic Indoctrination School, “The Friendly Arctic Conference,” NARA, RG 338, Entry 37042, Box 826, File Army Arctic Centre, Arctic Training Doctrine

⁵⁸ Tedlie, “Winter and Rough Weather,” 139.

been trained as parachutists and the Army had styled the three, along with supporting arms and services, the Mobile Striking Force (MSF). While in theory the MSF was a brigade group ready to defend northern Canada, in reality the “brigade” had no designated headquarters and never trained together. Battalion groups exercised independently although a shortage of transport aircraft usually limited parachute training to company-level operations.⁵⁹ The steady stream of exercises initiated by the military to start preparing the MSF for northern operations often reflected these limitations.

In the winter of 1950 the U.S. and Canadian militaries conducted Exercise *Sweetbriar*, a large-scale tactical exercise along the northern part of the Alaska Highway. Over 5,000 army and air force personnel participated in the exercise, which planners designed to test doctrine, clothing, equipment, vehicles, aircraft, and weapons, and to develop standard operating procedures between the two allies.⁶⁰ Although the scenario created for *Sweetbriar* involved an enemy invasion of Alaska, subsequent exercises featured MSF units responding to small groups of “enemy” landing in northern Canada to set up navigational beacons for bombers, to seize airheads to support sustained operations against southern targets, or to destroy radar and radio stations. These exercises often involved parachute assaults, aerial resupply, airfield building, and called for close army-air force cooperation.

As *Sweetbriar* unfolded along the Alaska Highway, Exercise *Sun Dog I* tested an infantry company group conducting tactical movements and patrols, while harassed by a small enemy force, along the treeline and into the Barrens near Fort Churchill. The Army concluded that *Sun Dog* represented the “first exercise of any size, of a tactical nature, to be held in the Eastern Arctic under conditions which are truly Arctic from the climatic and geographic viewpoint.”⁶¹ That July, Exercises *Shoo Fly I* and *Cross Country* explored the problems faced by small infantry and engineer units operating on the snowless tundra outside Fort Churchill. Northern summer exercises would continue to be conducted on much smaller scales than their winter counterparts, usually involving platoons and companies, as opposed to reinforced

⁵⁹ On the MSF, see Horn, *Bastard Sons*, and his chapter in this volume. After 1954 the reality of the situation was recognized by the Department of National Defence when the three independent battalions were styled the Defence of Canada Force (DCF). Reflecting the lessened importance of the North, the DCF was reduced to a single reinforced company per battalion after 1958.

⁶⁰ Eyre, “Custos Borealis,” 169. “Exercise Sweetbriar and Exercise Sun Dog I,” *The Arctic Circular*, Vol. 3, September 1950, 34.

⁶¹ Report on Ex “Sun Dog One,” DHH, 736.033 (D4).

company and battalion groups.⁶²

In 1951, the Canadian Army and RCAF conducted another *Sun Dog* exercise in the barrens northwest of Fort Churchill during winter, while *Shoo Fly II* tested a platoon in summer conditions. During the winter of 1951-1952, reinforced company groups of the MSF circulated through Churchill on Exercise *Polestar*, a four-week period of intensive Arctic training that centred around various enemy lodgment scenarios. In February 1952, *Sun Dog III* tested the skills acquired by several of these units in a situation that had them assaulting an enemy force that had seized an airfield at Kuujuaq (Fort Chimo).⁶³ That summer, three *Deer Fly* exercises allowed small MSF units to conduct summer training around Fort Churchill and Christmas Lake. Meanwhile, between January and July 1952, 135 Canadian and 300 American army engineers at Kluane Lake in Yukon undertook Exercise *Eager Beaver*, building emergency airstrips on frozen lakes in the winter and then on muskeg in the spring and summer.⁶⁴ The importance of air mobility in northern operations had long been a point of theoretical discussion. With *Eager Beaver*, the U.S. and Canadian militaries finally got down to the actual practicalities of training troops in the construction of the field expedient facilities that would be necessary adjuncts to air combat support.

During the winter of 1952-1953, Exercise *Prairie Tundra* provided Arctic indoctrination training to two reinforced company groups of the MSF in scenarios that had the soldiers responding to enemy lodgments in “diversified terrain” above the treeline north of Fort Churchill.⁶⁵ A large-scale exercise called *Bull Dog I* took place in February and March 1953 in the area around Norman Wells and Tulita (then called Fort Norman). After an enemy force captured the airfield at Norman Wells, two reinforced companies of the 2PPCLI, with the support of the RCAF and the Canadian Rangers, deployed to counter them.⁶⁶ In December 1954, *Bull Dog II* envisioned an enemy lodgment at an isolated radio station at Baker Lake and a parachute jump by the Royal Canadian Regiment into the barrens to recapture the station and destroy the enemy. Temperatures below -40°C and winds gusting from 20 to 40 miles per hour, however, eliminated any possibility of a parachute assault. As

⁶² See the documents in this volume. Historians Andrew Iarocci and Matthew Wiseman have explored several of these northern exercises, particularly *Sun Dog I*. See, for example, Iarocci, “Opening the North,” and Wiseman, “The Development of Cold War Soldierly: Acclimatisation Research and Military Indoctrination in the Canadian Arctic, 1947-1953,” *Canadian Military History* 24, no.2 (2015): 127-55.

⁶³ Exercise *Sun Dog III*: Opening Narrative, DHH 181.0004 (D7).

⁶⁴ Eyre, “Custos Borealis,” 170. “Exercise *Eager Beaver*,” *Arctic Circular*, Vol. 5, No. 2, February 1953, 22.

⁶⁵ Exercise *Prairie Tundra* in Lessons Learned: Winter Exercises, 1945-54, DHH 81/675.

⁶⁶ Exercise *Bull Dog I* in Lessons Learned: Winter Exercises, 1945-54, DHH 81/675.

a result, the exercise petered out with the “enemy” still ensconced on the objective.⁶⁷ In *Loup Garou*, the MSF successfully responded to a scenario that had an enemy force operating in the area around Sept Îles, Quebec. Finally, the Canadian military conducted Exercise *Bull Dog III* in the vicinity of Yellowknife between 23 February and 8 March 1955. The exercise simulated the enemy capture of the airfield at Yellowknife, with elements of the PPCLI and Canadian Rangers tasked with wiping out the lodgement. The Army hailed the exercise as clear proof of the workability of the MSF concept, even though many of the issues related to Arctic and Subarctic operations still needed to be adequately addressed.⁶⁸ After *Bull Dog III*, the tempo of northern exercises and training rapidly decreased.

The results of all these northern exercises led the Canadian Army to conclude that “no radical changes from accepted combat principles or tactical doctrine are imposed by conditions of snow and extreme cold.”⁶⁹ Just as it had after the wartime exercises, the Army continued to maintain that “in the barren lands, desert tactical principles apply virtually without change, while in the Yukon and Alaska, jungle and mountain warfare tactics applied.”⁷⁰ Although postwar exercises proved that there would be no major changes to tactical doctrine during deployments in the North, Army planners still crafted what they termed a “special technique of operation” for the region. These techniques included greater initial reconnaissance than in temperate zones and emphasized careful timing, shorter assault phases, the adoption of limited objectives, and the provision of speedy and effective front line relief to active troops. The Army developed almost all of these special techniques to limit the exposure of soldiers to the northern elements.⁷¹ The northern exercises had established, for instance, that troops “heated in the attack will be more liable to the effects of cold,” heightening the importance of immediate post-attack consolidation

⁶⁷ Summarizing the press reports on the exercise that appeared in British newspapers, *Polar Record* concluded that the failure of the infantry to reach their objective indicated that paratroops could not be relied on as an effective striking force in arctic regions. “Canadian Combined Forces ‘Exercise Bull Dog II’, 1954,” *Polar Record* Vol. 7, No. 51, September 1955, 492.

⁶⁸ Final Report, Bull Dog III, DHH 327.033 (D2).

⁶⁹ MGen J.M.M. Hainse, Commander LFDTS Planning Guidance – Land Force Arctic Strategy, 25 May 2009, DND file 3500-1 (G3), similarly notes that “the majority of the tenets of Land Warfare do not change just because the environment changes, but there are obviously some unique factors which may cause amendments to our doctrine, training, and ultimately in the TPPs we utilize during Arctic operations.”

⁷⁰ A Guide to Planning and Execution of Operations in the North, DHH 112.3M3.003 (D2).

⁷¹ Abstract of Reports on Canadian Army Training, Trials and Tests, Winter 1948-1949, Canadian Army Headquarters, June 1949, University of Toronto Archives, B93-0050, Box 51, File 09.

and front line relief.⁷² The Army recognized that this “special technique of operation” would be subject to the tremendous diversity within the general Arctic and Subarctic ecozones, and would involve considerable modification depending on specific topographical, climatological and environmental conditions in specific areas. The northern exercises conducted between 1945 and 1955 had made it abundantly clear that there existed no “one size fits all” type model for Arctic and Subarctic operations.

The after-action reports from the northern exercises conducted between 1945 and 1955 provide a road map of the trials and errors, failures and successes, and lessons learned that shaped the Canadian Army’s experience in the North. These reports give the impression that steady progress was being made on the development and improvement of equipment and other tangible factors, as exercises and tests pointed to technical solutions that would allow “machines, materiel, and men” to overcome the Arctic’s “unique challenges not met elsewhere in the world.”⁷³ There remained, however, a whole layer of intangibles for which it proved more difficult to engineer solutions through iterative processes. Human factors, particularly morale and motivation, remained a consistent problem in northern exercises even when the Army supplied troops with the proper training and equipment. Overcoming this “hostile environment” was not simply a physical challenge, but a psychological one as well.⁷⁴

Post-exercise reports highlighted that the only real solution to some of the more intractable human factors involved in northern operations, and the only way to increase the Army’s effectiveness in the Arctic and Subarctic, was time. It took time to familiarize troops – at every level from staff officers and planners to the individual infantryman – with the Arctic. It took time to teach soldiers how to think about the North and defeat their preconceived fears of its environment. It took time and repetition for soldiers to absorb the necessary training and skills to make the “business of living” in the North more manageable. Finally, soldiers had to spend time in the North, rather than simply passing through the region for short periods, if the Army wanted to significantly improve its Arctic capability.

By 1955 the Canadian Army had spent a decade operating in the Arctic and Subarctic and had developed an adequate northern capability -- although on a more

⁷² Lessons Learned: Winter Exercises, 1945-54, DHH 81/675.

⁷³ Howard quoted in Matthew Farish, “Frontier engineering: from the globe to the body in the Cold War Arctic,” *Canadian Geographer* 50, no. 2 (2006), 181.

⁷⁴ On these themes, see Farish, “Frontier Engineering”: 177-96; P. Whitney Lackenbauer and Matthew Farish. “The Cold War on Canadian soil: Militarizing a northern environment,” *Environmental History* 12, no. 4 (2007): 920-950; and Farish, *The Contours of America’s Cold War* (Minneapolis: University of Minnesota Press, 2010).

modest scale than originally intended.⁷⁵ As its capability improved, however, the changing strategic environment started to undermine the perceived military value of these efforts on the ground. When the Soviets acquired long range jet bombers such as the TU-16 Badger, the MYA-4 Bison and the TU-20 Bear, all of which could be aerially refuelled, the threat of an enemy lodgement in the North declined precipitously while the threat of an atomic strike on the North American heartland grew exponentially.⁷⁶ Defence planners focused on meeting the threat of Soviet air attacks on Canadian and American cities by creating an elaborate radar system in the Arctic. As these concerns and priorities gripped Canadian-American defence planning, a new wave of sovereignty concerns also hit Ottawa – concerns that drew federal officials' attention to the coastline of the Arctic Ocean and into the Arctic Archipelago itself.⁷⁷

⁷⁵ For example, between 1952 and 1954 more than 2200 army personnel participated in training or research at Fort Churchill to form a sturdy nucleus of soldiers with northern experience. Canadian Army Needs at Fort Churchill, 28 January 1955, LAC, RG 24, Vol. 8152, File 1660-15 (Vol.4).

⁷⁶ Maloney, , "The Mobile Striking Force and Continental Defence," 86.

⁷⁷ One striking aspect of the army's intense involvement with the North during the 1950s was the simple fact that all exercises were conducted on the mainland. The army did not venture into the Arctic Archipelago at all. There are obvious reasons for what seems today to be a strange void; most of them are associated with peacetime limitations. An advanced base was needed for administrative and safety reasons. There were simply more settlements with the appropriate facilities in the treeline. Churchill in particular was an ideal training site and in time came to be used almost exclusively for exercises. On the other hand, considering that the main requirement of a support base was that it have a suitable airport, there were three sites in the islands that met this qualification: Cambridge Bay on Victoria Island, Frobisher Bay on Baffin Island, and Resolute on Cornwallis Island. The Mobile Striking Force concept prepared in September 1951 envisioned that the most likely enemy targets for a lodgement in the Archipelago would be these air strips, in particular the facilities at Resolute Bay. If this happened, the MSF striking concept advised against launching an airborne assault into the Arctic islands. "Since we may not be able to use Resolute Bay or carry out an airborne attack on it, it is likely that operations against targets in the extreme Northern Islands will have to be carried out by long range bomber aircraft," the report concluded. Given the logistical nightmare of establishing advanced bases to support an airborne operation, and in view of the limited enemy action that would be involved in any lodgement in the Archipelago, the defence plan called for the situation to be dealt with using an air strike. With these parameters in mind, "The employment of parachutists could then be planned for a much smaller area limited by Canada's north shore line." "Mobile Striking Force Concept," Appendix 'A' to "Mobile Striking Force – Advance Base Requirements," Sept 1951, DHH 112.3 M2 D371. The possible value of a large-scale army exercise as a method of asserting sovereignty in the High North does not seem to have occurred to Canada's leaders at the time nor was there a perceived requirement.

Army activity in the Canadian North peaked in the mid-1950s and thereafter declined until, by the mid-1960s, the military had virtually abandoned the region as a potential operational theatre. Sub-units continued to train episodically at Churchill, but after this military base closed in 1964 this training became increasingly rare. The Canadian Rangers were seriously affected by the diminished army interest in the North and left to wither on the vine. The 1964 *White Paper on Defence*, which did not contain a single reference to the North, gave official utterance to what had become an informal reality. “It is, for the foreseeable future, impossible to conceive of any significant external threat to Canada which is not also a threat to North America as a whole,” the policy document noted, although it allowed that “the minimum requirements for the defence of Canada are: the ability to maintain surveillance of Canadian territory, airspace and territorial waters; the ability to deal with military incidents on Canadian territory.”⁷⁸ While these may have been the minimum requirements, there is no indication that the subsequent structuring of the Canadian Armed Forces involved any specific steps to develop a surveillance or combat capability in the forces appropriate to the needs of the North in the 1960s. Instead, the lessons learned by the Canadian Army in the decade after the Second World War were forgotten, a casualty of the arrival of the missile age and, as historian Andrew Godefroy observes, the fixations of “an army increasingly concerned with fighting on the north German plains.”⁷⁹

Lessons Learned: Yesterday and Today

Canada’s Army clearly has a role in strengthening Canada’s capabilities in the Arctic. Accordingly, the articulation of a concept to inform the manner in which the CA must generate forces for operations in this region is crucial for meeting the unique challenges that it may pose in the years ahead.

-- *Northern Approaches: The Army Arctic Concept 2021*⁸⁰

The Canadian Army’s recent concept for Arctic operations highlights that it must be prepared, at all times, to launch operations anywhere in Canada with minimal notice. “The absence of a military threat in the Arctic is no reason to ignore the potential for natural disasters, transportation accidents, pandemics and other unforecasted events to occur across our North” that exceed the capacity of local responders, it notes.⁸¹ In short, the Army must train and equip forces for a broad

⁷⁸ On this topic, see Lackenbauer, *The Canadian Rangers*.

⁷⁹ Godefroy, *In Peace Prepared*, 91.

⁸⁰ (Kingston: Canadian Army Land Warfare Centre, 2013), 19.

⁸¹ *Northern Approaches*, 3.

range of missions throughout the Arctic and Subarctic, backed by “a robust sustainment system, and requisite command, control, surveillance, liaison and planning capabilities ... for employment across the vast and frequently inhospitable environment.”⁸² The current Arctic concept seeks Army-wide improvement in Arctic capabilities and suggests further efforts to institutionalize land-based Arctic operations as a “normal activity.”⁸³

In the aftermath of Exercise *Sweetbriar* (1950), its Canadian commander, Major General Matthew Penhale reflected on the capabilities the Army had to cultivate to conduct regular deployments to the Arctic and Subarctic. He insisted that the “firm base” for a successful northern deployment had to include tested and adequate equipment, excellent training, experienced soldiers, high morale, superior planning and careful preparation. Plans for northern exercises could leave nothing to chance in the face of an unforgiving and unpredictable environment. While in more temperate zones planning mistakes and omissions could be rectified, in the North they could cripple a deployment. Penhale stressed that the ordinary affairs of a soldier’s life in the North had to be “timed, ordered and controlled in all aspects, and in great detail, 24 hours a day, else confusion will abound.” Every detail possible—and northern operations involved “innumerable details”—had to be covered prior to a force deploying to the North.⁸⁴ Penhale recognized that soldiers had to feel like their leadership had ordered and controlled their every move in the North, and stressed the importance of passing this information on to the troops in the field to boost their confidence.

What made this high level of planning and preparation possible were the lessons learned from previous northern exercises, which played a central role in Penhale’s concept of Army Arctic operations. They informed the planning for *Sweetbriar* and, in turn, the commander hoped that the exercise would continue to “develop standards or yard-sticks for future planning and logistics for this type of operation.”⁸⁵ The outcomes of previous exercises provided command staff with the tools required to face the unforeseen challenges that always crept into northern operations and to embrace the flexibility needed to overcome changing conditions in the field.

⁸² Northern Approaches, 20. Northern Approaches concludes that the Canadian Army must “focus on appropriate levels of force generation for Arctic operations spanning a broad spectrum of missions.” Northern Approaches, 48.

⁸³ Hainse, Commander LFDTS Planning Guidance – Land Force Arctic Strategy.

⁸⁴ Exercise Sweetbriar, Address Given To USI by Major General MHS Penhale, LAC, MG31-G21, Vol. 5, Exercise Sweetbriar.

⁸⁵ Ibid.

The three documents reproduced in this volume highlight the value in not only observing but also distilling and assimilating lessons on how to anticipate, overcome, and accept the unique challenges encountered during Northern operations. We hope that, by making this information more readily available to practitioners and scholars today, the insights borne of cumulative experience extending back to the Second World War will contribute to robust institutional knowledge and support best practices as land-based Arctic operations become entrenched as a normal activity for Army units.

Otterville, Ontario
August 2016

Appendix: Canadian Army Exercises in the Canadian North, 1945-55⁸⁶

YEAR	NAME	LOCATION
1945	Eskimo	Prince Albert and Lac la Ronge area, Saskatchewan
1945	Polar Bear	Caribou and Coastal Range British Columbia
1945	Lemming	Churchill, Manitoba to Padlei, NWT
1946	Musk Ox	Churchill, Manitoba to Edmonton, Alberta, via Cambridge Bay, Kugluktuk (Coppermine) and Tulita (Fort Norman)
1946	North	Alaska Highway
1947-1948	Moccasin	Churchill, Manitoba
1948-1949	Sigloo	Churchill, Manitoba
1950	Sweetbriar	Northwest highway system between Whitehorse, Yukon and Northway, Alaska
1950	Sun Dog I	Churchill, Manitoba
1950	Cross Country	Fort Churchill to Cape Churchill, Manitoba
1950	Shoo Fly I	Cape Churchill, Manitoba to Duck Lake, Saskatchewan
1951	Sun Dog II	Fort Churchill and Nunnalla area
1951	Shoo Fly II	Churchill, Manitoba

⁸⁶ Andrew B. Godefroy, *In Peace Prepared: Innovation and Adaptation in Canada's Cold War Army* (Vancouver: University of British Columbia Press, 2014), 87–88, supplemented by “A Guide to Planning and Execution of Operations in the North,” DHH 112.3M3.003 (D2) (doc. 2 in this volume).

YEAR	NAME	LOCATION
1951-1952	Polestar	Churchill, Manitoba
1952	Sun Dog III	Kuuujuaq (Fort Chimo)
1952	Deer Fly I	Fort Churchill and Christmas Lake, Manitoba
1952	Deer Fly II and III	Fort Churchill and Christmas Lake, Manitoba
1952	Eager Beaver	Kluane Lake, Yukon
1952-1953	Prairie Tundra	Area north of Fort Churchill, Manitoba
1953	Bull Dog I	Area around Tulita (Fort Norman) and Norman Wells, Northwest Territories
1954	Bull Dog II	Area around Fort Churchill and Baker Lake
1954	Loup Garou	Area around Sept Îles, Quebec
1955	Bulldog III	Yellowknife, Northwest Territories

List of Acronyms

ACT	Air Contact Team
APIS	Army Photographic Interpretation Section / Air Photo Interpretation Section
ATC	Air Transport Command
ATLO	Air Transport Liaison Officer
Bde Gp	Brigade Group
Bn Gp	Battalion Group
Bty	Battery
C Pro C Sec	Canadian Provost Corps Section
CDC	Canadian Dental Corps
CIC (US)	Army Counter Intelligence Corps
CJATC	Canadian Joint Air Training Centre
COD	Central Ordnance Depot
Coy Gp	Company Group
CQMS	Company Quartermaster-Sergeant
CSM	Company Sergeant Major
CSRDE	Canadian Signals Research and Development Establishment
DHH	Directorate of History and Heritage (Department of National Defence, Ottawa)
DRB	Defence Research Board
DRNL	Defence Research Northern Laboratory
DZ	Drop Zone
Fd Amb	Field Ambulance
Fd Bty	Field Battery
Fd Coy	Field Company
Fd Sqn	Field Squadron
FOO	Forward Observation Officer
GSO	General Staff Officer
HLI of C	Highland Light Infantry of Canada
HQ	Headquarters
JAPIS	Joint Air Photo Interpretation School
JSES	Joint Services Experimental Station (Fort Churchill)
LAA	Light Anti-Aircraft
LAC	Library and Archives Canada (Ottawa)
LAD	Light Aid Detachment
LMG	Light Machine-Gun
LO	Liaison Officer
LOB	Left Out of Battle

LRP Ops	Long Range Patrol Operations
Lt Bty	Light Battery
Med Sec	Medical Section
MI (US)	Military Intelligence
MMG	Medium Machine Gun
MO	Medical Officer / Meteorological Observer
Mor Sec	Mortar Section
MSF	Mobile Striking Force
NARA	United States National Archives and Records Administration (College Park, Maryland)
OR	Other Ranks
PA Vol	Prince Albert Volunteers
PI (US)	Photographic Interpretation
PPCLI	Princess Patricia's Canadian Light Infantry
PRO	Public Relations Office
R 22e R	Royal 22 ^e Régiment
RAP	Regimental Aid Post
RCA	Royal Canadian Artillery
RCAC	Royal Canadian Armoured Corps
RCAF	Royal Canadian Air Force
RCAMC	Royal Canadian Army Medical Corps
RCASC	Royal Canadian Army Service Corps
RCE	Royal Canadian Engineers
RCEME	Royal Canadian Electrical and Mechanical Engineers
RCHA	Royal Canadian Horse Artillery
RCOC	Royal Canadian Ordnance Corps
RCR	Royal Canadian Regiment
Recce	Reconnaissance
Sgt	Sergeant
Sigs Det	Signals Detachment
Sigs Sqn	Signals Squadron
SOP	Standard Operating Procedure
TAC	Tactical Air Command
Tp	Troop
Tpt Coy	Transport Company
Tpt	Transport
TTIS	Tactical and Technical Investigation Section
UKALS	United Kingdom Army Liaison Staff
WLI	Winnipeg Light Infantry

1. Lessons Learned Winter Exercises, 1945-54

Department of National Defence (DND), Directorate of History and Heritage
(DHH) 81/675

Originally marked "Secret (with enclosures)"

LESSONS LEARNED WINTER EXERCISES

1945 - 1954

EXERCISE “ESKIMO”

LESSONS LEARNED

GENERAL

1 This exercise was a dry-cold, one-sided joint manoeuvre. Detailed facts supporting the findings of this exercise are contained in volumes 1, 2, 3 and appendices titled WINTER WARFARE, RESEARCH PROGRAMME, 1944-45 EXERCISE “ESKIMO”, issued by the General Staff, Department of National Defence, Canada.

- 2 (a) Date: 16 Jan - 25 Feb 1945
- (b) Area: NORTH CENTRAL, SASKATCHEWAN, PRINCE ALBERT, LAC la RONGE area
- (c) Troops Participating:

One Bde Gp composed as follows:

1 RCAC Recce Tp
RCA Fd Bty
RCA Tp LAA
RCE Fd Coy
RC Sigs Det
RCE of C
HLI of C
WLI
RCAMC Fd Amb
CDC Det
RCEME LAD (3)
C Pro C Sec

- (d) RCAF: RCAF participation on this exercise consisted of close support and transport support.
- (e) Aim: On 31 Jul 44, the Minister of National Defence approved the exercise for the study of the following problems in relation to military operations under extreme Canadian winter conditions in typical sub-Arctic terrain:

- (i) Mobility, or extent to which a Force could operate beyond base or railroad, and nature of maintenance echelons required to support progressive extension of operations beyond base or railroad.
- (ii) Most effective scales and types of standard or special transport and equipment required.
- (iii) Movement of troops, heavy equipment and supplies, concealment and camouflage from air and ground, and engineer problems.
- (iv) Conditions affecting supplementary supply by air in conjunction with ground supply echelons, and other conditions of air-ground co-operation and communication.
- (v) Study of the variations from accepted tactical doctrine which would be imposed by the winter conditions of snow and extreme cold.

LESSONS LEARNED - OPERATIONAL

3 Planning and Preparation

Although the emphasis on planning in modern military doctrine is already paramount, there is no situation where it applies with greater force than in winter operations. The sustained morale and combat efficiency of a force, and its depth of penetration towards distant objectives, may be regarded as directly proportional to the time and intelligence devoted to the planning task. A normal part of this planning in all operations is reconnaissance by air and ground. Whereas Europe and many other potential battlefields of the world have been mapped and meticulously reconnoitred by successive generations of officers, much the greater part of Canada (perhaps 95%) has never received such attention. One of the greatest lessons of this exercise is the need revealed for a progressive programme, during the years of peace, whereby all of Canada, up to the Barren Lands at least, will be mapped and reconnoitred by officers of both Reserve and Active lists. It has been said that the soldier makes good the planning errors of the staff. This may be true in ordinary country and in milder seasons. In winter, as it must be faced in the Canadian north, the soldier has enough to do to survive, to move and to fight against both the enemy and winter. The planning mistakes of a staff officer are less likely to be rectified. The sub-Arctic leaves a very narrow margin between successful planning and disaster.

4 Transport Support

Owing to the vast distances and lack of roads in the sub-Arctic, it may in future be considered expedient for a striking force to be conveyed to, and to work from, successive airheads. Although fourteen different types of air support and supply operations were used on this exercise[,], these may be usefully extended in future, both in number and type, to the great tactical advantage of our ground forces. Many serious air problems in winter warfare remain to be solved, including proper use of gliders and glider snatch in winter bush-covered terrain; design of gliders and transport craft to carry oversnow vehicles, including the latest types; effective defence of airheads; compacting of snow for landing heavy transport planes at advanced airfields, denial of lake airheads to an enemy by developing a better type of ice-churning delayed action bomb; accurate indication of bomb line; proper scale of equipment for light airborne raiding detachments.

5 It was evident that normal procedures can generally be followed and standard equipment utilized to supply ground forces by air under conditions of extreme cold.

6 The numerous lakes common to sub-Arctic terrain provide a plenitude of landing grounds for ski-equipped aircraft in winter operations. These frozen surfaces may be employed both for air landing and air dropping of supplies and for air-landed combat troops.

7 Extreme cold accentuates the need for rapid evacuation of all seriously wounded to the rear. Therefore, air evacuation should be employed whenever feasible.

8 Most ration items will be frozen because of the low temperatures. Therefore, it is possible to free drop a wider variety of fresh rations and to simplify packing.

9 Engineer Support

It is now considered that the heavy demands on engineer services during this exercise may, in future, partly be obviated by airportability and air support and by the observance of principles set forth in (14) below. South of the sub-Arctic line, the clearance and maintenance of roads and tracks will, however, continue to place some additional strain on the engineers. One of the unusual functions of the engineers, which was performed on this exercise with great skill, was the clearance of bivouac areas to permit immediate halting of a force in a position of defence with maximum concealment, with orderly routing of supply vehicles, and with prompt movement to the next Starting Line.

10 The limitation of performance in snow of all vehicles, both wheeled and tracked, places special emphasis on road construction and clearing, and an added responsibility on the engineers. Increases in the scale of issue of road building equipment and operating personnel are considered necessary.

11 Engineer road clearing detachments should move with or immediately behind the vanguard, preparing roads as speedily as possible, to avoid too great a separation between oversnow equipped echelons and road-bound echelons.

12 Reconnaissance

One of the distinguishing features of sub-Arctic terrain is the vast stretches of wooded areas devoid of readily recognizable landmarks and so flat that observation on the ground is very restricted. This factor, together with the absence of accurate maps, makes the location and identification of targets and dropping zones difficult and necessitates increased air co-operation for the following tasks:

- (i) Air photography to supplement existing maps.
- (ii) Air observation for artillery.
- (iii) Aerial road reconnaissance for engineers.

13 Because of limitations in cross-country performance of transport in heavily wooded areas, increased reliance must be placed on reconnaissance by air, and dismounted movement of reconnaissance troops.

14 Mobility

Wheeled vehicles tend to render a force road-bound in winter. All fighting and "A" echelon unit vehicles should therefore be tracked. South of the sub-Arctic line there are usually sufficient roads and tracks to warrant the use of wheeled vehicles in "B" echelon and in supporting convoys. North of the sub-Arctic line a commander should be able to depend altogether on oversnow vehicles or alternatively on supply by air. Otherwise his initiative in selecting alternative routes of advance, and in deploying his force, will be seriously restricted. Moreover, his pace would have to conform to that of his engineers and of his road-bound "tail". All vehicles to be used north of the 1000 kg wind-chill line should be winterized to -20°F. Arcticization to -40°F is essential for vehicles used north of the 1400 kg wind-chill line. Failure to do so involves a disproportionate number of man-hours on starting and maintenance and places undue limitations on mobility.

15 Given adequate equipment and training, it is considered that a force can operate in dry-cold continental winter conditions, beyond base or railhead, over equal distances and in the same manner as in a temperate climate. The daily rate of advance would vary widely because of terrain and weather conditions without considering enemy action. The operation of the lines of communication presents no unusual difficulties and maintenance echelons generally would require no changes other than a marked increase in road building equipment and personnel.

16 Movement generally, whether of troops, heavy equipment, or supplies, has be[en] achieved with wheeled vehicles and normal method wherever roads are available but these vehicles are road-bound. Oversnow movement requires tracked oversnow vehicles for transport of all types. Oversnow performance, however, does not mean unlimited cross-country performance. Bush, trees and the unfrozen muskeg commonly encountered in sub-Arctic regions, form barriers which necessitate the use of special equipment and methods, or re-routing.

17 To move on foot ahead of or away from a cleared road or trail, troops require skis or snowshoes. All marching troops, and those who would benefit by the speed normally conferred by skis, should be so equipped. Mounted troops, who usually do not move or fight on foot, should be equipped with snowshoes for dismounted movement and action.

18 Assault Tactics

Deployment for the attack requires more time than in other seasons and in settled areas. The slower pace due to cold; the obstacles of windfall, muskeg and drifted snow; the care required in describing and defining assembly areas, positions and unit boundaries in a country which lacks the normal means of orientation; the exacting demands of bush navigation; the short hours of daylight; all of these and other factors require intensive pre-training of commanders, staff and troops to appreciate properly the factors of time and space. During the attack the use and effect of support weapons is limited by the factors already outlined, and by the deadening effect of snow on artillery shell and mortar bomb. All of the foregoing applies to an attack in force. Attacks by small airborne infantry, or light armoured raiding detachments, especially when directed at L of C installations, offer special advantages and may be regarded as normal in this type of operation.

19 Survival stores such as sleeping bags, tents and heaters, should be carried in "A" echelon vehicles. In certain circumstances they will be carried on, or towed behind, "F" echelon vehicles, or even be snow-packed.

20 Patrols

Flank guards should be supplemented by wireless equipped standing patrols or listening posts at frozen lakes near the axis. Such lakes are potential landing zones and dropping zones for enemy airborne troops.

21 Ground Battle

No variations from accepted combat principles or tactical doctrine are imposed by conditions of snow and extreme cold. This conclusion is based directly on the premise that the force is so equipped and trained that it can attain, and retain, mobility. Experience gained on the exercise suggests certain changes in method of application of accepted tactical doctrine in the advance, attack, defence and withdrawal.

22 In the assault, speed is reduced by difficult footing in soft, deep snow and movement is very exhausting. Particular attention should be given to closing with enfilade fire the interval between the cessation of high-trajectory supporting fire and the arrival of troops on the objective.

23 Attacking troops should be given early relief by reserve troops.

24 Consolidation should be carried out by reserve troops to permit the bringing up of survival stores to protect fatigued attacking troops from the cold.

25 Exploitation should be the role of reserve units.

26 Defence

It is a truism of modern war that every unit and sub-unit, including any formation HQ, is responsible for its own all-around defence, at all times. This exercise illustrates the special difficulties of, and the exceptional emphasis on this rule which will be encountered by a force which may be engaged in operations in the sub-Arctic continental bush-covered plain. In the first place such operations are essentially of the Long Range Penetration type, exemplified by Wingate's first raid into Burma in 1943. The close and difficult country, the emphasis on concealment and deception, the unvarying alertness demanded of every officer and man, the constant expectation of attack or ambush from any quarters, the maintenance of distant objectives - these characteristics are common to all "LRP" operations. In winter, however, in addition to all the above, there is the preoccupation of all ranks with the ordinary problems of survival, of living and moving in acute cold and windchill, of carrying out vehicle maintenance under special handicaps, of more

frequent reliefs for sentries. Mental and physiological reactions are seriously retarded. Moreover the creation of defensive positions is complicated by frozen ground alternating with unfrozen muskeg. All of these factors combine to render defence on the move, or at rest, unusually difficult.

27 More frequent relief of sentries and provision of sentry shelters are considered necessary.

28 Concealment is difficult in snow-covered terrain. Conversely, more opportunities exist for deception in this terrain than in any other.

29 The use of explosives in preparing defences will be increased.

30 Preparation of defences will require greatly increased effort in frozen ground. Ice and ice concrete defences may be substituted satisfactorily, where a position is being held for 24 hours or longer.

31 Every well-frozen lake being a potential landing ground for enemy airborne troops, additional patrols and other protective measures for lines of communication installations are considered necessary. Every detached sub-unit and installation must adopt and maintain an all-around defence, on the move or at rest.

32 Withdrawal

Reconnaissance parties should be increased in size by the addition of advanced guards or working parties for the preparation of defences and erection of tents.

33 Whenever possible infantry of rear guards should be withdrawn by vehicle as withdrawal on foot, even on skis, can be slow and very fatiguing.

34 Camouflage, Concealment and Deception

A high standard of training and versatility in track discipline, and in the use of deception and concealment, is essential to successful operations over snow. Special winter camouflage clothing and equipment is required.

35 A force operating in snow-covered terrain should be completely equipped to conform to either a light or a dark background. With proper attention to equipment, training and camouflage discipline, it is possible for the general concealment of a force to be of a high standard. Many ideal opportunities of presenting to the enemy false signs of strength and intention by the use of deceptive display occur in this type of terrain.

36 Communications

Laying and maintaining line in snow and bush-covered country demands an increased proportion of line laying detachments. In this connection full use should be made of wire laying by aircraft. Provision of good air-ground communications and development of a small portable long wave transmitter for use as an alternative to short wave in the auroral zone are important.

37 Medical

Extreme cold demands for casualty evacuation the highest degree of efficiency and improvisation, as well as special oversnow equipment and adequate personnel. Air evacuation from advance landing fields may be regarded as an essential feature.

38 Meteorology and Topography

Meteorological forecasts are not only essential for the air force but also for ground forces. The experience of this exercise indicates that forecasts were sufficiently accurate, up to 24 hours and even longer, for commanders and staff to plan usefully on a short term basis, both on tactical and administrative matters, where these were conditioned by anticipated temperature, precipitation and wind velocity.

39 Selection and Training of Personnel

The ordinary functions of survival demand more time, energy and skill than under temperate conditions. All troops therefore require intensive pre-training in winter camp craft and movement. Inexperienced troops will require up to ten hours a day, apart from sleep, just to make and break camp and to live. Winter-adapted troops, properly equipped, can cut this time to three hours. Such winter training will require eight to twelve weeks even for troops of combat calibre.

LESSONS LEARNED - EQUIPMENT

40 New Developments Required

For a division in winter operations a requirement exists for tracked oversnow vehicles of all types, comparable in function and capacity with the present wheeled vehicles. This replacement would be necessary only for vehicles operating in forward areas (eg "F" and "A" echelons of combat units, RCASC task vehicles, RCAMC vehicles and RCEME recovery vehicles) and not necessarily for the full scale of transport. Scales of vehicles are generally adequate but additional load-carrying

capacity is required by combat units which would necessitate an upward revision of approximately twenty per cent in present scales. All vehicles require winterizing or arcticizing to ensure quick starting and efficient operation at low temperatures.

EXERCISE “POLAR BEAR”

LESSONS LEARNED

GENERAL

1 Exercise “POLAR BEAR” was conducted as a wet-cold winter operational and equipment trial.

2 (a) Date: Feb 1945 - Apr 45

(b) Area: CARIBOU and COASTAL RANGE OF BRITISH COLUMBIA

(c) Troops Participating: The following troops participated -

24 Fd Rgt RCA
26 Fd Coy RCE
6th Cdn Div Sigs
31 Alberta Recce Reg
1 Bn PA Vol
28 Tpt Coy RCASC
29 Coy RCASC
No 1 Pack Tp Tpt RCASC
25 Fd Amb RCAMC
13 Beach Det RCOC
Pacific Command Coy RCEME
102nd LAD RCEME
96th LAD RCEME
45 Coy CDC
No 10 Coy C Pro C
10 Area Sigs Coy

(d) RCAF participation on Exercise “POLAR BEAR” consisted of transport support and tactical support.

(e) Aim: The aims of the exercise were laid down as follows:

- (i) Mobility or extent to which a force could operate beyond base or railhead, and nature of maintenance echelons required to support progressive extension of operations beyond base or railhead.
- (ii) Most effective scales and types of standard or special transport and equipment required.
- (iii) Movement of troops, heavy equipment and supplies, concealment and camouflage from air and ground, and engineering problems.
- (iv) Conditions affecting supplementary supply by air in conjunction with ground supply echelons, and other conditions of air/ground co-operation and communications.
- (v) Study of the variations from the accepted tactical doctrine, which will be imposed by winter conditions of snow and extreme cold.

LESSONS LEARNED - OPERATIONAL

3 Planning and Preparation

Careful preparation of organizational load tables is essential. Actual tests of all these in training are also a requirement.

4 Careful prior planning between Repair and Spare Parts personnel is essential to proper functioning of repair and recovery services, which should be co-ordinated by a staff officer (EME) at Force Headquarters.

5 While certain information concerning the system to be used and the level of supply to be established was available, it is of utmost importance that such information be accurate, more detailed and available from the start to all concerned. It was also shown to be essential that the system be tested in detail prior to the actual operation.

6 Organization

Requirement for an enemy force on such an exercise is clearly indicated for the creation of a reasonable tactical background.

7 Existing brigade and battalion organizations, with minor modifications, should be retained for winter operations.

8 An increase of 100% in stretcher bearers is suggested for winter operations in difficult terrain since rapid evacuation, so much more important under severe conditions of weather, is essential.

9 Importance of well-organized auxiliary services is stressed for winter operations due to the increased rigors. While energetic and worthwhile work was done in this regard the benefit to be derived from more careful planning was clearly evident.

10 Scale of issue of axes, hand, as an item of personal equipment should be one axe per two men, this axe to be of the Hudson Bay type, 2 to 2½ pound head with 30 inch handle.

11 Transport Support

Air supply is a most efficient means of supplying a force of this type, particularly in areas not accessible to wheeled and tracked vehicles.

12 Evacuation of casualties is a practicable operation with Norseman aircraft under the conditions encountered.

13 Fire Support

Effectiveness of mortar and artillery fire is considerably reduced by the smothering effect of deep snow. Further research on this point is recommended.

14 Accepted methods of tactical employment and deployment of artillery appear suitable for such operations. An oversnow vehicle suitable for moving guns and transporting personnel is, however, an added requirement for maintenance of mobility. Where use of vehicles is not practicable, Pack Artillery appears to be the best solution.

15 Engineer Support

Tactical employment of engineers will be modified only in emphasis in winter under such conditions since all movement becomes canalized into valleys, passes, roads and trails. Hence, the emphasis will be placed on road construction and maintenance, fixed bridging and demolitions.

16 Reconnaissance

Restriction of activity to main roads resulted in chief reconnaissance tasks being advance route reconnaissance and limited cursory search of side roads and trails with close search being ordered at some phases.

17 Mobility

Pack transport units are almost indispensable once a force moves beyond vehicle head in terrain such as the Western Coastal region. Even should weather and a change in the situation not interfere with air supply, pack animals are required to move the force tactically and to transport supplies and equipment on the ground.

18 Organic animal units such as Horse Calvary and Pack Artillery would be more efficient than motorized and dismounted units moved by pack transport units. If use of the latter is necessitated, however, careful planning, co-operation, discipline and proper pack equipment are essential.

19 Pack animals within the signals organization are as important when movement is by animal transport as are vehicles when moving by motor.

20 Movement

Movement of a force operating in deep snow in bush country is canalized to roads and trails.

21 It was found necessary to restrict traffic to the hours when the road was frozen in order to preserve its surface. Movement along a single axis may be stopped completely if this precautionary step is not taken at the earliest possible time after first thaw.

22 Under "break-up" conditions of spring, 4 wheeled vehicles operated with great difficulty. Restriction of travel to the hours between 0100 and 1000 hours daily was necessary to enable such vehicles to continue operation. 6-wheeled 4 x 4 and 10-

wheeled 6 x 6's are suggested for the heavier cargo classes. In any case dual rear wheels are strongly recommended on all wheeled vehicles to be used in winter.

23 Assault Tactics

Tactics to be used are similar to jungle and mountain warfare tactics, with consideration of the added feature of snow.

24 Night operations are practicable under these conditions and thorough training therein is a necessity.

25 Although security measures in general are similar to those employed in any operation, noise and track discipline should receive added emphasis.

26 Slower rate of movement imposed by snow and rough terrain will necessitate modification of present concepts of supporting fire and assault distances.

27 Patrols

Limited visibilities in wooded country indicates the need of more extensive patrolling of a very high standard.

28 Ground Battle

Tactical employment of medical units does not differ from methods used generally.

29 Defence

All round defence of an area is a special problem in deep snow because of the difficulty of moving off roads.

30 Since lines of communication are so much more difficult to establish and maintain, and their disruption has so much more serious consequences under such conditions, it is likely they will be primary enemy objectives in winter warfare.

31 Camouflage, Concealment and Deception

Open fires are to be severely restricted since their smoke, flame and resultant scar create an unmistakable signature.

32 Communications

Standard methods of ground/air communication are considered satisfactory.

33 The limited signals facilities on this exercise indicated strongly that under such shortage not only may staff officers reach erroneous conclusions as to the actual capacity of available means of communication, but in fact, grave incidents may well result. It is suggested that a minimum requirement is three wireless nets and one line for a brigade group on such operations.

34 It is worthy of comment that the best all-round set for performance was the RCAF PN-1A. It is felt that there exists a requirement for a light man-pack set with range comparable to that of Canadian No. 19 set and weight not in excess of 30 pounds.

35 Medical

Best means of evacuating casualties were the snowboat (Akja) and the cargo carrier US M 29 (Weasel) with US M 19 trailer. For long distances aircraft provided the best method.

36 Diseases or injuries peculiar to conditions of terrain and weather experienced present no difficult problems in prevention or treatment.

37 Aid men should be with or immediately behind the troops.

38 Even under such rigorous conditions Nursing Sisters suffer no undue inconvenience or loss of privacy and are an asset to the medical organization.

39 Early evacuation of casualties is of even greater importance under winter conditions and is hampered by snow and difficult terrain.

40 Casualty Collecting Posts may have to be established beyond wheeled transport and several collecting posts or warm-up stations may be necessary along the line of evacuation.

41 Since narrow trails may well be the only means of access to the operational force, the Field Ambulance must be prepared to handle the majority of surgical cases.

42 Selection and Training of Personnel

For infantry, the exercise re-emphasized principles found in all the basic field manuals. All personnel must be trained in the use of snowshoes and an organic unit of approximately one-third the strength of the infantry component is suggested for special training on skis.

43 If the force has previously completed its basic and advanced training, a training period of three months is adequate. This must include training in bushcraft, living in the cold, and a method of travel over deep snow - either on skis or snowshoes. Hardening training for such operation must run concurrently with other special work required.

44 Man-management and interior economy become increasingly important in winter because of:

- (a) The more rigorous living conditions.
- (b) The much more serious results to be expected from neglect.

45 "Drills" for establishing and breaking camp, moving by transport, etc., are of even greater importance in winter operations than at other times, since sudden falls of snow or drops in temperature may have much more serious consequences.

46 An extremely high level of vehicle maintenance is demanded in winter operations, since not only weather, but road conditions will invariably impose greater strain on all equipment and personnel.

47 A proportion of fitters must receive special training in the repair of oversnow vehicles which are not standard issue.

48 Increased individual hazards of winter warfare over and above those imposed by combat demand even more extensive first aid training than usual. In addition to training in basic winter warfare as carried out by other troops, medical personnel require technical training in casualty evacuation, care of casualties, erection of hospitals and sanitation, as they relate to cold weather and difficult terrain.

49 Conditioning of all troops, including medical personnel, to exposure and exercise must be gradual and continuous, up to the standard required for the operation.

50 A syllabus of training for medical personnel is presented, with recommendations for modifications to the usual medical organization (See Exercise "POLAR BEAR" Report).

51 A party of well-trained demolition engineers should be available to go on long range patrols with specialized mountain infantry. In addition, one section should be specially trained and equipped for mountain engineering and rigging to assist in placement of cableways, recovery of vehicles, and in demolitions, and to assist surprise operations over difficult country by any of the combat arms.

52 Administration

Three types of ration were used. The Winter Field Service Ration, in bulk, presented problems in break-down, packaging and cooking for small sub-units and groups.

53 Of the two pack rations the Canadian Arctic Monopack was generally well-liked and considered much superior to the Canadian Mess Tin Ration.

54 Dental detachments could operate well forward under all conditions experienced by fighting troops in winter operations. They are very small detachments, and should be attached to some other sub-unit for administration.

55 A mobile dental lorry can operate in any location where vehicles of its type can move. Where movement off roads is anticipated, dentals will require an oversnow vehicle. When moves are made without vehicles, dental detachments should have pack animals and packers attached permanently.

56 A problem worthy of operational research is the comparison of surfaced maps, British tank maps, US maps and canvas-backed maps, in order to incorporate all desirable features.

57 Laundry facilities should be carefully considered in planning for such operations, and the laundry equipment should be set up as close to the using troops as practicable, not necessarily at base.

58 Drying facilities, particularly for such items as bedrolls, the insulating qualities of which are markedly reduced by dampness in the filling, must receive careful attention. This problem may even necessitate erection of special drying tents or shelters since it is unlikely that the use of open fires in an actual operation would ever be allowable to the extent used on this exercise.

LESSONS LEARNED - EQUIPMENT

59 New Developments Required

Standard Canadian web equipment is not satisfactory for use with special winter clothing. An assault jerkin is suggested.

60 It is thought that any oversnow vehicle should be so designed as to accommodate the load within the vehicle itself without use of sledges or trailers. If trailers must be used, then a tracked trailer is indicated.

61 Seating design and comfort should be considered more carefully in vehicles to be used in winter operations because of increased importance of driver fatigue under more rigorous conditions.

62 With reference to the tracked oversnow vehicles used (US M 29, M7, and the Canadian Snowmobile), a combination of features of the US M 29 and the Canadian Snowmobile Mk I seems to be the ideal. For all three, operation in deep snow was difficult. The M 7 Snow Tractor (US) is too fragile and not suitable for this type of operation.

63 Shelters suitable for repair work must be provided. Improvised shelters may be used but consume time which should properly be devoted to repair tasks.

64 A track-laying vehicle for recovery of oversnow vehicles is required, in the same proportion as medium break-down lorries.

65 A need exists for an organizational tentage unit of the wall-tent type approximately 8 x 14 feet for use as office, stores, etc.

66 A small collapsible wood-burning stove should be developed for use in marquees and 6-man tents by static or semi-static units.

67 A hot-air heater of the Stewart-Warner ground heater type is best suited for heating hospital, surgical and ward tents.

68 Absence of any volume of casualties, real or simulated, prevents conclusive observations as to suitability of scales of issue. However, it is felt that standard medical equipment is suitable but must be supplemented by casualty shelters, winter evacuation equipment, sleeping bags for casualties, and heating equipment.

EXERCISE “LEMMING”

LESSONS LEARNED

GENERAL

1 This non-tactical exercise was the first extensive manoeuvre ever carried out by the Canadian Army over the Arctic barrens.

2 (a) Date: Mar - Apr 1945

(b) Area: CHURCHILL, MAN to PADLEI, NWT, and return, a total of 653 miles.

(c) Troops Participating:

(i) Four officers under command of Maj PD Baird.

(ii) Observers from Department of Munitions and Supply, Mines and Resources, and US Army.

(iii) Eleven rank and file.

(d) Vehicles:

(i) Two Snowmobiles Armoured Mk I

(ii) Two Tractors, Snow M7.

(iii) Two Tractors M-29 (Weasel).

(iv) Ten Sledges Trailer.

(v) Two Komatik Sleds.

(e) Aim:

(i) To obtain information of a non-tactical nature by which to extend Canadian Army winter doctrine from sub-Arctic conditions.

(ii) To provide data upon which to base further development of oversnow vehicles.

- (iii) To explore the barren grounds as an area for further winter exercises.
- (iv) To assist civil development and surveys in the barren grounds.

LESSONS LEARNED - OPERATIONAL

3 Mobility

The exercise proved that travel over the Barren Grounds and coastal sea ice in oversnow vehicles is not difficult. 113 miles were covered in a single day and 653 miles during 10 travelling days. The inland Barren Grounds may be likened to a cold and windswept desert. Conditions there are as different from those of the cold sub-Arctic bush country as are conditions in the African desert from those of the jungles.

4 The exercise proved that the inaccessibility of the Arctic is just another myth and, providing supplies are ensured, operations on the barren grounds which represent one third of Canada's area can be as unhindered as operations on the Libyan deserts. It would therefore seem desirable that for defence purposes Canada should develop further oversnow vehicle types and train personnel to operate in these regions.

5 Comparison between vehicular and dog team travel[,] while not directly made on this exercise[,] can be stated here. The unsupported range of dog team travel is not far short of the 700 miles maximum range of oversnow vehicles. The disadvantages of dogs are:

- (a) They have to eat therefore consume payload while stationary.
- (b) They need specially trained drivers.
- (c) An average of 40 miles per travelling day is good.

Advantages are:

- (a) They can follow tracks, especially their own, in blizzards. Their drivers can also see tracks more readily than from vehicles.
- (b) In emergencies they can travel without food for several days while vehicles cannot move without petrol.

6 Meteorology and Topography

The Barren Grounds are those portions of Canada situated north of the tree limit. This limit crosses Northern Quebec and stretches northwest from the coast of Hudson Bay in the neighbourhood of Churchill to near the mouth of the Mackenzie River. The total area of Canadian Barren Grounds is 1,100,000 square miles, representing 32 percent of the Dominion's area, and including all the Arctic Islands.

7 In winter when the snow coverage extends one foot it is often impossible to distinguish lake from land without digging.

8 The sea in Hudson Bay and elsewhere in Arctic Canada freezes over in winter. A portion of this is termed "LANDFAST ICE", ie, that portion which is solid with the land, the remainder "PACK ICE" which is in motion. The boundary between the two is termed "THE FLAW" (more usually in Canada, the FLOW).

9 The inner margin of the LANDFAST ICE is aground and depending on its thickness and the slope of the shore a varying width grounds every low tide. A hinging effect is thus produced and the ice alongshore is therefore nearly always rough and tumbled, particularly when tides are high. Along the west coast of Hudson Bay between Churchill and Eskimo Point the maximum tides have a rise and fall of 15 feet.

10 In coastwise travel by vehicle in winter there are thus three roads for traffic, any of which may yield the best going:

- (a) The lowland, if marshy or a level snow-covered beach.
- (b) The ice foot, particularly when it has board ice coverage.
- (c) The landfast ice to seaward of the barrier.

11 Although landfast ice moves up and down with each tide, its contours tend to change slowly, especially in late winter and spring, so a road cut through it will stay fairly permanently.

12 When sea ice begins to freeze the platy crystals of ice that form are fresh. Globules of salty brine are enclosed between them and by a leaching process this brine flushes downwards though some gets forced to the surface. Thus the surface of young sea ice is nearly always sticky. This means that snow adheres to it very readily and it is never glare ice, also the friction on sled runners is considerable where they cut through any snow cover to the salty ice surface.

13 In small cracks and leads undisturbed by wind or wave action the surface water is often fresh due to its lesser density; this is particularly noticeable in spring when melting of the ice and snow increases this fresh water content. This accounts for the fact that overflow, if fresh, can cause board ice to be comparatively smooth and glare.

14 Due to the process of its formation thin sea ice is only one third to one half as strong as its equivalent of fresh ice though after a thickness of perhaps 20 inches is reached the leaching process has gone sufficiently far for the ice to be well knit, and for thicknesses greater than 20 inches our present state of knowledge is that for a given thickness there is no great difference in weight-bearing capacity between the two forms of ice. Sea ice of only 4 to 5 inch thickness will bear a man and a dog team with the load on a sledge well dispersed. The rather alarming phenomenon of the ice surface bending can then be noted.

15 Due to the invariable snow cover and slower process of formation sea ice seldom attains a thickness greater than 6 feet in undisturbed conditions, though pack ice through violent motion and rafting can pile up to very great thicknesses. The maximum thickness of landfast ice is not obtained till early May.

16 On this exercise average snow depth encountered was about 20 inches. This is rather more than can be expected in a normal year in these regions. All estimates of average depth are extremely vague since the uniformly windswept condition of the country results in a very uneven snow cover distribution, with bare ridges and accumulations in the hollows.

17 On most of the terrain the snow is hard packed bearing the weight of a man (5-7 lbs per square inch) easily. Expectations encountered were:

- (a) In rough sea ice where deep soft drifts pile up.
- (b) Inland where areas of willow bushes contain soft snow.
- (c) Various areas with breakable crust. On 80% of the going encountered, it may be said that oversnow vehicles with loading of 1 to 1½ lbs per square inch cut in from nil to 3 inches and only rarely did the vehicles become bellied.

18 The wind results in irregular snow ridges forming parallel to prevailing winds. Sastrugi (ridges with over-hanging windward points) are frequent. It therefore makes a considerable difference to travel whether a vehicle heads with or across the

prevailing drifts. The M29 which is particularly susceptible to pitching could only reasonably make 8 mph across drifts, and 12 mph or better with the drifts.

19 “Drift” is the expression normally used, in this country, for blowing snow. “Ground Drift” snakes along the ground, “High Drift” can mean the air filled with flying snow to a height of 30 or more feet. The velocity of wind required to raise a given amount of drift varies throughout the year. On this exercise it was found that a wind of about 12 mph would start ground drift. (In midwinter 4 or 5 mph wind will do this.) Drift affects visibility considerably. On this exercise a wind of about 18 mph cut visibility to about a mile, 25 mph to 100 yards. Winds of gale force, particularly in midwinter, can reduce visibility to 10 yards, even when no fresh snow is falling.

20 In the Barrens there are high steady winds which may average 20 mph for long periods.

21 Temperature alone is no criterion of the effect of weather on the human body, which keeps warm and active only by retention of a layer of warm air around it. The Wind Chill, ie, the combined result of temperature and wind, has been scientifically worked out to show the dry shade atmospheric cooling effect on the body expressed in kilogram calories per square meter per hour.

22 In the Barren Grounds winds are high and there is no vegetation to break the wind. This aspect cannot be stressed too much. In sub-Arctic Canada below the tree line, temperatures may be low but the wind chill factor is low too. Even though wind records show appreciable figures there is always the bush present to break the wind and produce relatively still air, so that frequently wind records from the bush country should be halved to give the true wind chill value. In the barrens natural shelter is completely lacking.

23 Selection and Training of Personnel

Special training is required to enable normal troops to operate safely, eg, construction of snow shelters, route finding, operation of fuel cookers. This is over and above training necessary to fit troops for sub-Arctic winter operations.

LESSONS LEARNED - EQUIPMENT

24 Modification to Existing Equipment

The Canadian armoured snowmobile functioned efficiently but to be a desirable barren ground vehicle it needs the following modifications:

- (a) Much improved petrol consumption.
- (b) Capacity to seat three or four men with sufficient cargo space on the vehicle for carrying personal equipment.
- (c) A snow-proof cover for the interior of the vehicle allowing all-round vision for the Commander.
- (d) Slight reduction in ground pressure.

25 The M29 cargo carrier also functioned fairly efficiently but due to overloading at the start its transmission did not stand up. It would be a useful barren ground vehicle with the following modifications:

- (a) More powerful (truck type) transmission.
- (b) Strengthening of the track idler wheel assembly unit.
- (c) Reduction of the ratio in high range of the rear axle.
- (d) A more durable track link connecting cable.

This vehicle was found more efficient than the snowmobile in the following ways:

- (i) Greater cargo and passenger carrying capacity.
- (ii) Better petrol consumption.
- (iii) Lower ground pressure.

26 Experiments as to the friction qualities of sled transport were carried out. The findings are as follows:

- (a) Friction is less on long narrow runners as compared with shorter, broader runners.
- (b) While variable at 32°, friction increases in a fairly straight line ratio with falling of temperature below this figure.
- (c) Friction increases with speed.

27 In the barren grounds the standard dog sleigh is the Eskimo Komatik, with long narrow runners and a low platform of cross-bars lashed to them. This is shod with steel, whalebone, or frozen peat mud, the latter two surfaces being iced, daily, with a thin film of ice. In spring and fall the steel shoeing is used, but in winter the latter two types are necessary since steel shoeing tends to have far too great friction at temperatures below zero. At a temperature of 10 below, one experiment carried out on Komatiks showed a co-efficient of friction of 0.16 for steel shoeing and 0.08 for iced whalebone at 5-6 miles per hour. At 40 below zero even the runner drags heavily, snow at this temperature being similar in consistency to dry sand.

28 Only one of the Komatiks was constructed firmly enough. The main difficulty encountered was the failure of this type of sled, towed by rope, to track with the turning vehicle, resulting in its striking rocks and breaking its bow. A rigid tow bar on this type of sled would be helpful, since it would be difficult for a steerman to steer it satisfactorily at vehicle speeds as is done when the sled is being pulled by dogs. A further test of this type of sled is recommended for use behind vehicles with low draw bar pull (eg, the M29).

29 The snowmobile sleds at least proved sturdy, though several tow bars broke and tow eyes pulled out. The upturn of the skis became very bent and worn. The sled is heavy (475 lbs) and the coefficient of friction very great (0.2 on hard snow at 10 below at 6 mph). This must be to some extent due to the cross-section of the runners and also to the short base, 5 feet, which defies the principle of long, narrow runners described above. The sled when loaded, and therefore weighing 1000 to 1400 lbs, was impossible to man-handle with less than 6 men even on flat going.

30 Mitts winter shell did not adequately perform the function for which they are intended. A fur mitt, not necessarily of caribou, though this is the warmest material, is necessary in the Barren Grounds in winter. With regard to the trigger finger, it is felt preferable to have an easily removable mitt, perhaps with safety string attached, and use the glove inner liner to fire weapons and discard the trigger finger altogether.

31 Mitts winter liner are well knit and of sturdy construction. However, the trigger finger gets in the way when putting on the mitt together with the mitt winter shell. Recommended that the trigger finger be omitted. Even if fur mitts are issued this item should be taken as well, although its use as a liner for a fur mitt gives no additional warmth.

32 Gloves inner liner wear easily. It is recommended that the glove should be more skin-tight fit.

33 Tins mess rectangular were used uniformly for cooking and eating. When used in the open the large surface area cools too rapidly. It should also have the old type rounded corners.

34 Mess tin, US type, has a high heat conducting capacity and is not recommended as in any way superior to tins mess rectangular.

35 Knives clasp type A is not satisfactory and issue should be discontinued. It is too large, heavy and unwieldy.

36 Cook set, small detachment, was found useful for melting snow, however the square corners are not easy to clean.

37 Container portable, one gal., was found to be unsatisfactory insofar as heat retaining properties are concerned. A more satisfactory type of container is desirable.

38 The housewife is an essential item of issue but should have scissors included.

39 Stones, pocket, sharpening, was found satisfactory, but perhaps unnecessarily large.

40 Caps, winter melton, proved reasonably warm. A peaked ski cap of similar weight material would probably be preferable.

41 Caps, Yukon, were found very warm, but too bulky to be worn under parka hood. They are considered unnecessary when a suitable lined parka hood is available.

42 Caps, ski, US pattern, fit adequately under parka hood, and are recommended for use if of slightly heavier material.

43 Goggles, sun, Canadian type, were unsatisfactory, and are by no means recommended.

44 Goggles, sun, US type, tend to fog up when worn in vehicles, due to insufficient ventilation, and are not recommended.

45 Goggles, sun, browrest type, are judged the best, however slight modification is required to ear stays.

46 Masks, face, chamois, were not found satisfactory since they absorb moisture from the breath and freeze rapidly, becoming very cold and uncomfortable. It is not

considered that any kind of face mask is needed if a satisfactory parka hood providing a warm funnel of air in front of the entire face is provided.

47 Lanterns, hurricane, did not prove too satisfactory, and there is also need for a strong and snow-proof carrying case for them.

48 Cooker, portable, Coleman, kerosene burning, was found to be satisfactory, but suffers from the limitations of being slow cooking for more than two people.

49 Cooker, portable #4, worked excellently for cooking for four to six men, and is recommended, but with a weather-proof carrying case.

50 Torch hand (TL 122B), was found to give an excellent light but was otherwise unsatisfactory. It needs suitable improvements before it can be recommended for issue. The switch must have a positive lock on it.

51 Torch hand pocket, was satisfactory, but should have a positive lock.

52 Matches, water resistant, gave good results but did not light easily in the wind. These would be useful for spring and summer conditions, but in real winter there is no great need for anything beyond the ordinary match.

53 Drawers, long, khaki, were generally worn and found to be satisfactory, however, a double-thickness knee patch would be an advantage and for winter operations underwear should not be khaki for obvious camouflage reasons, if hung up to dry.

54 Vests string, were found to serve the purpose intended, however, modifications are needed to shoulder straps, there should be a closer fit below the armpits, and the length of the garment should be to just below the waist.

55 Shirts, cotton khaki, were found cold to put on in sub-zero temperatures. A shirt, of pattern of the US Army shirt, wool, OD, would be preferable.

56 Suspenders issued were found not elastic enough and it is recommended that a belt be used instead.

57 Sweaters, high neck, were found satisfactory though the buttons can be hard to do up with freezing fingers. A roll top is suggested.

58 Bags, container sleeping bag, become very hard in the cold and tear easily. A canvas bag after the pattern of Kit Bag Mk III is much preferable.

59 Covers sleeping bag, water repellant, are not recommended. There is need for a stronger and waterproof cover.

60 Parka coat, Canadian, is sturdy and pockets are found to be adequate. The hood, however, is very unsatisfactory. It should be fur-trimmed in order to retain warm air and from the side the wearer's nose should be invisible. It should also be lined for further warmth.

61 Parka, field pile, US Type, is not satisfactory and should have the same modifications to hood as for Item 60.

62 Overalls, combination, are suitable if hip pockets are added, however, where windproof outer clothing is the normal rule they are probably superfluous.

63 Bags, Kit, Mk III, should be slightly enlarged in diameter.

64 Rucksack, steel frame, was found to be far from snow-proof, and a light flap should be installed in the mouth as in the Kit Bag Mk III.

65 Pistol, 9 mm Browning, gave good performance but some method of preventing the rear sight from moving forward while being fired should be adopted.

66 Covers, breech, rifle, were not satisfactory. An overall cover with drawstring at the rear is recommended.

67 Boots, mukluk, rubber sole, were found quite adequate if kept dry, but much discomfort was experienced by melting snow. It is recommended that reduction be made of the weight of the sole and possibly velanized uppers of slightly heavier canvas.

68 Mocassins, caribou (hairy), are easily spoiled by wetting, and are not recommended as practicable.

69 Tents, six-man, were not satisfactory, and the following recommendations are made:

- (a) A stronger, non-collapsible pole.
- (b) A flap at least 18" wide and continuous at the corners around the bottom for weighting and snow-proofing.
- (c) Attachments for 3 guy ropes from the top of the pole for gale conditions.

- (d) Guy ropes provided with sliders so they can be tightened without removing pegs.
- (e) Double metal pegs extended to the point.
- (f) Less inflammable liner.

70 Shovel, snow, short handle, is not recommended. A long handled, large and flat-bladed shovel is required with mechanical transport.

71 New Developments Required

Future development should concentrate on at least two types of vehicle, a light reconnaissance vehicle capable of carrying 3 or 4 personnel and equipment and a heavier type which by itself could fulfill the functions of a 15 cwt and with trailers fulfill the functions of a 60 owt. It is concluded that with the major improvements suggested oversnow vehicles could have a maximum range for unsupported operation of 700 miles which must be compared with the range of slower moving tractors of two to two-and-a-half times this figure.

72 Any tracked trailer design should have a payload to weight empty of at least two to one, eg, weight unloaded 900 lbs, payload 1800 lbs.

73 Equipment Satisfactory

Mitts, caribou skin, were found to keep the hands warm and were good for driving and mechanical work in sub-zero weather. They are simply to take off and put on quickly.

74 Mugs enamel, 3/4 pint, were found satisfactory, and are recommended for issue.

75 Knives, clasp, new design, type B, were completely satisfactory.

76 Bags, food, film were not used for their design purpose, however, were found useful for keeping safely dry wallets, papers, etc, and as waterproof covers on ignition systems on vehicles. It is considered desirable to issue for such alternatives.

77 Caps, comforter, new type, give extra protection to the face and were satisfactory.

78 Candles, wax, give good light, and are recommended for issue on a limited scale.

79 Tablets, fuel, trioxane, are essential for pre-heating kerosene burning stoves.

80 Undershirts were found satisfactory.

- 81 Squares neck were found satisfactory.
- 82 Supporters athletic were found satisfactory.
- 83 Bags, sleeping, Arctic, were found adequately warm for the conditions encountered.
- 84 Skins, caribou (undressed) were found to be one of the greatest comforts of the exercise. Some skin, of which caribou is the best, considered necessary. Tent ground sheets and insulating pads can then be withdrawn.
- 85 Windproof trousers, Canadian, were found quite satisfactory.
- 86 Parka caribou, were found very satisfactory in providing guaranteed warmth, especially for the face. It is recommended that their principles of construction be applied to issue parkas.
- 87 Battledress blouse, velanized, was found satisfactory. The velanizing served to shed all snow met with on this exercise.
- 88 Battledress trousers, velanized, were found satisfactory.
- 89 Compass Prismatic, Mark III, was found quite adequate.
- 90 Binoculars as issued were found satisfactory.
- 91 Socks, GS, 3 lb[s] and Socks Heavy, 6 lbs were on the whole satisfactory, but it is recommended that men should take the same size of each.
- 92 Socks, duffle, were found adequately warm.
- 93 Socks, cushion sole, met with general approval.
- 94 Insoles mukluk (blue), are a good serviceable insole about which no complaint was made. Two pairs are necessary for extreme cold.
- 95 Shoepacks, Canadian type, were satisfactory when the temperature was warmer than plus 10.
- 96 Boots, ski mountain (US), were found satisfactory and are recommended for marching troops in temperatures above minus 10.

97 Saws rip, 24 inches, are necessary for cutting snow blocks for constructing walls, shelters, and igloos. They are considered essential for barren ground operations.

EXERCISE “MUSK OX”

LESSONS LEARNED

GENERAL

1 This was a non-tactical exercise. An initial training period for all personnel was held at Camp Shilo, Man. Following this, six weeks were spent in advanced training at Churchill, Man. During this latter period, organization and training were tested by short preliminary exercises on the barrens.

- 2 (a) Date: Feb 46 - May 46
- (b) Area: CHURCHILL to EDMONTON, via CAMBRIDGE BAY, COPPERMINE and FORT NORMAN, a total of 3,130 miles.

- (c) Troops Participating:

There was a total of 24 officers and 239 OR on this exercise, as follows:

Moving Force	33
Baker Lake Force	9
Base Force	188
Loran Increment to Base Force	33

- (d) A number of military and civilian scientists and observers also accompanied the force.
- (e) Supplies for the force were delivered by RCAF.
- (f) Transportation consisted of 12 snowmobiles and 3 weasels.

- (g) Aim: The aim of this exercise was to study movement and maintenance in differing cold weather conditions and in particular:
- (i) Army Air Force co-operation.
 - (ii) Mobility of oversnow vehicles under a wide range of winter conditions, beginning on the barren grounds and terminating in the spring in the northwestern bush country.
 - (iii) Methods of air supply, including the possibility of establishing temporary landing strips on the barren grounds.
 - (iv) Certain technical research projects related to Arctic warfare.

LESSONS LEARNED - OPERATIONAL

3 Organization

There appears to be a requirement for a light aircraft for use before proper lines of communication are established.

4 Mobility

The present vehicle has the mobility required for winter operations in this country but is not completely satisfactory. A series of vehicles ranging from light reconnaissance to heavy load carriers is required before operations in all seasons will be possible. This series should have the oversnow capabilities of the present vehicle but should be floatable.

5 Vehicle maintenance points should be located at air bases at 500-mile intervals with intermediate caches and maintenance shelters at 100-mile intervals. The vehicles should carry enough fuel to travel unassisted between caches and should be reliable enough to travel between bases without air support. Air support should be reversed for an emergency.

6 Navigation

It has previously been stated that navigation across unmapped stretches of the barrens was equivalent to navigation of a ship at sea. The experience gained on this

exercise suggests that this statement be modified since the general rule appears to be that a straight course cannot be kept by oversnow vehicles for any great distance owing to obstacles encountered.

7 Small military bodies operating in unmapped territory, or in mapped territory of poor relief in winter, should be commanded by officers who can handle and calculate position from a Bubble Sextant of Type 9 or 9a.

8 Training and experience should be given to all such officers in normal map reading and in direction finding by sun and stars. Dry card compass should be issued down to the smallest detachment that may have to operate on its own more than one mile from any other body of troops. LF LORAN, in its present stage of development, is not considered a valuable method of position finding owing to the complications of equipment and operation involved for ground troops. It is, however, considered extremely useful for any aircraft operating in the north and isolated ground detachments could ask for LORAN position to be given them by aircraft overhead.

9 Communications

All oversnow vehicles should have two-way radios linked with base installations. Radios should be suitable as homing beacons for aircraft and should have Direction Finding loops for navigation.

10 The WS Cdn No 52 used with the radio-compass of the aircraft worked very satisfactorily as a homing device.

11 Medical

In training and indoctrination of the main factors from a medical point of view are prevention of snow blindness, frost bite and trench foot.

12 The cab of the present snowmobile was not adaptable for medical purposes, and it was impossible to stow equipment in a manner which allowed it to be immediately accessible.

13 Meteorology and Topography

All meteorological instruments to be used in the Arctic should be thoroughly winterized.

14 The following are recommendations relating to meteorological programme with moving force:

- (a) Improve reporting programme by regular halts of 10 to 15 minutes, to permit the weather observer to make accurate observations and deliver the coded message to signals.
- (b) Weather vehicle should be near the signals vehicle to facilitate handling of both reports and forecasts. It should have inter-communication with lead vehicle and signals vehicle to provide information such as used in the "Sitrep", altimeter settings, surface wind speeds, etc, required for air supply drop and landings.
- (c) Forecasts should be delivered to the Meteorological Officer for his interpretation. He should then advise the Force Commander of the anticipated weather.
- (d) A forecast issued late at night and at mid-day would be more useful in preparing and breaking camp.
- (e) Instruments which can be read from inside the vehicle are recommended for this type of travel. An astrodome fitted on the top of the vehicle would improve observations.

15 Due to the nature of terrain in the winter and the numerous lakes, the force was able to pick out a landing strip for aircraft rapidly, with little or no preparation. Generally speaking, the higher the latitude the less snow cover was experienced and, therefore, less preparation was necessary.

16 Selection and Training of Personnel

A crew of an oversnow vehicle should consist of a minimum of three, one of whom should be a mechanic, one a wireless operator and all capable of driving.

17 It should be stressed that normal training must be completed prior to the specialized training for this type of climate.

18 Signal personnel, preferably volunteers, must be carefully selected for ability and physical fitness. Operators must be top rate code men, able to send and receive with gloves on and copy code in vehicles on the move. Instrument mechanics and electricians must be familiar with the wireless sets being used. Signal personnel

should be trained in their duties prior to an exercise to enable them to participate in the complete general training given to other members of the expedition.

LESSONS LEARNED - EQUIPMENT

19 Modification to Existing Equipment

Although it is advisable that troops operating in the barren grounds during winter should be trained in the cutting of snow blocks and construction of shelters and igloos, and efficient tent will give ample protection. The size of this tent depends on the number of men required to be housed, but the tent used should have the following modifications:

- (a) Cotton liner.
- (b) Wider snowflap.
- (c) Pegs at door opening.

20 For more extended tactical manoeuvres or operations in the barren lands further shelters for repairs, maintenance and drying of equipment will be essential.

21 A satisfactory parka for winter motorized operations in the barrens would require:

- (a) Outer material light and flexible, equivalent to "Byrd" cloth.
- (b) A lighter and more flexible liner than that in the RCAF parka.
- (c) Full-length front opening and pockets with windproof closure operative with mittens.
- (d) Modified drawstring assembly to permit easy adjustment when wearing mittens.
- (e) A closure at bottom of hood that gives greater protection from wind than the present buttons.

22 The string vest is a very useful piece of clothing worn by nearly all the men on the expedition, but could be improved by fitting to cover a greater area of the body. After use they shrank so as to expose a large area of chest.

23 The neck square is much too short, but would be adequate if made longer.

24 The following modifications are required for the parka hood:

- (a) Fur having longer, stiffer hair similar to wolverine, so that most of the frost can be scraped or beaten off.
- (b) A means of securing the hood snugly around the face and manipulating it easily with heavy mittens. Outer edge reinforced as in Craft hood.
- (c) A means of holding the front of the hood in place with the least possible use of a drawstring.

25 The following modifications are required for handguns:

- (a) An extremely light outer mitten to be worn over a work mitten with a liner, and capable of being slid on and off easily.
- (b) A long, wide stiff gauntlet which can be slipped over the sleeve and secured with a very short wristlet fitting up inside the sleeve.
- (c) A light gasoline proof mitt that will remain pliable in temperatures of -40° F to -50° F.

26 The mukluk should be modified by lightening of the sole, use of a rubber that does not stiffen with cold, strengthening the canvas upper, and permitting a better fit over the instep. An all-rubber snowpack should be developed.

27 Considerable shifting of the sleeping-bag material occurred and might be lessened by inserting partitions in the tubes.

28 The knife and fork issue was seldom used. Most of the cutting was done with spoons and pocket or sheath knives.

29 The issue snow knife was used a great deal, but would be improved by making a longer handle similar to the Eskimo knife.

30 The snow now could be improved by making a pointed end, providing easier penetration into the hard-packed snow and a longer handle opening for use with mittens.

31 The following modifications are necessary in order that the Penguin snowmobiles can be used on exercises in northern Canada:

- (a) The cooling system must be redesigned to permit operation with a safe margin at ambients of 80°F.
- (b) A suitable air cleaner should be provided for for spring and summer operations.
- (c) The overall gear ratio should be altered to reduce the minimum speed in top gear by about 25%. This would permit continuous operation in higher gears and should reduce hunting.
- (d) Mechanical advantage of steering linkage should be reduced and all steering brake band adjusting yokes should be replaced by the modified part.
- (e) The pitching characteristic of the vehicle should be reduced if practical.
- (f) The cab should be completely redesigned with due attention to physiological consideration of personal comfort, riding position, location of instruments and controls and ingress and egress. Appearance is un-important. Rear vision, heating, windshield cleaning, and protection from toxic fumes are essential.
- (g) The generator should be fitted with charging voltage at idling speed.

32 The following conclusions may be drawn from the performance of sleds on this exercise:

- (a) Net weight payload and drawbar ratio was poor.
- (b) Runners are too short for drifts on sea ice and barren lands, causing excessive pitching.
- (c) Runners are too weak for hard drifts and rocky country.
- (d) Suspension system and method of attachment of runners are excellent from the point of view of shock resistance and replacement.

33 Night driving brought out the need for a reliable lighting system. Whether because of inferior quality bulbs, high voltage, vibration of the vehicle, or the extreme cold cannot be said, but the replacement rate of spotlight bulbs of 60 watt rating became troublesome.

34 The following recommendations are made with regard to eye glasses:

- (a) Neutral density glass should be used.
- (b) Should be more strongly constructed as the present issue crack and break easily in extreme cold.

35 The present oversnow vehicle has the mobility required for winter operations in this country but is not completely satisfactory. A series of vehicles ranging from light reconnaissance to heavy load carriers is required before operations in all seasons will be possible. This series should have the oversnow capabilities of the present vehicle but should be floatable.

36 New Developments Required

The issue flash light was inconvenient to use because of the long battery cord. Low-temperature batteries should be developed.

EXERCISE "NORTH"

LESSONS LEARNED

GENERAL

- 1 This exercise was conducted as a military reconnaissance of the Alaska Highway.
- 2 (a) Date: 26 Aug 46 - 8 Sep 46
- (b) Area: ALASKA HIGHWAY

(c) Troops Participating:

4 officers from HQ, Western Command
2 Active and 6 Reserve officers from Military District No
11
3 Active and 21 Reserve officers from Military District
No 13
44 OR , Active and Reserve from Military District No
13

(d) Six representatives of the press and radio also accompanied the force.

(e) Transportation consisted of 33 vehicles.

(f) Aim: The aim of the exercise was to:

- (i) Familiarize certain representative officers of the Reserve and Active Force with the Alaska Highway and its adjacent terrain.
- (ii) Select areas which could possibly be utilized for training at some future date.
- (iii) Gather data giving specific information relative to the north country.

LESSONS LEARNED - OPERATIONAL

3 Organization

The type of unit or group best suited for the Highway and the defence of its installations must be completely mobile, the Armoured half-track vehicle should form the basis of lifting infantry, and the unit should be well supplied with LMCs and include a certain number of Heavy Machine Guns such as the Browning .5. It was agreed that the Motor Battalion and its sub-units were the best suited organization now existing in the Canadian Army.

4 Armoured Cars should be an intrinsic part of the team or at least available. It is considered that a troop would be sufficient with each combat group.

5 Field artillery would be invaluable.

6 Local inhabitants who know the country, irrespective of their age, should be enrolled as guides.

7 Tank Support

Tanks would be very valuable in giving fire support, and in particular, for air field defence. Transporter should be used unless a lighter tank such as the M-24 could be employed.

8 Engineer Support

Tasks envisaged for Engineers are as follows:

- (a) RCE detachments to be included if the task required demolition, bridge repair or river crossing.
- (b) That Pioneer elements of the Infantry, if properly trained, would be capable of functioning efficiently in many instances.
- (c) That Engineer units should be available at properly spaced intervals to work as and when required, and to avoid breaking these units up into penny-packets.

9 Patrols

Aside from normal combat training, all ranks should be highly skilled in patrols off the road, and often times over mountain ranges.

10 Light aircraft should be employed to put patrols on the ground quickly.

11 The arms should be as light as possible. It was the unanimous belief that the .30 US carbine which is light, and would allow the maximum of ammunition to be carried, would be the best all-round weapon.

12 Patrol leaders must know the characteristics of a suitable landing place.

13 Defence

Each major installation should have a plan of defence and one of attack in the event that it should be temporarily occupied.

14 Generated smoke on the air landing strips would prevent the possibility of landings if it could be emitted in time, by reason of the fact that these fields are shut in by woods, and the pilots could not see, and this is of course, true in the North country.

15 There should be some form of movable barriers which could be placed on the landing strips to wreck aircraft coming down. The old type of Grizzly tanks, which were not to be a permanent part of the Canadian Army, would serve this purpose, and three or four could be used as a permanent fixture on the principal airfields, and manned by RCAF personnel if need be.

16 Selection and Training of Personnel

Training on how to exist in the country, particularly in the winter time, was a fundamental necessity.

17 Training in ambush, and working in small fighting patrols through undergrowth and in mountainous regions so as to work right as a team in a coordinated operation would be very valuable.

18 Training in vehicle maintenance should descend to all levels and not entirely to drivers and mechanics.

19 Training should include woodcraft and a simple method of signaling to aircraft.

20 The Highway had a great many "off-road" training areas which could be utilized by both the Active and Reserve Force.

21 Administration

Dealing more specifically with the type of Motor Transport required, emphasis was placed on the Armoured half-truck, particularly during the moderate weather. During the winter months it was fully recognized that enclosed vehicles were a vital necessity. Due to lack of specific information relative to the snowmobile and its availability, opinion was that the half-tracks should be enclosed and conditioned for winter operations until something better was forthcoming.

22 Hutt accommodation varying from 100 to 1000, is provided at frequent intervals by abandoned construction camps. These have been constructed in military style is that they consist of large barrack rooms, office buildings, mess halls, and frequently recreation rooms. With few exceptions, the camps have been stripped of

all stoves, electrical fixtures, and furniture. Certain camps located near populated localities have been damaged by removal of windows and flooring, but generally they afford suitable temporary shelter for short duration halts.

NOTE:

Main report also contains following general information on the Northwest Highway System:

- (a) Accommodation stats - Appendix "D", Annexure 1.
- (b) Airports & strips - Appendix "D", Annexure 3.
- (c) Petrol & Storage Tanks - Appendix "D", Annexure 4.
- (d) Water Points - Appendix "D", Annexure 5.

EXERCISE "MOCCASIN"

LESSONS LEARNED

GENERAL

1 During this exercise on RCASC trials some supplied troops and tested equipment used.

2 (a) Date: Dec 1947 - Nov 1948

(b) Area: CHURCHILL

(c) Troops Participating:

23 Transport Coy - 2 officers
9 OR

(d) Vehicles: 56 Caterpillar tractors
Athey tracked trailers (6 ton)
Sleighs, commercial (10 ton)

Wanngans
Bombardiers
Penguin MI II

- (e) Aim: The aim of the trial was to:
- (i) Determine the practicability of using tractor trains in the establishment of a line of communication in winter operations in the north.
 - (ii) Train RCASC personnel in the maintenance and operation of tractor train transport under Arctic winter conditions.
 - (iii) Provide test data and trained personnel with knowledge of the operation of ground transport under Arctic conditions adequate for instruction of additional personnel to conduct similar operations.
 - (iv) Test equipment used during the trials.

LESSONS LEARNED - OPERATIONAL

3 Planning and Preparation

Early planning is essential for any future northern exercises.

4 It is most important that an advance party from trials teams be sent to Fort Churchill before the winter sets in to ensure all equipment, tools and spare parts as to availability and condition.

5 If future operations are to be undertaken a separate establishment should be formed and personnel selected for continuous employment on trials teams, including clerks, welders, blacksmiths, carpenters and motor mechanics.

6 Mobility

It is considered practical to employ tractor trains in the establishment of an L of C in winter operations in the northland, as they can operate under the most severe winter arctic conditions.

7 Oversnow vehicles must be provided for the purpose of transporting personnel and equipment, also to contact tractor trains on the trail in case of mechanical failure, illness, change of orders, etc.

8 Communications

Long range wireless sets must be provided.

9 Any oversnow vehicles must be equipped with wireless.

10 Complete wireless communications, capable of covering the area to be travelled, should be established for all operations.

11 Selection and Training of Personnel

The operation of tractor trains requires highly trained technical personnel as all units must be self-sustaining and capable of performing all necessary repairs to equipment when operating at distances from base.

12 It is recommended that diesel tractors D6's and D7's be embodied in the training vehicle establishment of the RCASC School, Camp Borden, and that a course of instruction on the maintenance and operation of this equipment be made available to RCASC personnel.

13 All personnel operating tractor trains should be given an Arctic indoctrination course to include first aid, navigation, map reading and snow reading.

14 Administration

Repair facilities and stocks of spare parts for all equipment must be adequate and readily available at base otherwise the maintenance of the troops is seriously affected.

15 Clothing and equipment for use in the Arctic must be drawn under the supervision of an officer who is responsible for ensuring that the items issued are in good order and fit properly. This is most important.

16 It is recommended that a building or substantial shelter be allotted or supplied for maintenance and repair. This shelter should be large enough to accommodate at least three tractors.

17 Fresh rations were found to be satisfactory for tractor train operations under winter conditions.

LESSONS LEARNED - EQUIPMENT

18 Equipment Satisfactory

The D6 Caterpillar tractors were most satisfactory as prime movers, but should be supplemented with D7 for large tonnage hauling.

19 Modifications to Existing Equipment

Disadvantages should be very easily overcome by modification in construction of the Bombardier. It is therefore recommended that further tests of a modified version be carried out.

20 The Penguin MK II proved reasonably satisfactory, but was found to be very slow and extremely tiring on long trips due to excessive pitching.

21 The Wannagan is a reasonably satisfactory vehicle handling well on the road and on trails but needing modification of the body and of the sleighs.

22 The Athey trailer is considered unsatisfactory for tractor train operations.

EXERCISE "SIGLOO"

LESSONS LEARNED

GENERAL

1 This exercise dealt with technical tests and user trials conducted by Directorate, Royal Canadian Corps of Signals (D Sigs) and Directorate of Electrical and Communication Development (DE & CD) Trials Team. The trials were divided into technical tests on prototype equipment and user trials on proven equipment.

2 (a) Date: Winter 1948-49

(b) Area: CHURCHILL

(c) Troops Participating:

Seven officers and thirty-two OR.

Two CSRDE engineers accompanied the troops.

- (d) RCAE: JSES detachment materially assisted the conduct of the trials by providing aircraft to airdrop replacement parts required by the trials.
- (e) Aim: The aims of the trials are as follows:
- (i) Radio wave propagation and earth constant measurements.
 - (ii) User trials and investigations of VHF with AN/TRC radio relay equipment. (This equipment was not made available, therefore no tests were carried out.)
 - (iii) Comparison trials of low frequency and high frequency radio sets.
 - (iv) User tests on dispenser type coils of field cable.
 - (v) User tests on lightweight barrows drum and determine cable laying drill and technique.
 - (vi) User tests on Wireless Set Cdn No 29. Installations in Snowmobiles Penguin Mk II.
 - (vii) User tests of Signal Wannegans.
 - (viii) User tests on cold temperature type primary batteries.
 - (ix) Investigation into the use of low frequency wireless.
 - (x) Investigation into the use of unattended Signal equipment.
 - (xi) Design proving trials on cold weather wire and cable.
 - (xii) Tests on experimental steam electric generator under arctic conditions.
 - (xiii) Design proving trials on mobile frequency shift, transmitter exciter and receiver adaptor.

- (xiv) Tests on batteries.
- (xv) Design proving trials on sleds cable layer and sleds signal shelter.
- (xvi) Design proving trials on chests signal.
- (xvii) In the normal course of the trial many other items of equipment and clothing were used. Reports on these items are also included herein.

LESSONS LEARNED - EQUIPMENT

3 Communications Equipment

The WS Cdn 29 is a suitable set for use in the sub-Arctic as a mobile station when mounted in a metal bodied vehicle. However, it should be thoroughly checked and arcticized with the proper lubricants to avoid the sticking of relays and motors before being put into service in the sub-Arctic.

4 The WS Cdn 52 gave an excellent performance on frequency 2054 kcs. 100% communication was established between the three static stations on RT at all times during the three varying stages of distances. The travelling vehicles operating on 2054. maintained good RT communication up to approximately 50 miles, but beyond this distance communication was undependable. The carrying temperature from minus to plus degrees caused a great deal of condensation on the metallic components of the set and chassis. Trouble was experienced in the armature of the dynamotor which shorted and several condensers shorted due to collection of moisture.

5 The British Wireless Set No 88 proved very satisfactory except for one or two component troubles which were due not to the cold but to heavy handling which it would receive in any theatre. The dry batteries performed well but ceased to function if they became cold soaked. This took about 10 hours at a temperature of -25° F. The battery was normally carried in the parka pocket where some protection was provided. This set is well suited to use in cold weather conditions and extreme cold produces no operating or other difficulties except is the case of dry batteries.

6 The Wireless Set C43 and long wave transmitter effectively blocked out all reception on the WS Cdn 52. The WS Cdn 52 was used for propagation tests and for

controlling out stations, and in vehicles moving up and down the trail. Therefore the amount of time available for long wave and RTT transmissions was limited.

7 Research should be carried out to develop a form of wave block for receivers, in order that the transmitters will not interfere with reception.

8 More time should be devoted to the development of the 33-6-A receiver. A noise limiter might be a worthwhile addition.

9 Hydrometers, for use in the sub-Arctic should be capable of registering specific gravity over the range of 1150 to 1450. Inside the hydrometer should be incorporated a thermometer capable of registering the temperature of the electrolyte over the ranges of -50° F to 120° F. These are most essential in order to obtain accurate readings of the condition of the electrolyte in a lead acid cell.

10 The RCA meter was unserviceable in temperature below 20° F because of the uninsulated bias batteries freezing and failing to keep constant readings on the meter.

11 The Ferris meter was generally satisfactory if not left outside for more than twenty minutes. At temperatures below 0° F the controls would freeze and become unmoveable.

12 The sound powered telephone worked very satisfactorily under all conditions. No increase of speech volume was encountered between warm and cold operation. However, a thin membrane, which will not be affected by extreme cold temperatures, will have to be placed over the microphone to prevent moisture from the breath condensing in this component.

13 Generally speaking, the Trailer, Sled, Cable Layer, Type 52-4-A, is considered satisfactory for laying field cables under sub-Arctic conditions, with modifications.

14 The Barrows Drum, WD Mk II, Arctic Light Weight, Type 20-4-0, is considered satisfactory. It was found possible to manhandle the layer reasonably well. However, it is recommended that the magnesium clamps on the centre spindle be replaced with brass or steel and that the drive ratio be increased from 1:1 to 2:1 to enable faster reeling in.

15 The Trailer Sled Signals Shelter 52-3-A came through the trail test with a remarkable performance. The last 40 miles provided the most rigid test available in this part of the country. At no time was any of the equipment installed dislodged or damaged except for minor wiring faults. The Signal Shelter as provided, with small

modifications, is of correct dimensions and construction to provide a mobile signal shelter for use in sub-Arctic country.

16 The requirement for a satisfactory mobile RTT unit still exists. It is suggested that further attempts should be made to approach a satisfactory unit.

17 The Onan 2 KW is a satisfactory power plant for use in sub-Arctic conditions when used remotely to a Sled Signal Shelter. With better electrical suppression, better ventilation and better shock mounting it would be suitable for mounting in a shelter. Used as a heating device in the Sled Signal Shelter it is definitely practicable provided proper ventilation is planned.

18 The system of mounting one Onan plant on top of the other was unsatisfactory and caused a lot of vibration. A plant producing more power should be installed and properly shock-mounted to cut down the vibration. The power plants must be extremely well suppressed.

19 Considerable trouble was experienced, electrically and mechanically, from the power plants located inside the wannegans. This was overcome by establishing an outside power source.

20 The kites, balloons and [antennae] wire are a quick and easy means of erecting vertical antennae when weather conditions and terrain are suitable in sub-Arctic conditions. They are NOT dependable for a 24 hour a day wireless link unless a large supply of balloons hydrogen and antennae wire are on hand. As an emergency measure they are quite satisfactory. For use in sub-Arctic country these are the only type of long vertical antennae that can be erected unless large and bulky antennae gear can be carried.

21 It is recommended that a light braided flexible antennae wire easily handled in cold climates should be provided. All antennae should be issued on reels rather than as loose coils. Insulated antennae wire should be provided to offset noise caused by blowing snow. Standoff insulators should be provided on Signal Shelters to facilitate lead-ins from horizontal antennae. The tentacles on the crows foot counterpoise should be soldered more ruggedly to the centre plate to avoid constant breaks at this point.

22 The results all tend to show that a vertical antennae gives by far the best results. This is in accordance with the familiar radiation patterns obtained from horizontal and vertical antennae at these frequencies. The angle of radiation from the horizontal antennae is much too high and all the radiated power is lost.

23 All types of lead acid cells to be used in the sub-Arctic must be initially charged and cycled at a temperature of 70°F before being put into use in the extreme cold. Other types of secondary cells should be tested to determine whether the lead acid cell is the most efficient secondary cell at sub-zero temperatures.

24 Communication equipment will have to be made more ruggedly, so that the various pieces will not break into electronic oscillation when subjected to vibrations. All equipment installed in the wannagan will have to be well suppressed, filtered, or bonded, so that it will not cause interference to other equipment.

25 Personal Equipment

Vests string proved satisfactory. However, many of the vests issued shrunk badly and would not tuck into the waist band of the trousers. Larger sizes should be made available.

26 The parka coat with liner, modified, was not entirely satisfactory. The hood does not permit freedom of movement, and the depth and height of the hood is not sufficient to provide complete protection from the wind.

27 Mitts, winter, Arctic, outer, were reasonably satisfactory. There was, however, too much bulk in the palm. The cuff was not sufficiently stiff and as a result it was difficult to put on and take off quickly. The durability was fair.

28 Mitts, winter, Arctic liner, was completely unsatisfactory. The bulk was too large to permit any manual dexterity. Most of the men on the exercise did not use them at all. Mitts woolen, heavy, were found to be sufficiently warm in almost all cases.

29 Boots, mukluk, modified, were completely unsatisfactory. The sole was too heavy, and the body of the boot was too fragile and bulky. The use of newer type muklucs has shown that the damage to uppers is minimized by a snug top. Lighter weight soles have also proven satisfactory.

30 Socks duffle, modified, were not satisfactory. They have not sufficient shape to prevent the foot turning, and the bulk is excessive for the amount of warmth provided.

31 Caps, comforter, proved useful and satisfactory.

32 Goggles, brow rest, were not satisfactory. The plastic lenses break easily and fog up. They cannot be worn over ordinary eyeglasses.

33 Group Equipment

Tents, Arctic, lightweight, 5-man, were found to be generally satisfactory. However, they were difficult to pitch, and the tent pole as issued is absolutely useless. It is recommended that a new Arctic tent be made and tested.

34 Tents, Wireless, were used for stores, rations, and mess tents. Some of these tents had been "flame proofed". The compound used made them very stiff and unwieldy and dark in texture. The canvas in one tent cracked when it was folded in the cold. Due to the colour artificial light had to be used at all times in flameproof tents.

EXERCISE "SWEETBRIAR"

LESSONS LEARNED

GENERAL

1 In April 1949 it was decided by representatives of the Canadian and United States Governments to conduct a joint and combined exercise for the Army and Air Forces of both countries. The exercise was to be held on the Northwest Highway System - Alaska Highway, in February 1950 when weather conditions suitable for testing men and equipment could be expected.

- 2 (a) Dates: 13 Feb 50 - 23 Feb 50.
- (b) Area: Northwest Highway System, between Whitehorse, Yukon Territories, and Northway, Alaska.
- (c) Troops Participating:

ARMY FORCES:

COMBAT TEAM A

First Battalion, 14th Infantry
Battery A, 537 Field Artillery Battalion
Collecting Platoon, Medical Company, 14th Infantry
Detachment Survey Company, 14th Infantry
1st Platoon, Heavy Mortar Company, 14th Infantry

229th Signal Operating Company
Company B, 21st Engineer Battalion
CIC Detachment (Provost)
45th O/A Detachment
182 P.I. Detachment
Detachment 519th MI Service Platoon
Detachment 26th Infantry Scout Dog Platoon

COMBAT TEAM B

Princess Patricia's Canadian Light Infantry
C Troop 1 Field Regiment RCHA
Detachment 23 Field Squadron RCE
Air Supply Signal Unit
Platoon 23 Transport Company RCASC
Section 37 Field Ambulance RCAMC
Ordnance Field Park
Advanced Workshop Detachment RCEME
Section Canadian Provost Corps

AIR FORCES:

OFFENSIVE SUPPORT WING

One Jet Fighter Squadron (F.80)
One Flight Tactical Reconnaissance Squadron (RF.80)
One Jet Fighter Squadron (Vampires)
One Light Bomber Squadron (Mitchells)
One Fighter Squadron (Mustangs)
One Photographic Reconnaissance Squadron (Lancasters)

TRANSPORT WING

One Troop Carrier Squadron (C.54)
One Troop Carrier Elements (C.82)
One Heavy Transport Squadron (North Stars)
One Transport Squadron (112 Squadron) (Dakotas)
One Transport Squadron (435 Squadron) (Dakotas)

- (d) Aim: The general aim of the exercise was to develop procedures, doctrine, and technique for the employment of combined Canadian and United States Armies and Air Forces operating in the Arctic. The detailed Army aims were the following:

- (i) The provision of arctic training for an infantry battalion group, and the exercising of service units in support of the operations.
- (ii) The development of doctrine and technique for moving troop units under Arctic conditions by air transport and over the Northwest Highway System.
- (iii) The determination of the adequacy of standard items of clothing and equipment necessary for Arctic operation and the necessity of any additional requirements.
- (iv) To develop doctrine and technique for establishing a base camp in the Arctic.
- (v) To provide a detailed operational report on this exercise for use in planning future operations, and for instruction in Service schools.
- (vi) To provide aerial photographs of all phases of employment of army units in the Arctic for study by appropriate agencies to determine what change in technique will best prevent aerial observation and attack.
- (vii) To provide various research agencies with a means of furthering Arctic research.
- (viii) To develop standards of logistical support for sub-Arctic operations.

The detailed aims of the Air Force were as follows:

- (ix) To develop, test, and establish standardized doctrine, tactics, organization and equipment for combined operations in the Arctic.
- (x) To provide air support for both Allied and Aggressor Forces, by the utilization of:
 - close tactical air support with army units,
 - the provision of air transportation for rapid air movement of ground troops,

- provision of air re-supply to isolated Army elements and limited air re-supply for training purposes,
- provision of visual and aerial photographic reconnaissance,
- air evacuation of units and combat casualties,
- provision of air rescue personnel.

LESSONS LEARNED - OPERATIONAL

3 Planning and Preparation

Broad planning and provisioning action should start from eighteen months to two years before an exercise of this magnitude. Detailed planning staffs should be organized and functioning at least six months prior to the exercise.

4 While numerous liaison visits were made between the responsible administrative staffs and the closest co-operation existed at all times, a joint planning staff could have settled the day-to-day problems on the spot.

5 Organization

A movement control section should form an integral part of the Administrative Headquarters when large numbers of troops are being concentrated.

6 On arrival in the theatre of operations commanders are faced not with the build up of morale, but rather with its maintenance under conditions of Arctic warfare. This will depend largely on the facilities for relief which, on the end of a long line of communication, will always be limited. Not only is relief required from fatigue but from the squalor of confined tents, tent cooking, and the lack of water for washing. A forward rest area is necessary.

7 A 5-man section was used during the exercise and found to be entirely satisfactory. Where a section became reduced to the extent that it was uneconomical for it to function as a tent group, it was divided amongst the remaining sections and six men in a 5-man tent was not found to be unduly uncomfortable. A 5-man section is considered the most suitable provided its fire power is increased. To put five men into action will require an establishment of at least eight in a section when men "left out of battle" and wastage are considered. If sections are organized on an 8-man basis, another section is required in the platoon to absorb the additional manpower so that the company establishment is not altered. The organization of a

fourth section has many advantages; it can be used for administrative tasks and for bringing forward the withdrawing tentage so that the fighting sections are not depleted. By retaining the fighting group at three sections and by rotating the administrative section, more opportunity is given for rest and an additional patrol is provided.

8 A battery organization is necessary in order to provide sufficient artillery officers and assistants to perform all tasks which must be done and to allow for the minimum of reliefs.

9 Because of the reduction of efficiency of personnel in the cold, the additional maintenance required, and the increased danger of driving on slippery surfaces, a spare driver should be allotted to each vehicle, and workshop facilities must be increased to allow for heated shelters for vehicles and repair crews.

10 On account of the long line of communication it is necessary to establish an advanced Ordnance Depot in the forward base area. This must be done irrespective of the size of the force involved in the operation, and it must carry substantial stocks of rapid turn-over items and in addition hold a reserve of vehicles.

11 The number of umpires used should be kept to a minimum. Too many umpires cause inefficiency and increase administrative problems. Umpire vehicles should be of the oversnow type if oversnow operations are contemplated. Umpires should not depend on the units for transport. Vehicles should be kept to a minimum.

12 Command and Control

Commanders at all levels must learn to appreciate the difference in time values that apply in cold weather operations. In order to maintain morale at the level required for effective performance, every item and every minute of the twenty-four hours must be ordered and controlled. Double, or even treble, the time will be required for the completion of housekeeping duties, care of equipment and for the conduct of operations.

13 Offensive Support

If possible the air supremacy stage of an operation should be concluded in time to give the ground troops full benefit of air support, and on future exercises advantage would be obtained if time could be given for the preparation of a coordinated air/ground attack making full use of the ACT, immediate support, photo reconnaissance of the enemy positions and ground reconnaissance information.

14 Transport Support

Re-supply by air in the Arctic and sub-Arctic, particularly off the road, will be of paramount importance.

15 In the North country where the road may be blocked to wheeled transport for long periods by blizzards and drifting snow, or where the fighting troops are travelling across country, every means of transport available may have to be used to supply the force. This might include air dropping, glider or air landing supplies, or transporting them by tractor train, oversnow vehicles, or even to a limited extent, by animal transport.

16 There are certain factors affecting airborne assault under arctic conditions which do not apply to normal warfare. Sleds will be required to move packs, ammunition and tentage from the dropping zone. The fitting of containers to pararacks requires more time and adequate provision should be made for this.

17 Fire Support

As artillery support in sub-arctic operations will likely be on a reduced scale, the value of any other form of fire support is increased. In bush country such as is encountered in the Yukon, the limited field of vision and the need for curtailing the number of men employed on protective duties, reduces the size of the company area in defence. Ground between company areas must therefore be covered by fire and, in this and other defensive fire tasks, the value of mortars will be enhanced. Its high angle of fire makes the mortar a particularly valuable weapon in close and mountainous country where crest clearance is a problem. In both attack and defence where more than one battalion is employed all mortars could be concentrated and fired under the direction of an artillery mortar officer. The mortar should be carried in an oversnow vehicle to increase its mobility.

18 Great difficulty was experienced in getting vehicles and guns into positions off the road. This was caused by both deep snow and rough ground. Often guns were put into action on the road and then manhandled into position when the area had been cleared by bulldozers or work parties. The problem of crest clearance arose constantly, and accentuated the requirement for a gun which can fire in the upper registry.

19 An attempt was made to blow gun pits with explosive but proved unsatisfactory. The alternative of building up pits by making a wall of snow then building a log wall on each side, and packing more snow in between was used in other positions. To be effective these walls would have to be from six to eight feet thick, the estimated time

of preparation being from three to five hours. A bulldozer would be most useful in this task reducing the time considerably.

20 Tank Support

The reduced mobility of infantry, and the consequently prolonged period which must elapse between the cessation of artillery support and the arrival of the infantry on the objective, necessitates the much closer support which can be given by tanks in direct fire tasks. Use of the heavier tanks in support of infantry will give improved offensive power but on the availability of a road line of communication. Previous experience has shown that tanks can be used on almost any type of terrain and there are few places along the Alaska Highway they could not be employed provided that time was available for getting them into position.

21 Engineer Support

In operations in the Yukon and Alaska, on the axis of the Northwest Highway System in addition to normal functions Engineers may be employed on the following tasks:

- (a) Reconnaissance and reinforcement of ice crossings.
- (b) Maintenance of the highway, involving snow clearance, de-icing of the highway and normal bridge and road maintenance.
- (c) Preparation of air strips on frozen lakes and rivers for air OP, fighter and air supply.
- (d) Preparation of roads and tracks through virgin snow.
- (e) Preparation of warm bases and erection of temporary buildings.

22 Reconnaissance

The country in the Yukon and Alaska along the axis of the Northwest Highway System lends itself particularly to ambush and delaying tactics. The necessity for adequate reconnaissance ahead of an advancing column is therefore emphasized. Reconnaissance troops require armoured protection and oversnow mobility in order to carry out their task. Engineers moving with reconnaissance elements will also require oversnow vehicles and a bulldozer for the clearance of snow or road obstacles. An air OP will be of great assistance; flank protection can also be provided by air reconnaissance.

23 The necessity for previous detailed reconnaissance is increased in Arctic warfare, in order to avoid delay, misdirection of effort and the subsequent exposure of troops to cold and fatigue. Reconnaissance will include the preparation of trails to assist in subsequent movement either in attack or withdrawal and the additional time required for reconnaissance under Arctic conditions must be allowed for.

24 Throughout the exercise the lack of the carrier platoon or some lightly armoured reconnaissance element was strongly felt. Its deficiency caused many casualties and slowed all movement. In moving across country Penguins used in the reconnaissance role were exposed to unnecessary risk and loss. A lightly armoured, oversnow and airportable vehicle must be developed for the carrier platoon.

25 Mobility

Cross country movement of troops is restricted by deep snow, deadfall, heavy woods and rough terrain and the number of troops which could be effectively employed in any one action is therefore limited.

26 Travel by tracked vehicles and on foot along the frozen streams and lakes is practicable. Wheeled vehicles are, in the majority of instances, completely roadbound.

27 Primarily, operations will be from an established airbase to secure a new forward base for operations. In effect, these operations would be similar to the island-hopping tactics of World War II.

28 Movement by night is practicable. It imposes no greater hardship than movement by day and snow reflects sufficient light to permit control of transport and troop movement while, at the same time, visibility is insufficient for the execution of detailed observed fire.

29 Because of the long line of communication from Edmonton, Alta., and Vancouver, BC, operations in the Yukon must be supported from an advanced base in the Whitehorse Area. The Northwest Highway System is served by:

- (a) The Northern Alberta Railway from Edmonton to railhead at Dawson Creek, BC, where the Highway to the Yukon and Alaska begins.
- (b) Narrow gauge rail between Skagway, Alaska and Whitehorse.

- (c) The Haines road (summer use only at present) which joins the main Highway at Mile 1016. (Skagway and Haines are served by boat from Vancouver and Seattle.)
- (d) A four-inch pipe line between Skagway and Whitehorse and thence to Fairbanks, Alaska. A subsidiary three-inch pipe line runs from Whitehorse to Watson Lake, three hundred miles to the Southeast.
- (e) The Highway is paralleled by the Northwest Staging Route with sufficient airfields and landing strips to sustain heavy air traffic.

All these facilities provide the means for supporting forces which might be expected to operate in this area.

30 Movement on foot will be slow and the distance covered on skis or snowshoes probably not more than six miles in a day. Both skis and snowshoes are required for the varying conditions of snow and types of terrain to be traversed. Skis are best in open country, even in soft snow, especially when trail breaking vehicles can precede the infantry. In bush country snowshoes are more suitable.

31 Movement on wheels will be limited to the road, and the ease with which vehicles can be ambushed or delayed may make wheeled movement a slow process. Mobility may be considered the first principle of Arctic or sub-Arctic warfare and true mobility can only be obtained by the possession of oversnow vehicles.

32 The method of movement of both troops and supplies when on wheeled transport will be by bounds behind a mobile oversnow covering force, and will be by picking up, carrying forward, unloading and returning during the night. Transport must have a protected and prepared dispersal area from which to operate.

33 The hauling of sleds slows up movement so much that it is not recommended and the only alternative is to bring up tentage in oversnow vehicles, which may prejudice the surprise effect of the movement. Two methods of bringing up packs and tent loads were tried on this exercise. The first method was with the one-man toboggan loaded with rations and cooking kit, and the two-man toboggan with packs. The two-man toboggan was found to be too heavy, was discarded and used only for the removal of casualties. The second method was the use of two one-man toboggans only, the men carrying their packs. Toboggans were hauled to the forming-up place by the reserve platoons and were left there together with the men's packs while the assault was mounted. This proved such hard work that in subsequent operations the toboggans were brought up on vehicles after the attack.

34 Where movement is on a single road axis, such as the Northwest Highway System, where wheeled transport can be used, there will be no need to change the present system of supply although on occasion improvisation may be necessary. On account of vulnerability to air attack, vehicles may have to move up, unload, and return at night to the administrative area where there will be adequate dispersal facilities and anti-aircraft protection.

35 Movement

Given air superiority the Northwest Highway System can be used for the movement and employment of troops, supplies and equipment.

36 Concentration of troops and supplies in the Yukon and Alaska is feasible with existing air, road, rail and water facilities.

37 Assault Tactics

Guerrilla tactics can be effectively employed by small groups operating along the enemy's line of communication.

38 A proportion of armour should be included in any force detailed to operate in the north. This is necessary in order to provide reconnaissance and close support for infantry. Armoured action may be carried out in some localities.

39 The principles to be considered in the advance to contact do not differ from those which apply in normal circumstances. It is only where they are ignored that the nature of the country and climate are likely to make the result disastrous. Advance to contact must be carried out under cover of a protective force which must be fully mobile, have oversnow ability and requires to be armoured, or lightly armoured if airportable. It must have sufficient fire power to eliminate minor opposition.

40 The assault will be best delivered at night, when the efficiency of the enemy is at its lowest because of being concentrated in tents, and owing to the impaired alertness of sentries. Surprise becomes such an important factor that it may be preferable to deliver the assault without previous artillery support. The assault should be made down-wind if at all possible, as it will materially assist the attacker and add to the problems of the defender. Sentries will normally have their backs to the wind. It may be necessary to wear skis or snowshoes for the actual assault but troops will generally prefer to discard them if the going permits.

41 On arrival on the position troops heated in the attack will be more liable to the effects of cold. In consolidation it will be necessary to bring up tentage and packs.

Care must be taken not to weaken the troops on the objective in carrying out such tasks to the point that they are unable to withstand counter attack.

42 A night drop is feasible, but as no suitable parachute for a leg kit bag has been developed, consideration must be given to the time men will be exposed to the cold without protection. Although some casualty bags will be dropped for wounded, a complete drop is impractical at night because of the difficulty in finding equipment before moving off. Night drops, therefore, require timing so that sleds and equipment can be dropped and picked up in daylight.

43 In all airborne assaults the prime requisite is the seizure and preparation of a landing strip to permit the air landing of follow-up troops, equipment and supplies, and also provide for the evacuation of casualties.

44 Where a force relies on a single line of communication and where its axis passes through defiles or bush and forest, as is the case of the Northwest Highway System, it is particularly susceptible to guerilla action. One of the first necessities of this type of action is that there should be local inhabitants who are capable of being organized as guerillas and who, by their knowledge of the country, are capable of rapid concentration at the point of attack and rapid dispersal thereafter. On dispersal it is important that they should leave no trace of their movement.

45 Action against the enemy line of communication should take the form of raids against specific objectives, the raiding force being completely withdrawn as soon as possible after the attack. Such a force can be night-landed or dropped on a lake adjacent to the target and can move by ski or snowshoe to the attack. No particular risk is involved until the attack is carried out and several days might elapse before a favourable opportunity presented itself. Once the attack has been delivered the force can be followed up either by air reconnaissance or on foot. Attacks could be delivered against bridges, or against enemy aircraft on landing grounds in the same manner as those so successfully carried out by Special Service patrols in the desert.

46 The dependence of the enemy on tents and vehicles for survival and the importance of destroying his gun positions offer suitable objectives for armoured assault if outflanking movement can be effected. The country lends itself to the employment of close range recoilless anti-tank weapons. The effectiveness of armoured assault will therefore depend largely on the degree of surprise which can be obtained and the extent of development and employment by the enemy of recoilless weapons.

47 Patrols

Owing to the difficulty of control imposed by the effects of cold and fatigue, a small patrol is more efficient than a large one and, except for a specific task, should not exceed five men. Smaller patrols would be subjected to greater fatigue in trail breaking.

48 The evacuation of a patrol casualty presents increased difficulty and it may be necessary for a patrol to take a small sled for evacuation. Patrols should carry a survival kit in case they are forced to stay out.

49 The snow camouflage dress and the lowered efficiency of enemy on protective duties favour the action of patrols at night, particularly if they can take advantage of wind in their approach.

50 Defence

Operations along a single axis such as the Northwest Highway System must inevitably invite interruption in the form of flank attacks. These can readily be undertaken by relatively small hostile elements using guerrilla tactics. Portions of a force extending along this route thus frequently and easily may become isolated and subject to defeat in detail. Retention of the airfields and airstrips for purpose of aerial re-supply therefore becomes of paramount importance.

51 A large anti-aircraft component must be included in any force which operates along a single line of communication. Light anti-aircraft is of prime importance as low flying fighter bomber aircraft must be frequently engaged. Unit anti-aircraft resources must also be increased. Anti-aircraft protection can be provided only by guns in site since these attacks are swift and sudden and no time is available to get equipment into action.

52 Owing to the vulnerability of men sleeping in tents a company is the smallest force which can make itself secure while affording troops the maximum rest. To maintain control, company areas will have to be small and compact. Defence will therefore be based on company areas which should be inter-supporting. Ground and approaches between company areas will be covered by defensive fire of artillery, mortars and medium machine guns. Perimeter wire must be put out and fire lanes arranged.

53 When in contact with the enemy one third of the company must be actually dressed and ready for action, either in their tents on sentry, or on listening post duty. One third will be dressed but with boots off and sleeping, and one third will be off

duty. The degree of readiness maintained is necessary owing to the delay incurred in getting dressed and turning out in the cold and in the dark.

54 The best protection will be adequate dispersion. One angledozer per company group is required to facilitate proper dispersion. The preparation of areas will take time, about two hours per company and strict road and traffic discipline must be maintained until they are ready.

55 The alternation of wooded areas and expanses of lakes, muskeg and riverbeds, afford particular advantage to MMG defence. The location and destruction of such positions would be the primary task of tanks.

56 Counter attack has additional chances of success owing to the exposure of the enemy to cold on consolidation and reduction of fighting power in bringing up tents and other maintenance duties. Trails should be well broken in preparation for counter attack tasks.

57 Withdrawal

On the axis of the Northwest Highway System the frequent and excellent delaying positions will give many opportunities for successful rearguard actions, and will allow time for the main body to occupy and prepare its main position. The degree of delay which can be imposed by a comparatively small force will largely depend on the enemy's oversnow mobility and the possibility of flank movement.

58 Withdrawal will best be effected by night when enemy reaction will be slowest. Trails should be broken from positions before withdrawal commences and may be booby-trapped as rear parties leave. Mines may be extensively employed.

59 Camouflage, Concealment and Deception

In the Yukon and Alaska camouflage from ground observation is comparatively simple, provided that it is combined with intelligent appreciation of the background. The existing colours of protective clothing and tents, and the olive drab and white disruptive camouflage of vehicles are considered suitable.

60 The camouflage of vehicles and tents from the air presents a far greater problem which is aggravated by the initial impossibility of concealing tracks, and the clouds of condensation from running vehicle engines. An all-white camouflage for vehicles may be better than the disruptive paint, as in bush country during static periods natural camouflage can be used. Although tracks cannot be effectively concealed,

strict track discipline is necessary about tent sites, and use should be made of deception by making of dummy tracks, vehicles or tents.

61 Communications

Owing to the great distances and difficulties of operation, communications personnel and equipment must be heavily augmented and thoroughly trained and tested before commencement of operations.

62 Line communications were normal but telephone set batteries had to be kept warm to maintain their efficiency. An oversnow line laying vehicle is required and it is possible that light aircraft could be used for this purpose. Wireless communications functioned efficiently provided that batteries were kept warm, but an oversnow vehicle capable of carrying two sets is needed.

63 Extensive modifications to existing Signal vehicles are necessary for winter operations. Vehicles and equipment must be given exhaustive operating tests prior to the date required for use and while still near a base workshop.

64 Canadian wireless equipment will function normally when housed, together with its power unit, in a heated vehicle. The WS C29 set operates satisfactorily even under conditions of cold if an efficient battery charging and replacement organization is provided. The WS C58 set is not satisfactory for use in the Arctic or sub-Arctic.

65 Efficiency will only be obtained by the perfection of a communication system which will permit rapid tactical movement without interruption of communications.

66 Medical

The evacuation of casualties was not tested to any great degree on this exercise. The need for immediate attention and speedy evacuation is essential in order to maintain a high level of morale.

67 As a casualty will often be separated from his sleeping bag, it is essential that casualty bags be provided well forward. Some two-man toboggans will be required to move casualties to a point where they can be picked up, and these will go forward with assaulting troops and can carry the casualty bags.

68 The provision of shelter, suitable for the temporary holding of casualties or urgent operation is necessary both at the casualty collecting post and at the advanced dressing station. The 5-man tent is too small. Tents hospital extending, marquees,

or RCAF general purpose shelters would be more suitable. Such tents will require Herman-Nelson type heaters.

69 Selection and Training of Personnel

Strong and forceful leadership, coupled with a high degree of man-management are required in order to obtain the maximum from troops when operating under sub-Arctic conditions. Morale must be brought up to the necessary pitch by establishing confidence in the equipment and its use and self-reliance in the mental attitude of the individual. The effectiveness of equipment can be demonstrated in training, and the natural fear of the cold can be overcome by acquiring confidence in one's own ability to withstand it.

70 It is essential that troops complete corps training and winter indoctrination prior to being called upon to participate in northern operations. Technical personnel must be highly skilled tradesmen. Any force required to function in the sub-Arctic must have trained collectively under rigorous winter conditions. Every effort must be made to promote the idea of hard living and self-sufficiency. The need for artificial shelter by civilized men is probably the greatest factor in the loss of mobility of troops in the Arctic. In war, as apart from training, they will have added incentive, and this incentive and pride in being part of an Arctic force, capable of withstanding the rigours of the Arctic, and fighting in it, should be special targets in the conditioning programme.

71 Movement will be simplified if infantry can acquire a degree of training where they can live out in the most severe weather, as trappers and police have done before them, making use of strips of windproof material which can be carried and used individually, or assembled to make some form of shelter with the help of snow and branches. Although tentage can never be dispensed with entirely, it could then be done without for longer periods. This is the real key to the re-establishment of dismounted infantry mobility in the Yukon and Alaska; with time and experience infantry may adapt themselves to this procedure.

72 Umpires should undertake pre-exercise training with troops to which they are attached and a two day umpire course should be given before a large exercise is held. Umpiring side should be kept to a minimum.

LESSONS LEARNED - EQUIPMENT

73 Modification to Existing Equipment

The Bren gun is too heavy for arctic warfare. A lighter LMG which can be carried and fired as an assault weapon is needed. Such a weapon would help to increase the mobility of the already encumbered assault troops and counteract by fire power the proposed reduction in section man-power.

74 The rifle in use at present is too heavy and cumbersome for warfare under Arctic conditions. The manual operation of a bolt action rifle and the charging of magazines is difficult in extreme cold. A light semi-automatic rifle of not more than seven pounds in weight is required.

75 Research and development must also be continued on rations, vehicles, lubricants, personal equipment, and wireless equipment. Properly arcticized oversnow vehicles should be developed for load-carrying, command posts, evacuation of casualties, reconnaissance, etc. Development should be continued towards making all Arctic equipment airportable.

76 In view of the heavy consumption of fuels and the variety of POL products now required, vehicles, generators, stoves, etc, should if possible, be designed to use the same fuel.

77 Suitable heated shelters are required for RCEME workshops, which can accommodate all types of vehicles. Shelters portable armoured corps were found satisfactory with the following exceptions:

- (a) Canvas covering was of one piece construction, requiring great effort to lift over the frame. If this canvas were fabricated in sections, it would be much easier and less subject to tearing.
- (b) Inlets should be provided for the insertion of the Herman-Nelson type heater tube.

In forward areas where it may be impracticable to use large shelters, smaller shelters or windshields will be required. A shelter built in sections which can be enlarged or reduced to provide a windbreak would be suitable.

78 It was generally considered that the parka was warm although not entirely satisfactory. Its bulk limited free movement and most users felt it could be made lighter and longer with increased effectiveness. A lighter type such as that used by the

British was suggested with a flap in the rear to sit on, vest pockets for pencils, maps and notebook, warmer chin cover, deeper hood and stronger zipper. The inner liner of the parka should also be windproof so that on the trail or on relatively warm days it can be worn alone with a warm cap.

79 The mukluk is a good type of footwear but requires improvement. It has a tendency to creep down the calf of the leg and there is insufficient support for the arch, ankle and instep. The canvas cracks across the foot, the buckle and eyelets on the ankle strap are difficult to manipulate even without mitts, and the zipper tends to ice up requiring thawing before it can be used. A more durable type of canvas is needed, a lace with very large metal eyes or loops would be better than a zipper, and a more form fitting design would obviate the need for an ankle strap. This type of footgear is warm and comfortable.

80 Mitts require improvement. The outer shell is good except for the fasteners at the wrist. A more satisfactory type of fastener is required which will facilitate both insertion and removal of the hand. The felt liner was unsatisfactory as it was both cold and cumbersome. The mitt woolen, trigger finger, was very good. It is felt that an outer with an improved fastener and a lighter wool liner is required, in very cold weather or when in contact, the mitts woolen, trigger finger, can be added to provide more insulation and to enable the man to use his weapons. Some type of harness attaching the mitt to the parka[,] to avoid losing it, is also required. Perhaps eight to ten inch tabs on the end of the inner parka sleeve is the answer to this problem.

81 The sleeping bag requires improvement. Bearing in mind the need for a light, durable and compact, sleeping bag the following criticisms and suggestions are made:

- (a) The zipper frequently catches in the nylon and is difficult to undo.
- (b) The bag is not sufficiently insulated.
- (c) The fit at the shoulders is too loose and much heat escapes.
- (d) The nylon lining is cold to the touch. The inner lining should be an insulating material such as flannel.
- (e) An insulated head covering is required.

82 Pads sleeping inflatable require modification. Their insulating properties were poor, many leaks and punctures were experienced and there was condensation between the pad and the sleeping bag. It was difficult to stay on the pad on uneven

ground. This would be partially overcome if the two outer ribs were made larger. The light weight and compact nature of this article are advantageous.

83 The vacuum bottle was only fair. In extreme temperatures the liquid cooled quickly and the corks and cup tops often froze up making them difficult to open. A larger bottle with a plastic cup top would be more useful and more durable.

84 The Bearpaw type of snowshoe is not satisfactory in soft snow. They bury easily and unless the man is an expert on them they are awkward and cumbersome. The Trailbreaker type is preferred but improvement is necessary. It required more rise at the toe to avoid burying the tip in the snow. It should be narrower with a large foot aperture. Leather harness is preferred to lampwick. In both types the snowshoe was too brittle and broke easily.

85 Improvement can be made in the tent arctic light, 5-man. The magnesium pegs bent easily, zippers were too weak, tents were not lightproof. Some sort of floor is required and the inner liner sags too much, reducing the living space. More anchor points should be made.

86 Toboggans arctic one-man were too heavy to pull and the lashing points were improperly located. The toboggan is difficult to handle in underbrush and deep snow, and tends to bury itself when going down hill. The nylon bag was too small, frayed easily and could not be used for lashing unless the man removed his mitts. The British one-man toboggan, two of which may be joined to make a two-man toboggan, was superior. The toboggans arctic two-man were not satisfactory except for hauling casualties. They were too heavy and cumbersome in deep snow and close country, requiring from three to five men to haul them. Men prefer carrying loads to hauling these sleds.

87 The Coleman lamp provides ample heat and light but is quite fragile. One group considered that less light and heat could be accepted and a more durable type of lamp supplied.

88 New Developments Required

Consideration should be given to the development of adequate starting aids bearing in mind that warmth for the battery, oil and engine coolant must be provided. Although the continual operation of vehicles in static periods did not prove as harmful as expected, the provision of starting aids is imperative.

EXERCISE “SUN DOG ONE”

LESSONS LEARNED

GENERAL

1 This exercise served a most useful purpose since many of the conclusions, which were previously based on conjecture, have now been established as fact. They have been shown to be sound and comprehensive. Important lessons learned are summarized in the following extracts.

- 2 (a) Dates: 16 Feb 50 - 15 Mar 50
- (b) Area: CHURCHILL
- (c) Troops Participating:
- (i) One coy gp RCR
Det RCE
One tp RC Sigs
Det RCAMC
One pl RCASC
 - (ii) RCAF provided tactical and transport support.
- (d) Aim: The aims of the exercise were to:
- (i) Determine the requirements for one infantry company operating in the Arctic in the winter for one month.
 - (ii) Determine a tactical technique of operating on the barrens in the winter.
 - (iii) Determine the requirements of supporting Arms and Services.

LESSONS LEARNED - OPERATIONAL

3 Planning and Preparation

Sound and accurate planning is vitally necessary since the consequences of errors are more serious than in other theatres. The effect of mistakes on troops is greater because of the extreme weather conditions which make remedial action slower.

4 Organization

In general, existing organizations can be adopted to meet the requirements of arctic warfare. No special establishments are required. However, transport and plant of a special nature must be provided, necessitating slight changes in establishment of the number of drivers and operators.

5 Command and Control

Control of troops during an operation has proved to be generally more difficult due to climatic conditions:

- (a) Limitation of hearing and vision due to environmental clothing.
- (b) Limitation of visibility in blowing snow.
- (c) The difficulty of looking into the wind.

6 On the platoon and section levels this can be overcome to a certain extent by the use of hand signals and where possible by the commander positioning himself on the lee flank.

7 Engineer Support

There is no requirement for engineer assistance to a small mobile force equipped with oversnow transport operating in barrenland terrain, although a reconnaissance party should be included. In a static position, however, there will normally be a heavy demand on engineers. Road or air field construction by snow clearance or compaction methods, water supply, and assistance in the construction of fixed defences are a few of the tasks envisaged. This necessitates a higher proportion than in other theatres of machine to manpower, and plant of a special nature for snow clearance, compaction and the thawing of ice, snow and frozen ground.

8 Logistics

It was established that one tractor train could supply an average load of twenty tons over thirty miles in twenty-four hours. The net pay load was fifteen tons, five being consumed as domestic load, over an average distance of ninety to one hundred miles.

9 For an operation of this type, supply by air is the only feasible method.

10 Reconnaissance

The requirement for a lightly armoured vehicle with good oversnow performance and low silhouette for close reconnaissance by the infantry is required.

11 Mobility

It was noticeable that the troops tended to be vehicle bound. The major factor contributing to this was the difficulty of moving dismounted with the present weight and bulk of equipment. Three out of every 5 men were required to either haul or carry the group living equipment. Thus only a maximum of 40% were available to transport infantry support weapons, extra ammunition and fulfill other operational duties. This is unacceptable and must be reduced.

12 It was established that, for operations over barren land or similar terrain, all transport in front line units must have good oversnow performance, and fighting echelons must be fully tracked.

13 Vehicle maintenance must be stressed.

14 Snow before mid-December and after mid-April, in all areas in the barrenlands, is an obstacle to dismounted mobility. Troops should be equipped either with snowshoes or skis. Between these periods the snow is wind packed and will support a fully loaded soldier except in areas sheltered from the wind where the snow remains soft.

15 The total weight of living equipment, arms, ammunition and one day's rations for a tent group of five men is approximately five hundred pounds. The maximum weight that can be carried while retaining adequate operational mobility is considered to be no more than sixty pounds per man.

16 The exercise proved that the tractor train is quite unsuitable by virtue of its slow speed (not more than two miles an hour) and vulnerability to air attack.

17 Assault Tactics

The exercise confirmed that the normal tactical principles apply without any major changes. Techniques evolved in the Western Desert during the last war are of equal application to the barrenlands. The major difference lies in the greater restriction on mobility. This is such, both dismounted and mechanized, that an operation could not be undertaken with any certain prospect of success unless mobility is improved.

18 Usually attack in such open terrain by small lightly supported forces would only be feasible either at night or in periods of high wind and consequent poor visibility.

19 A very high standard of training is essential for the retention of control during the assault.

20 Consolidation is generally only possible on the occupied position because of the lack of alternative ground in which digging-in is feasible.

21 A decision as to distance troops are to be carried forward by either air, vehicles or a combination of both, will be made after consideration of the following factors:

(a) Climatic conditions

- (i) Visibility
- (ii) Audible range of sound
- (iii) The amount of light.

(b) Terrain

- (i) Covered approaches offered
- (ii) Whether bush country or barrenland.

22 Unless the location of the enemy is known, the advance guard should advance on a broad front. It should be preceded by 5 to 10 miles either by light armour, or by a mobile company supported by the battalion machine gun platoon. This is to allow sufficient distance between the reconnaissance element and the main body to permit the latter to proceed without constant halts. The reconnaissance element will

be responsible for reconnaissance both to the front and to the flanks, and will move forward by tactical bounds.

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

24 Due to lack of tactical features and the greater range of visibility on the barren lands the approach to a position and its attack are often only feasible under conditions of bad weather, poor visibility or darkness. Under such conditions it has been found best to attack down wind. This method is likely to achieve a greater degree of surprise owing to the difficulty sentries have of observing into the wind for any but short periods. In addition, it throws the disadvantage of fighting facing the wind on to the defenders.

25 Detailed ground reconnaissance of the enemy position, possible forming up areas, and start lines, is essential in order to ensure that timings will be accurate. This is especially important when operating in bad weather. Men waiting unnecessarily long in the open are liable to become casualties from the cold. As many junior commanders as possible must be given the opportunity of viewing the ground providing that it will not prejudice the operation.

26 Detailed planning and careful control are essential if the attack is to be a success. A navigating party must mark clearly the axis of advance and start line using coloured tape, sea dye, or infra red equipment. If the advance is long, it is suggested that intermediate bounds be marked as well, care being taken that such markings are not placed out too far in advance of the attack thereby prejudicing surprise. For a successful attack to be carried out under such conditions troops must be well trained and junior leadership must be of the highest order; control must be maintained at all times to ensure that the attack goes in at the right time and at the right place.

27 In snow, even where only a foot deep, the present smoke projectiles of both the 3" mortar and the 25 pounder are smothered by the melting water when they burn. Conditions unsuitable for the use of smoke are often encountered due to the strong wind prevailing on the barren lands. This is also true in use of chemical weapons.

28 The use of flame weapons in the attack will destroy any shelter existing that could be used by our own troops on consolidation. It is considered that such weapons should be used with reservation, and only when the attack is beginning to falter, and other means of helping it forward have been tried, unsuccessfully.

29 Due to the lack of tactical features in the barren lands it will usually be necessary for consolidation to be carried out on the enemy position. In spite of the obvious disadvantages it is considered that this course is more acceptable than attempting to consolidate forward on the barren lands where the most hastily constructed defences are a laborious and time consuming problem.

30 Careful planning is required to ensure that troops have their living equipment brought up to them as soon as possible on consolidation.

31 The nature of the ground seldom offers other nearby positions of tactical importance. Resolute follow-up of a retreating enemy by fresh troops will often ensure their complete destruction.

32 Patrols

The technique of short range patrols and their tasks remain the same. However, the briefing prior to the patrol will have to be more than usually thorough to ensure that the mission is accomplished and that the patrol returns to base. If the patrol is to take place by night the time allowed should be doubled to cover the greater difficulties of moving quietly over snow in the diffused light and maintaining direction.

33 The size and composition of the long range patrol will be governed by the distance to be covered and the time it will take to accomplish the task in addition to the normal considerations. Details of loads to be carried require careful calculation in order to ensure that the efficiency of the patrol is not impaired by carrying an excess.

34 Detailed reconnaissance could not be carried out from the existing oversnow vehicles owing to the limited visibility through the windows which continually coat with snow and frost. In addition any enemy hearing the vehicle approaching had time to take cover, or lie down when caught in the open, thereby escaping possible detection.

35 For special long range patrols there would be a use for dog teams.

36 Ground Battle

The availability of deep snow dictates the location of defensive positions since excavation of frozen ground is rarely possible. In hard snow, defences will have to be built "up" rather than "down".

37 No artillery was present on this exercise. Support weapons were limited to the two and three inch mortar, neither of which are really suitable for use in the deep snow. Additional support is an obvious necessity, and the question of the most effective methods, bearing in mind the difficulties of movement, remain important questions to be answered. Recoilless weapons and medium machine guns would appear to have many applications in an infantry role. Artillery support will however be essential to any operation of a magnitude greater than a small raid. Trials are required to determine the best methods of carriage and transport, of all supporting fire weapons and an assessment made of their use in northern operations.

38 Defence

On the barrenlands a slight rise in the ground may become a tactical feature of importance. Elevated ground may be an esker or, due to its better drainage, a lightly wooded area. In the lee [*sic*] of such features drifts will form. Experience on this exercise was that construction of a defensive position in snow on gravel eskers, took approximately the same number of man hours as in soft earth.

39 The danger by day is from the air, requiring a high degree of dispersion whereas the main danger by night is from ground troops infiltrating into the defensive locality. This may be overcome by occupying positions widely dispersed by day, when the visibility will enable the defence to observe enemy movement, and by withdrawing to a closed perimeter by night or when weather conditions limit visibility.

40 When holding ground in close contact with the enemy it is considered that the present 5-man tent offers a large target, even if dug in, and that it would soon be rendered unserviceable by shell fragments, etc. In addition, the normal practice of changing to alternative positions when the situation demands would be impractical as it would mean abandoning the tent and equipment so vital to existence under conditions of extreme cold. The tent should be regarded as an emergency means of shelter, only to be used during the period of constructing defences and snow caves or lean-to shelters. When these shelters are completed the tent should be struck and packed away on the sled. In this way the tent would be protected from damage by enemy fire and would be readily available should it be necessary to reorganize on an alternative position.

41 Environmental clothing restricts vision and hearing. At night, therefore, less warning of enemy movement can be expected than is normal. In view of this, and of the time taken to get out of the sleeping bag and prepare to leave the shelter, it is for consideration whether the normal practice should be to sleep by day and work on

improving defences, etc, by night. By this system, the defences would have the following advantages:

- (a) Retention of good all around observation by day.
- (b) Less movement in the defensive position by day.
- (c) The position is manned by night when least warning can be expected of an enemy advance.

42 Navigation

Gridded air mosaics [,] taken during the same season as they are to be used in, must be provided.

43 Existing service magnetic compasses are unsatisfactory for long marches. Suitable types are now under development. In any case, they require to be supplemented by astro-compasses or other aids to permit periodical check of the magnetic compass type.

44 There is an established requirement for an aid to keeping direction when moving in vehicles. No suitable equipment exists.

45 Difficulties in navigation were increased due to lack of large scale maps and to the lack of detail on the existing maps. Before an operation takes place photo map coverage will be required if not of the entire area then of areas of tactical importance.

46 The method used was dead-reckoning, and it proved sufficiently accurate providing care was taken in the use of the compass and in checking distances. Difficulties encountered were due to:

- (a) Lack of landmarks on the barrenlands on which to take bearings and set course.
- (b) Difficulty in judging distance due to the lack of depth and perspective. On occasions when a distant object was used as a guide to march on it was found that instead of being the estimated five to six hundred yards away it was only fifty yards distant.
- (c) When moving in vehicles there was a natural reluctance on the part of personnel taking bearings to stand outside the vehicle in the cold resulting in hasty inaccurate bearings being taken. The prevailing

wind in the Churchill area being from the northwest all the snow anvils point in the same direction, these could be used as a rough guide as to direction.

- (d) Detours around areas of thick bush, creeks and stream beds to avoid being bogged down sometimes threw the column off course.
- (e) Errors in distance as measured on the vehicle speedometer due to track slip were appreciable on a long run.

47 Officers and senior NCOs should be trained in the use of the astro compass. It is a useful instrument to verify the readings of the magnetic compass which, due to the weak horizontal field, is often affected by local interference.

48 On the battalion level it is considered that navigation should be the special responsibility of the Intelligence officer who may, under special circumstances, be assisted by an attached navigator.

49 Camouflage, Concealment and Deception

Concealment is difficult to achieve. The use of all-white for vehicles, outer clothing and all items of equipment will greatly assist in concealment.

50 Concealment of tracks is impossible; dispersion and deception must be practiced. Deception is facilitated by the snow cover.

51 Communications

When the wind exceeded fifteen miles per hour with blowing snow, (approximately thirty percent of the period) interference caused by snow static was such as to black out wireless communication by voice over seventy-five percent of the range of the set.

52 Between platoons and company headquarters communications depend almost entirely on a satisfactory wireless net being maintained. Due to the greater degree of dispersion employed on the barrenlands it was found that the WS No 88 was not adequate and the WS No 31 was used. On several occasions the former had to be used to control sections when the distance from platoon headquarters became too great for voice or visual control.

53 It is considered that there is a requirement for a set of the WS No 31 type to be issued down to platoons but that a set of the WS No 88 type should not be a

permanent part of the section. It is suggested that a pool of such sets be carried by the battalion signal platoon sufficient to equip two platoons of two companies down to sections.

54 In defensive positions use should be made of line, this helps to alleviate the logistical problem of battery supply as well as lessening the danger to security. Due to the difficulties in recovering field cable in the cold, greater use should be made of assault cable.

55 Medical

The exercise confirmed that health of the troops is in general as good or better than in temperate climates. Frostbite necessitating medical attention is exceptional and should be considered a matter for disciplinary action.

56 Meteorology and Topography

The collection and collation of meteorological and topographical intelligence is essential to any sound planning.

57 Weather changes in the Arctic are frequent and rapid and, if artillery is to give the same high standard of fire support that the infantry has come to expect, meteorological reports will be required more frequently. Due to meteorological changes and inaccuracies of existing maps, predicted shoots in close support of infantry will seldom be possible. This must be realized by commanders and whenever possible registration of targets allowed.

58 Selection and Training of Personnel

The exercise established that a high standard of leadership and management is essential. Troops need not be hand-picked. However, some weeding out during the training period must be permitted to eliminate temperamentally or physically unsuitable men who would otherwise become liabilities during operations.

59 A very high standard of training is essential, and in the case of drivers and mechanics it is vital. Without it the success of an operation would be seriously prejudiced. Ten weeks is the minimum period acceptable for northern training up to battalion level. This is broken down into three weeks indoctrination, two weeks trades training, three weeks familiarization and two weeks collective training. Such training to be of value must be carried out in conditions of climate and terrain with a reasonable resemblance to those of the projected theatre of operation.

60 The ordinary soldier doing normal duties is not a great deal less efficient than in other theatres. The efficiency of the tradesman in tasks requiring manual dexterity may, however, be as little as fifty percent of normal under the worst conditions. An increase in establishment of such trades, particularly driver mechanics and mechanics will therefore be necessary.

61 Maps of northern areas are likely to be inaccurate or difficult to read due to the lack of well[-]defined features, and because of the many changes in appearance of the terrain throughout the seasons. Therefore, to ensure accurate navigation, all officers and non-commissioned officers must be highly trained in navigation by dead-reckoning.

LESSONS LEARNED - EQUIPMENT

62 Modifications to Existing Equipment

A reduction in the weight of rations, fuel, tentage and other domestic equipment is possible both by design and by accepting a lower standard of comfort.

63 A difficult and important problem yet unsolved is the suppression of vapour from engine exhausts.

64 The replacement or modification to existing items will necessitate the revision of normal equipment tables.

65 New Developments Required

Investigation is required to evolve suitable camouflage drapes for tentage, vehicles and equipments in open snow conditions.

EXERCISE "CROSS-COUNTRY"

LESSONS LEARNED

GENERAL

1 This was an RCE cross-country engineer reconnaissance exercise to obtain engineering data, and investigate problems and techniques which arise for small reconnaissance parties operating in these environments during the arctic summer.

- 2 (a) Date: 12 Jul - 24 Aug 1950
- (b) Area: FORT CHURCHILL - CAPE CHURCHILL - OWL RIVER.
- (c) Troops Participating:
- 23 Fd Sqn, RCE
- RCE - 1 officer - OIC
3 OR - (1 trained No 29 W/S Operator 1 trained in first aid.)
- HQ Fort Churchill
- RCASC - 2 OR - Drivers for 2 Penguins. (One to be a Driver Mechanic.)
- (d) Vehicles: 2 Penguins, as provided by Prairie Command from Fort Churchill.
- (e) Aim: The aims of this exercise were as follows:
- (i) To verify and clarify features noted in air photographs by observations on the ground.
 - (ii) To investigate and report on sites suitable for development as ground air landing strips; this information to include in the form of a work table, an estimate of time, labour and equipment required in their preparation.
 - (iii) To study and report personnel and equipment requirements for future engineer reconnaissance parties operating under similar circumstances.
 - (iv) To investigate and report on local resources and materials available in the area.

LESSONS LEARNED - OPERATIONAL

3 Transport Support

Air supply should be considered essential for any reconnaissance.

4 Engineer Support

Suitable local materials for airfield construction exist in this area.

5 Mobility

A more robust vehicle than the Penguin is necessary for this type of terrain if the heavy repair and maintenance tasks that proved necessary are to be eliminated. An amphibious vehicle would have numerous advantages.

6 Topography

The terrain is almost entirely low lying and flat in this area. This and the abundance of glacial debris, makes surface drainage very poor. The close proximity of the permafrost level raises the water table and obstructs sub-surface drainage. The few well drained, and hence dry areas, are confined to the gravel deposits and the infrequent and restricted areas that protrude above the mean level.

7 The entire area abounds in shallow lakes of various sizes. With few exceptions they are bounded by parapet-like walls of moss-covered earth varying in height from 4 feet around the large ones to 1 foot around the smaller. There are also numerous small streams encountered in this area.

8 The greater part of the area is covered with either a grey moss or grass turf. Trees are spruce and [tamarack], of diameters up to 12 inches and a density of about 1 in 30 square feet. There is some deciduous growth along the banks of the streams and small rivers and the shores of the larger lakes.

9 A large number of gravel ridges exist along the coastline, varying in shape and size from knolls of 100 ft diameter to ridges from 2 - 3 miles long.

10 Selection and Training of Personnel

Instruction in navigation and dead reckoning should be a pre-requisite for the members of such reconnaissance parties.

LESSONS LEARNED - EQUIPMENT

11 Modification to Existing Equipment

A more robust vehicle than the Penguin is necessary for this type of terrain if the heavy repair and maintenance tasks that proved necessary are to be eliminated.

12 The tent pole for the Arctic 5-man tent should be made stronger.

13 All air mattresses (Pads Insulating) developed slow leaks which were impossible to repair.

EXERCISE “SHOO FLY ONE”

LESSONS LEARNED

GENERAL

1 This was a non-tactical exercise carried out in two phases with an intervening day for refitting of equipment at Fort Churchill.

2 (a) Date: 20 Jul - 2 Aug 1950

(b) Area: CAPE CHURCHILL and DUCK LAKE

(c) Troops Participating:

One officer and ten other ranks of the Royal Canadian Regiment.

(d) Observers: Five officers representing Directorate of Military Training, Directorate of Inter-service Development, Defence Research Board, and the British Army.

(e) RCAF: One Canso (Phase II)
Norseman from JSES Unit (Phase I & II)

- (f) Aim: The aim of the exercise as laid down by the Directorate of Military Training, was as follows:
- (i) Investigate the tactical movement of an infantry section in the reconnaissance role.
 - (ii) Determine the clothing and equipment requirements of an infantry section operating for a period of two weeks.
 - (iii) Conduct engineering trials on certain items of clothing and equipment.
 - (iv) In addition to the above, observers took the opportunity insofar as the scope of the exercise permitted, to evaluate the problems of northern summer operations.

LESSONS LEARNED - OPERATIONAL

3 Planning and Preparation

The environmental conditions encountered presented few problems in the conduct of small scale operations beyond those inherent to any undeveloped region arising from the great distances, lack of all forms of developed communications and the difficulty of their provision. These would necessitate reliance to a great extent upon air transport and supply. In turn it will be of importance to reduce the weight, bulk and quantity of equipment and stores of all kinds by design, by hard living and by the elimination of the non-essential.

4 Transport Support

A light aircraft, preferably a helicopter, working integrally with the ground troops would materially increase their effectiveness. Its primary purpose would be to act as the eyes for the ground force for route finding and distant reconnaissance. Other uses would be for wireless communication with base, for the rapid transport over short (in terms of movement by air) distances of small groups of men, small quantities of stores, and for forward casualty evacuation.

5 Neither the Norseman nor Canso aircraft were entirely suitable in their role on the exercise. The major disadvantage of the first in its limited payload (375 lbs) with full fuel load and survival equipment), and of the second the restrictions on the water bodies suitable for landing. Both problems might be overcome by employment of

gliders. It appeared probable that landing zones on the tundra could be selected without difficulty wherever required, although this requires confirmation by experts to ensure both landing and snatching are feasible without damage.

6 The construction of operational airstrips, given gliders suitable for the transport of plant, appears feasible. Large gravel deposits exist throughout the area. Level runway sites can be found in the vicinity of many.

7 It is recommended that the feasibility of employing gliders be the subject of expert investigation.

8 Logistics

Range is limited by the weight and bulk of rations which can be carried by the individual in addition to his operational scale of arms and equipment. Using the US Arctic Trail ration (AT 1) a range of three days was practical and five days possible and feasible by going on to half rations.

9 Reconnaissance

It would be of value in future exercises if a light aircraft could be made available for tactical employment and reconnaissance in conjunction with ground troops.

10 Mobility

The uneven hummocky moss and marsh slow down the rate of marching. For fit troops 1½ mph is normal. In a day 10 map miles may be expected on the average, 15 - 20 for a forced march.

11 Water transport (canoe or other means) suffers from several disadvantages. The major objection to its tactical use is in the difficulty both of obtaining surprise and of guarding against it. Freedom of action is restricted by the necessity to follow the water-way. Movement upstream would usually be slow and difficult. Consequently the use of canoes by a section in a reconnaissance role, air landed in proximity to the enemy as envisaged in the exercise, would rarely be warranted. They might, in favourable circumstances, be used for the transport of troops and supplies in a support role. However, they are difficult to transport by air, relatively unstable, and require considerable skill in their use. It is possible that more generally suitable craft might be found from existing military patterns. A rough guide to canoe moves, obviously widely variable with conditions of weather, wind, current, number of rapids, is given below. Figures are for a 16 foot canoe carrying three men and their equipment.

<u>Item</u>	<u>Miles in the hour</u>	<u>Miles per day</u>
On lakes	3	24
Rivers - upstream	5	40
Rivers - downstream	1	7-10

12 Movement

Movement on foot is possible without difficulty throughout the area. Most swamps and sloughs can be waded. Those sections which cannot are easily by-passed. Swamp shoes or other artificial aids to movement are necessary. The comparatively few rivers or creeks which cannot be forded may be easily crossed by many improvised methods - the inflatable mattress which is an item of individual equipment is useful for this purpose.

13 Study of the country traversed and observation of oversnow vehicles and tractors in the area FORT CHURCHILL - CAPE CHURCHILL suggest that the film and report on CHURCHILL Vehicle Trials 1946 may have exaggerated the difficulties of movement. While the use of wheeled transport cannot be envisaged it is considered probable that standard tracked vehicles could move without great restriction in many areas and that passable routes could be found over most. Conditions might deteriorate appreciably later in the season as the permafrost table lowers.

14 Assault Tactics

Accepted tactical principles apply without change and operational techniques and procedures call for little modification.

15 Navigation

The lack of accurate large scale maps makes accurate route finding and land navigation most difficult. In coastal plain areas the difficulty is further increased by the multitude of lakes and water ways, restricted observation and lack of visible or charted land marks. Air mosaics would be of material assistance and are considered requisite to successful operation where direct air reconnaissance for ground troops can not be provided.

16 It is recommended that air mosaics of the exercise area be prepared and issued prior to any future exercises so that the degree of assistance they afford in map reading and route finding can be determined. They should, if possible, be gridded.

17 Camouflage, Concealment and Deception

The olive drab provided for cold weather clothing and equipment is most suitable for summer use. It should be extended to all items. Disruptive camouflage in clothing and equipment is not required. It is of interest that landing counts of mosquitos and flies were appreciably less on the Canadian experimental clothing of olive drab nylon than on materials of different colour and texture.

18 For dismounted troops concealment is easily achieved. For vehicles it would be more difficult, but no more so than in temperate theatres. While there would be little difficulty in concealing vehicles in creek beds, willow or spruce clumps, tracks remain clearly visible and track discipline is as important as elsewhere.

19 Communications

A problem was presented in providing communication between the reconnaissance section and base. A possible solution with existing wireless equipment is to establish a suitable high-powered rear link with relays of man-pack sets working forward. Obvious disadvantages are the increased size of group required, complexity, and added danger to security. A preferable alternative eliminating the necessity for separate rear link and relay system is, as already mentioned, to employ a light aircraft or helicopter as an integral part of the group.

20 It is understood a wireless set exists which is man-portable and of the same range as the No 29. It is suggested this be investigated with a view to its provision in future exercises. Such a set is required to provide communication between the reconnaissance element and its advanced base if communication through an aircraft in tactical support is not available.

21 Medical

No particular medical problems arose during the exercise. It is possible, however, that over a longer period the incidence of respiratory diseases and foot casualties might be greater than normal since wet feet must be accepted as routine and immersion to the waist or higher of frequent occurrence.

22 Selection and Training of Personnel

Men classified medically fit for active service are acceptable for northern summer operations. Special selection is not required.

23 Training, additional to normal corps training, is necessary in those subjects classified under the general heading of bush or woodcraft. Two weeks is adequate for individual training. An additional week or two weeks for sub-unit and unit training might be necessary for operations on a larger scale. While it is not essential that such training should be carried out in the north, it is desirable when possible in order that preconceived misconceptions concerning the hardships and difficulties encountered in the Arctic should be dispelled and the correct mental approach ensured prior to the operation.

24 There is no doubt that the average individual has a mental picture of the Arctic greatly exaggerating its difficulties and hazards. While the problems of summer are not such as to demand special training in the north, it is recommended that summer indoctrination courses at Fort Churchill be continued. The object in so doing would be to build up a nucleus of officers and NCOs in all units able to disseminate balanced and factual information on the Arctic and its problems and thus counteract the exaggerated views so widely held. The same purpose would be achieved through continued exercises.

25 Administration

A light weight trail ration is essential for operations of the nature envisaged during the exercise. That tested, the US AT 1 experimental Arctic trail ration, while basically satisfactory was considered to be too heavy, too bulky and lacking in [palatability].

26 For operations of longer duration ration packs suitable for use in temperate regions would be equally suitable for Arctic summer use. It is essential however that they should be waterproof and desirable that they be floatable if wastage is to be kept within reasonable limits.

27 In case of emergency small groups could usually live off the country although this is not recommended as an administrative principle. A shot gun and fish net make the task easier and form useful adjuncts to catering equipment when carrying capacity permits.

28 The US 5-1 B Pack Ration is generally satisfactory except that the inner container which holds the cigarettes, salt, sugar, etc, is not waterproof and that tea should be provided.

29 For small operations of isolated groups up to platoon strength the provision of stoves and fuel for cooking is unnecessary. For larger groups the gasoline stoves and fuel as used for winter operations are required. Fuel expenditure approximates 1

gallon weekly for each five man tent group when using the Coleman mountain type stove.

30 All repellants used were satisfactory as was the spray for tent use. No appreciable difference in the effectiveness of repellants was observed, although in some cases eye and skin irritation was reported in minor degree. None were sufficiently factual to warrant a firm recommendation and investigation under controlled conditions is required.

31 No suitable 24 hr trail ration or 5 man pack ration is yet available. It is recommended that an adequate trail and pack ration be made available as soon as possible.

LESSONS LEARNED - EQUIPMENT

32 Equipment satisfactory

With few exceptions suitable clothing either exists or requires only minor modification to be quite acceptable.

33 The experimental insect-proof suits tested performed satisfactorily and a desirable feature is the quick drying property of the nylon used. The screened vests were, however, unnecessary and the type of combat clothing assembly as being developed for use in all theatres by Great Britain and the United States would be equally suitable, with minor modifications, for Arctic summer.

34 Personal and group equipment used on the exercise was generally suitable and requires little modification. With few exceptions, equipment presently available as normal issue, is considered acceptable for future summer operations.

35 The headnet X-50 is considered too heavy and bulky and is difficult to pack or carry. It is recommended that issue headnet be retained and that no further development of this item is necessary.

36 There is no requirement for an anti-insect glove. However, it is recommended that the Gloves Anti-Contact K-50 be issued for wear on cold days, for cooking and for handling cordage, etc.

37 Holders, candle, X-50 are considered satisfactory.

38 The machete US pattern is satisfactory.

39 Pads inflatable, X-50 are satisfactory and it is recommended they be adopted for northern operations in summer.

40 Shirts flannel w/collar are satisfactory.

41 Socks, GS, are satisfactory.

42 Tents Arctic 5-man insect proof, without floor, are considered satisfactory.

43 Vests, string, nylon, are satisfactory.

44 Bags, sleeping X-50 w/liner, combined with the inner bag and cover is considered satisfactory.

45 Insoles SARAN are recommended for summer use due to their quick drying properties.

46 Tablets, water purifying, are considered satisfactory, because of the taste removing tablets included.

47 Modification to Existing Equipment

It is recommended that the carrier be given further trial under typical Arctic summer conditions. It is known that going can be found to immobilize it. The object of the trials would be to determine to what extent the prevalence of such going destroyed its operational value. It is considered this would be much less than is at present believed. Carriers under trial should be equipped with flotation equipment.

48 Standard military craft of the assault or inflatable type are considered to have advantages over the canoe in terms of airportability, stability, and ease of handling by untrained troops. Since there would be occasions when such light craft might be valuable in a support role their trial on lakes and fast running waters is suggested both with and without outboard motors.

49 Clothing designed especially for northern operations is not required. It is considered that clothing developed for summer operational use in other areas can be utilized for future northern operations. However, the present issue battledress is not satisfactory due to its water absorbent qualities and difficulty of drying. Ideally, future Canadian winter clothing, with insulating liners removed, should be capable of summer wear in northern regions. Detailed scale of issue of clothing for summer operations is found at Appendix "A".

50 There appears to be no requirement for anti-insect clothing as such. However, a combat suit of similar design and of the same material as the Jacket and Trousers Anti-insect is a desirable item. The normal issue battle dress does not provide suitable protection from climatic conditions and its colour is such that it attracts large hordes of insects. Insects are attracted by certain colours and repelled by others. Technical investigation should be instigated in order to determine proper type of material.

51 Both Paddles Maple and Paddles Spruce proved satisfactory. Due to the lighter weight of the spruce paddle it is recommended that this type be adopted. All paddles should be painted OD 7 in colour.

52 The Poncho w/hood is considered satisfactory with the addition of press studs on all four edges.

53 Pots cooking w/lid are satisfactory, but would be improved if made of a lighter material.

54 Pots tea X 50 are unsatisfactory. A requirement exists for a suitable tea pot and it is felt that by improving the spout and handle of this item, a suitable pot might be obtained.

55 Shoepac, US pattern; Boots rubber bottom, leather top, US pattern; and Boots rubber bottom, leather top, Cdn pattern, were all generally unsatisfactory because of their weight and the fact that they were uncomfortable and too hot. It is recommended that investigation be commenced on the issue of an oil tanned boot of design similar to the Boots Battle Dress of World War II.

56 Bowls 1 qt X-50 were unsatisfactory because mess tin cooking was not feasible without a handle. Issue mess tins were preferred.

57 It is indicated that the canvas canoe is superior to the fiberglass canoe because of its sturdier construction and flexibility. Further study is required before it can be established if there is a requirement for canoes in northern summer operations.

58 The Caps peaked, service general pattern, [are] too heavy and [do] not retain its shape after becoming wet. It is recommended that a cap of a design similar to the British or US winter cap be adopted.

59 Cases Saw Knife and File X 50 are considered unsatisfactory. The saw would not cut green wood and the knife was too light for use as a machete. A requirement exists for a suitable saw and machete.

60 All the various types of repellant issued appeared suitable, however, it is recommended that a technical study be made to establish which is best and an unbreakable container be provided.

61 The match box waterproof is a definite requirement in summer operation. The type used did not hold enough matches. It is recommended that a larger box be obtained.

62 The cookers, US mountain type 1942, are satisfactory for summer use but should be superceded by the latest US type available. Petrol consumption averaged one gallon per 5 men per week.

63 New Developments Required

A candle provides adequate illumination for summer use. The candle, Arctic, edible, is not considered satisfactory as it does not retain its shape in warm weather and does not burn for a sufficient length of time.

64 A requirement exists for a suitable 2-man tent.

65 There is no requirement for the snowshoe in summer operations. After numerous trials it was established that any type of snow or mud shoe would only hinder movement.

Appendix A

CLOTHING & EQUIPMENT SCALE OF ISSUE

CLOTHING

The following scale of issue is recommended for future short term operational use:

(a) Headgear

(i)	Cap light weight	1
(ii)	Headnet	1
(iii)	Necksquare	1

(b) Handgear

Gloves anti-contact	1 pair
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(c) Footgear

(i) Oil-tanned leather boots	1 pair
(ii) Socks GS	4 pair[s]
(iii) Insoles saran	1 pair

(d) Body Clothing

(i) String vest	1
(ii) Pyjama trouser	1 pair
(iii) Shirts flannel w/collar	1
(iv) Sweater high neck	1
(v) Combat clothing complete	1
(vi) Suspenders	1 pair

EQUIPMENT PERSONAL

In addition to personal clothing the following personal equipment is required:

(a) Battle Jerkin DIDX-50 mod. (rucksack in lieu)	1
(b) Eating utensils	1 set
(c) Mess tins	1 pair
(d) Mug enamel	1
(e) Water purification tablets	1 box
(f) Water bottle	1
(g) Emergency ration	1
(h) First field dressing	1
(j) Housewife	1
(k) Knives clasp	1
(l) Match box waterproof	1
(m) Nylon cord	25 feet
(n) Repellant insect	1 bottle
(o) Pads sleeping inflatable	1
(p) Sleeping bag (inner) w/ cover	1
(q) Poncho	1
(r) Entrenching tool	1
(s) Lysol	1

EXERCISE “SUN DOG TWO”

LESSONS LEARNED

GENERAL

- 1 Exercise “SUN DOG TWO” was a two-sided, joint exercise.
- 2 (a) Dates: 14 Feb 51 - 23 Feb 51
- (b) Area: FORT CHURCHILL, NUNNALLA Area
- (c) Troops Participating:
 - (i) Friendly Force - 1 Coy Group 1 RCR
Det Lt Bty RCA
Det RCE
Tp RC Sigs
Det RCASC
Det RCAMC
Det RCEME
 - (ii) Enemy Force - 1 P1 1 R 22e R
Det RCE
 - (iii) The RCAF provided tactical and transport support to the friendly force.
- (d) Aim: The aim of the exercise was to:
 - (i) Compare the relative efficiency of parachute assault in the Arctic with a co-ordinated attack by an air-transported force.
 - (ii) Exercise Canadian Army/Royal Canadian Air Force (RCAF) staffs in joint planning for airborne, air-transported winter operations.

- (iii) Exercise the First Battalion Royal Canadian Regiment (1 RCR) in airborne/air-transported operations on a company group scale.
- (iv) Reassess the problems of maintaining a force in the barren lands.

LESSONS LEARNED - OPERATIONAL

3 Planning and Preparation

Tactical loading of aircraft is a must. All components must be loaded in “packets”, eg, infantry sections, RCAF, etc.

4 A three day supply of rations and naphtha is the maximum amount of each commodity that can be carried by airborne troops on “D” Day.

5 Sufficient stores should be held in mobilization reserve to permit the speedy equipping of a force to operate in the north.

6 A representative of Air Transport Command should attend the first joint conference.

7 Tactical and Technical Investigation Section (TTIS) of the Canadian Joint Air Training Centre should be responsible for planning of aircraft loads.

8 The Army Headquarters’ conference should be held at an early date to allow the Army directive to be issued as early as possible, to allow the Command concerned to proceed with planning.

9 A small permanent planning staff, on an Army/RCAF basis, should be set up to carry out preliminary planning on northern exercises. This staff would operate under the Command Headquarters concerned once the preliminary Army Headquarters directive had been issued. The Command in whose area the exercise is to be conducted would be responsible for the detailed planning of the exercise and the provision of additional planning staff.

10 The Command conducting the exercise should be permitted to deal directly with participating units. Copies of all such correspondence could be sent to Commands concerned for information.

- 11 Very careful planning for the number of troops required from arms and services should be carried out at an early date. These should be sufficient to allow for pre-exercise casualties due to sickness, accidents, etc.
- 12 Air members of the Joint Headquarters should be separate personnel from those concerned in the actual operation of aircraft.
- 13 The Joint Headquarters should be in the same building with Army and RCAF opposite numbers in the same offices.
- 14 The roles of Commander and Exercise Director should not be combined.
- 15 The weight capacity of aircraft participating should be known well ahead of time.
- 16 The briefing should be carried out as soon as possible after the arrival of the troops at the Advance Base.

17 Organization

A Forward and Rear Air Supply Organization, or personnel to carry out these requirements, is required.

- 18 A ground liaison officer should be provided on all future exercises of this nature.
- 19 The Enemy Force should be transported to their exercise position by air.
- 20 Extra LMGs, 75 mm and LAA guns, and oversnow vehicles should be allotted to the Enemy Force.
- 21 The Enemy Force should be equipped with wireless down to and including sections.
- 22 RCEME should be responsible for all field repairs.

23 Command and Control

The commander should decide when, where, and the number of personnel to be committed.

24 Offensive Support

More active use of offensive air support in Arctic operations must be considered.

25 Transport Support

Norseman aircraft equipped with skis can land close to most objectives without prior air strip preparation.

26 The RCAF should be responsible for evacuation of personnel and equipment after the exercise proper has been completed.

27 Engineer Support

Clearing the snow down to the ice is the most practical method of constructing a forward air strip.

28 During the winter season, preparation of air strips for light or medium bomber type aircraft is feasible. There are large numbers of lakes on the barrens which are ideally suited.

29 Reconnaissance

Continuous research should be made in respect to photography, navigation, pinpointing and relocating areas once photographed, and pathfinding tactics. Year round practice should be carried out.

30 Aerial reconnaissance is essential.

31 Army personnel should be provided as photo interpreters on future exercises. The importance of the experience gained through participation in such exercises cannot be over-emphasized.

32 Further study should be made of the whole question of ground reconnaissance.

33 Personnel should be selected for duty in northern areas to learn how to live, move and fight. They could form the nucleus for reconnaissance parties required in future operations and exercises.

34 A special light ration should be provided for reconnaissance parties.

35 A light wireless set should be made available with a range of 25 miles for reconnaissance parties. The set would provide communications from the party's base camp to roving patrols.

36 An Army representative should accompany long range reconnaissance aircraft during visual reconnaissance and when oblique photographs are being taken.

37 Five to seven days should be allowed for full coverage by air reconnaissance.

38 Every advantage must be taken of suitable weather conditions.

39 The commander of Own Forces should arrive at the Advance Base before, or as soon after the long range reconnaissance airplanes as possible.

40 Movement

On a number of occasions, light vehicles deviated from the route and consequently created a number of tracks over which light vehicles could traverse. In so doing, they misled heavy tractors into rough country and rendered night travel difficult. All routes must be marked clearly and no deviations should be allowed. A requirement exists for a suitable type of road marker which can be employed during either night or day movement.

41 Assault Tactics

There is no tactical difference, theoretically speaking, between an operation conducted on the barrens in the winter and one carried out in any other area. Troops can be dropped in the Arctic during the winter and, in turn, live, move and fight.

42 The overhead landing method visualized by many, when speaking of “smothering” tactics, is considered false and not practical and should only be employed when conditions of weather, ground and enemy disposition ensure successful conclusion of the operation.

43 The administrative DZ must be secured before resupply takes place. This applies to any airborne operation but is particularly important to northern operations due to requirement for survival equipment.

44 Personnel parachuting in the Arctic should do so with a minimum of equipment.

45 Personnel should be rested during periods of inclement weather thus enabling them to take advantage of every opportunity to mount the assault.

46 Ground Battle

If paratroops or air-landed troops are to be used, a re-organizing period once on the ground must be granted. In order to do so, troops must land some distance from enemy position - out of range of small arms fire is the suggested distance.

47 Camouflage, Concealment and Deception

All camouflage positions gave good protection against ground observation but were obvious to air reconnaissance. However, the use of camouflage main positions with several alternative positions confuse both ground and air attackers.

48 Communication

Cipher should only be used when there is the possibility of enemy interception in sufficient time to allow them to take counter-action.

49 The possible use of a system of code words should be investigated.

50 Some standardization in frequency range of Army and RCAF wireless equipment is necessary.

51 An exhaustive study of communications in the north by a special committee is strongly recommended.

52 Medical

Medical authorities should be advised as to what casualties may be expected.

53 Meteorology and Topography

The meteorologist who is to attend the exercise should be selected early and the requirements made known to him. He should be brought into the planning as early as possible.

54 Selection and Training of Personnel

Familiarization training for Arctic operations must be carried out in an area similar to where the exercise is to be conducted.

55 The troops must be physically and mentally fit. The responsibility of junior leaders towards their men is increased, especially during periods of rest.

56 Selection and training of umpires should be made early in the planning stages and their selection should be governed by past experience. All umpires should have northern experience prior to their participating in the exercise.

57 All personnel proceeding on northern exercises should be interviewed by their commanding officers to ensure that compassionate cases do not exist.

LESSONS LEARNED - EQUIPMENT

58 Modification to Existing Equipment

Zipper screens should be provided for the doors in aircraft carrying personnel into the assault.

59 Modifications to our present types of vehicles should be undertaken immediately pending procurement of Beavers and Wapitis. This is particularly applicable to the Penguin.

60 The X51 trousers and X50 parka (modified with crupper for use as jump smock) should be adopted for northern areas.

61 The feasibility of adopting USA boots, winter, rubber, for wear in the Arctic should be investigated.

62 The X51 jacket, if used, should be lengthened to protect the kidneys and fitted with a crupper so that it may be used as a jump smock.

63 The provision of tentage should be carefully investigated. The 5-man tent is favoured for use by outlying parties whereas the 15-man tent allows for better control, economy of manpower and reduction in overall weight.

64 New Developments Required

No satisfactory battery for use in cold weather operations has yet been designed. Priority should be given to this subject.

65 The Canadian 5-in-1 ration pack is satisfactory, but can be improved upon.

- 66 An aircraft, suitable for carrying equipment necessary in the construction of airfields, is required. At least two C-119 aircraft should be obtained either by purchase or by United States participation in our northern exercises.
- 67 More modern photographic equipment is required for air photography.
- 68 A light long-wave set with a range of 200 miles should be developed.
- 69 A lighter cable for line communication should be procured.
- 70 A suitable type of mechanized toboggan should be developed. The vehicle must operate with a minimum of noise.
- 71 A larger and better “flare pot” for marking of airfields should be investigated.
- 72 The RCAMC should be provided with a tent suitable for use as an operating room. The British 10-man tent appears to satisfy this requirement.
- 73 A more efficient casualty bag is required.
- 74 A portable, lightweight shelter should be developed in which maintenance and field repairs can be conducted.
- 75 RCEME should carry out trials on canvas shelters during winter 1051-52.
- 76 The Canadian Silva Compass should be provided for northern operations.
- 77 Matches must not be packed in the ration packs as the RCAF or commercial carriers will not transport them.

EXERCISE “SHOO FLY II”

LESSONS LEARNED

GENERAL

- 1 This was a two-sided exercise carried out to investigate the tactical techniques and logistic requirements of an infantry platoon operating overland against an enemy of one infantry section which had been landed for reconnaissance purposes.

- 2 (a) Date: 19 Aug - 1 Sep 1951
- (b) Area: CHURCHILL
- (c) Troops Participating:
- (i) Own Troops
 - 1 Pl R 22e R
 - 6 RC Sigs personnel
 - 1 RCAMC medical orderly
 - (ii) Enemy Troops
 - 1 Sec R 22e R
 - 6 RC Sigs personnel
 - 1 RCAMC medical orderly
- (d) Observers and umpires were from UKALS, DRB, and Training Wing, Fort Churchill.
- (e) RCAF: 2 Norseman aircraft of the RCAF (JSES) Unit. (One aircraft equipped with wheels was used for administrative details only. Float equipped aircraft was used in the tactical and emergency role.)
- (f) Aim: The aim of the exercise as laid down by the Directorate of Military Training was to:
- (i) Practice sub-units of 1 R 22e R in a tactical role.
 - (ii) Establish firm scales of clothing, arms, ammunition and personal and unit equipment for employment of forces at the platoon level operating over diversified terrain during the Arctic summer.
 - (iii) Test infantry platoon tactical techniques now in effect and to recommend where necessary, their modification to suit Arctic conditions.

LESSONS LEARNED - OPERATIONAL

3 Planning and Preparation

A large part of the training carried out in Churchill, as has been previously stated, is designed to dispel the fears of the Arctic and the troops involved. This is only possible if the conditions such as are found far from human habitation can be duplicated. It is recommended therefore that if possible all future exercises should take place in areas far enough away from Churchill to approximate the desirable conditions.

4 Command and Control

In both wooded and barren areas the normal drills for laying out a platoon bivouac apply. As in other regions, each individual situation must be considered on its own merits and modified from the drill accordingly.

5 Transport Support

It is considered that RCAF participation in all exercises in the north is essential but on a larger scale than is normally considered in the meaning of the word emergency. This participation should include:

- (a) Normal supply to ground forces.
- (b) With the present limitations of ground wireless equipment the establishment of wireless communications with the main base at predetermined intervals.
- (c) At present, conventional aircraft cannot be relied upon in casualty evacuation, due to the limitation of landing areas. It is considered that helicopters could best fulfill this requirement.
- (d) Helicopters could also be used on special tasks as route reconnaissance, aerial reconnaissance, to locate the enemy and direct support of army component operations.
- (e) Gliders could also be used.

6 Fire Support

It is considered that a light semi-automatic weapon, preferably of the present British pattern, is most desirable weapon to be carried. The weight of the Bren gun and the weight of the ammunition required to make it effective would have to increase the individual man's load over the optimum considered desirable.

7 The Sten Machine Carbine, plus ninety rounds of ammunition, can be carried within the optimum load requirement.

8 Platoon weapons and ammunition, due to the weight factor, can not be carried. It is considered, however, that the use of these weapons is desirable and that they should be air-dropped prior to the action taking place.

9 Logistics

It is considered that 45-50 lbs is the optimum load carried by the individual soldier over diversified terrain. It was noted that during this exercise there was a marked drop in distance covered, rate of march, fitness to fight and morale, when weights above 50 lbs were carried.

10 Reconnaissance

It is evident that very little reliance can be placed on visual air reconnaissance from Norseman type aircraft in locating troops on the ground. The clothing worn by the troops blended with the texture of the ground and provided troops remained still, they were almost invisible.

11 Assault Tactics

The most suitable method of advance in both barren and wooded areas when enemy is unlikely is in single file. It must be appreciated, however, that these tracks can readily be seen from the air in the barren lands and open bush. The force commander must therefore maintain security and deception by frequently breaking track. Where contact is imminent, advance should be made in extended order in the barrens, and single file in wooded areas.

12 Defence

On operations of this scale, due to the rough nature of the terrain, defensive positions are not difficult to find. On larger scale operations, however, difficulty

would be found in placing sub-units in mutual support for some or all of the following reasons:

- (a) Lack of sufficient areas of dry ground.
- (b) Necessity of building up positions of sod. A solid sod wall 9' thick is considered the minimum width of safety against small arms fire.
- (c) As large areas of sod would be removed, camouflage due to the scars left in the ground would be extremely difficult. In this area it is possible to dig only a depth of one foot. At this depth the permafrost table is encountered and further digging is impossible.

13 Navigation

The following aids to navigation are required:

- (a) Oil bearing prismatic compass, one per section.
- (b) Service protractor, one per section.
- (c) Pace counter, one per section.

14 It is considered that maps on a smaller scale than 1" to the mile must be augmented by air photographs. The scale of issue of these photographs would depend to a large extent on the nature of the operation, but could generally be considered to be one set per section.

15 A Sun Compass is required as a check on the magnetic compass in areas in proximity to the magnetic pole or where large local areas of variation are suspected. The Chichester sun compass appears to be satisfactory and should be provided on the scale of one per oil bearing prismatic compass.

16 Camouflage, Concealment and Deception

Local materials combined with X-51 clothing provide good camouflage. No extras are needed for operations of this scale.

17 There are no special camouflage problems in a bivouac area.

18 The clothing and equipment worn by the troops blended well into the local terrain, and no camouflage problems arose other than those when defensive works were required. Concealment from the air was naturally simple provided the troops remained still. Concealment from ground observation however depended on the methods of movement employed by the commander. These are not different to those precautions necessary in other areas.

19 Communications

It is considered, due to the lack of mobility, that a supporting umpire signals net is required. This signals net should extent down as far as one wireless set per umpire.

20 The W/S No 62 was too heavy to be carried beyond D/2 and as this set was the main communication link with Fort Churchill, communications had to be carried out by either orbiting aircraft or when possible and available, a No 29 set from a Penguin. This W/S No 29 could not be relied upon. The W/S No 58 in the aircraft worked extremely well. Excellent communications were established by using this set to contact the ground troops and using the normal aircraft set to communicate back to base.

21 Selection and Training of Personnel

No group of specially trained men is required to operate in this type of terrain during the Arctic summer, however, it is preferable that all troops undergo a short indoctrination course, mostly to dispel preconcerned misconceptions.

22 Administration

When the Canadian 5-in-1 ration pack is used, no additional cooking equipment is required beyond the service mess tin.

23 During summer, tentage can be dispensed with.

24 In this area, local fuel can be relied upon. Heating tablets issued one per day per man are desirable but not essential.

LESSONS LEARNED - EQUIPMENT

25 Equipment Satisfactory

The X-51 pattern anti-contact glove is satisfactory.

26 The Canadian shoepack, rubber bottom, leather top, is the best type of footgear at present available, due mainly to its capabilities of wear during a wider variety of seasons.

27 The nylon X-51 clothing adapted for summer use is the most desirable due to its quick drying capabilities.

28 Web equipment was not found satisfactory, but the rucksack was found most desirable for fighting troops.

29 It is considered that the packboard is required for specialized use, eg, ammunition carrying parties, demolition parties, wiring parties and possibly certain other carrying parties such as infantry support weapons, wireless sets, etc, over short distances.

30 Modification to Existing Equipment

It is recommended that investigations continue on the provision of a wireless set capable of being man-packed and with an operating range of 50 miles, and that this wireless set, or portions thereof, when loaded in conjunction with the personal gear and equipment of the signaler should not exceed the optimum load of 50 pounds.

31 It is recommended that consideration be given to modifying the X-51 jackets to include a skirt in which two large side pockets could be provided. In addition, as is the case in the British combat jacket a useful pocket for carrying the poncho or other small soft items could be made in the skirt.

32 The headnet is required and the present head net is satisfactory if the colour is changed to Olive Drab No 7. An additional desirable modification would be the inclusion of a wire ring at nose level which would allow the head net to stand out well from the face.

EXERCISE "POLESTAR"

LESSONS LEARNED

GENERAL

1 During the winter 1951-52 reinforced company groups of the Mobile Striking Force (MSF) were rotated through Fort Churchill for a four week period of intensive

Arctic training under the direction of the Commandant, Fort Churchill. The training schedule for each company group was as follows:

- (a) Indoctrination training 7 days
 - (b) Exercise "POLESTAR" 17 days
 - (c) Staging in and out of Fort Churchill 4 days
- 2 (a) Dates: Group One - 18 Nov to 16 Dec 51
 Group Two - 13 Jan to 10 Feb 52
 Group Three - 17 Feb to 16 Mar 52
- (b) Area: CHURCHILL
- (c) Troops Participating:

Friendly Force

Enemy Force

Group One

Coy Gp 1 R 22e R
 4.2-in Mor Sec,
 1 Lt Bty (Para)
 Det 23 Fd Sqn
 Det AF Bde Gp Sigs Sqn
 Det 23 Tpt Coy
 Det 37 Fd Amb

P1, 1 RCR
 Det 23 Fd Sqn

Group Two

Inf Coy Gp, 1 RCR
 Two 4.2-in Mor Secs,
 1 Lt Bty (Para)
 Det AF Bde Gp Sigs Sqn
 Det 23 Tpt Coy
 Det 37 Fd Amb

P1, 1 RCR, as
 required from Friendly
 Force.

Group Three

Inf Coy Gp, 1 PPCLI
 Two 4.2-in Mor Secs,
 1 Lt Bty (Para)
 Det AF Bde Gp Sigs Sqn

P1, 1 PPCLI, as
 required from Friendly
 Force.

Det 23 Tpt Coy
Det 37 Fd Amb

- (d) Air supply was limited to two RCAF Norseman aircraft.
- (e) Aim: The aim of the training programme was to:
 - (i) Exercise components of the MSF in dismounted oversnow movement in the Arctic under operational conditions.
 - (ii) Exercise infantry companies of MSF battalions operating with the minimum support of other arms and services, in three phases of war, ie, attack, withdrawal, and defence.
 - (iii) Test the tactical techniques now in effect and recommend, where necessary, their modification to meet Arctic conditions.
 - (iv) Re-assess the requirements for the basic minimum logistical support for such a force by reducing weight, bulk, and the number of items used in northern operations.
 - (v) Assess user reactions to operational arctic equipment.

LESSONS LEARNED - OPERATIONAL

3 Planning and Preparation

Ground operations should commence from a point where supplies can be landed and from which casualties can be evacuated. This air head should be approximately 5-10 miles from the enemy lodgement so as to be out of range of enemy ground weapons.

4 Organization

It is recommended that no change be made to the section and platoon organization. In the company organization, however, there are many who will not be required, eg, RCASC cooks, company drivers, possibly the pioneer section, etc. These men must be considered only on their individual merits as soldiers, porters, etc, and within the availability of aircraft which is normally at a premium. The decision as to who will be required must generally be left to the company commander, and may be greatly affected by the specific operation being undertaken.

5 Command and Control

While march discipline was good and morale high, there was a decided tendency to gather too close together during the night halt. It is considered that tent groups must not be closely concentrated, and that a distance of approximately 40 to 50 yds between sections must be accepted.

6 Fire Support

The 4.2-in mortars of the Lt Bty were unable to continue with the company group. However, it was possible for the company 3-in mortar and MMGs to move with the group. No particular delay was imposed upon the company by the inclusion of these weapons, even though they carried with them their first line ammunition.

7 Little field firing was conducted, and in most cases firing was limited to blank ammunition. However, little difficulty was experienced with small arms provided they were properly arcticized. Emergency rifles taken into tents should be kept at ground level. The only major problems encountered were as follows:

(a) 3-in Mortars

There was considerable loss of range during fire power demonstrations when these weapons were used. With charge 2, the sights were set for 2800 yds, and the bombs fell approximately 1000 yds short. The reason for this is not positively known, but three possibilities are offered:

- (i) The fact that sand filled bombs were used.
- (ii) That the temperature at the time of firing was minus 20° F.
This may have had an adverse affect on the propellent charge.
- (iii) The propellent charge was of old stock.

(b) Medium Machine Gun - Vickers

First position stoppages occurred with considerable frequency until such time as the coolant became sufficiently heated. When this had been attained through fire or pre-heating, no particular difficulties were experienced with the operation of the gun. There appeared, however, to be a loss of range.

8 Logistics

The number of days which a reinforced company group can move unsupported is limited by the amount of rations and fuel which can be carried by the group. Normally, 3 days' supplies are carried. By conservation, these may be made to suffice for 4 days.

9 The average weight of rations consumed was approximately 4 lbs per man per day.

10 Reconnaissance

Although visibility is generally good in the Arctic, detailed reconnaissance is still necessary prior to putting in an attack, and unless such reconnaissance is made, there is a strong likelihood that troops may be committed either in the wrong direction, or against the wrong objective.

11 Mobility

Due to the difficulties of movement, commanders at all levels must appreciate the increased time required to carry out ground operations.

12 An average mileage of 8 miles per day can be attained by a reinforced company group, provided weather conditions are not severe enough to hamper movement. This does not include the movement of 4.2-in mortars or their ammunition, which are only capable of being moved over extremely short distances, ie, approximately one mile.

13 It is considered that a load not in excess of 50 lbs can be carried in the rucksack, if travelling is unusually difficult, 35 lbs is the optimum.

14 Movement

It is not considered that any special devices are required for trail marking. Snow cairns can easily be built in the barrens, and trails can be blazed in the wooded areas. However, this does not eliminate the possible requirement for marking devices such as sea dye, etc, for marking cut start lines or other tactical formation lines in the barrens. Many of these must be visible at night.

15 Assault Tactics

The night attack is possible and offers many advantages over the daylight attack. The airdrop can only achieve momentary surprise. Tactical surprise must be obtained by normal ground methods, ie, the night attack, the direction of the attack, the scale of the attack, etc.

16 Complicated tactics have no more likelihood of succeeding in the north than in any other area. Assault plans must be simple, and the rules which apply in normal climates and terrain must be followed with even greater detail.

17 Care must be exercised in crossing open spaces, and it may be necessary for the commander to decide to send troops around open spaces rather than across them.

18 The only bearing the Arctic environment has on this problem is that of storms and blowing snow. During such conditions, the troops must maintain the same formations as those that are used during night approach marches. If these conditions should be severe, however, it is questionable whether an approach march is feasible.

19 Patrols

In crossing country within the tree line, patrols without radio communication to the main group can easily be ambushed or lost. Therefore, patrols should not move beyond the range of immediate assistance from the main body.

20 Navigation

Distance judging is most difficult in Arctic areas beyond the tree line or within the transition zone. Those distinguishing features which give the observer an indication of his distance from a specified object in other areas are either not present, or are dwarfed to such a degree that in nearly all cases, distance will be over-estimated.

21 Camouflage, Concealment and Deception

No specific arrangements or materials are necessary for camouflage in wooded areas. Present clothing and equipment are adequate.

22 In barren areas, the camouflage of tentage, clothing and equipment is necessary.

23 Communications

The No 58 set could not be depended upon for company to platoon communications. During the second exercise, a wireless set No 62 was used for the

main communications back to base, and the No 88 set from company to platoons. Neither of these sets functioned satisfactorily. It was impossible to keep the No 88 set batteries warm, therefore the sets soon went dead.

24 Medical

It is considered that the RAP should remain with the administrative group and avoid the strong tendency for medical units to approach too closely to the operation in hand.

25 Living conditions in a 5-man tent favour the spread of upper respiratory infection. There were a number of soldiers reporting each day with minor colds and coughs.

26 Any ointment with a paraffin or lanolin base was useless, in that it solidified, but some measure of success was obtained by taking an ointment which had a glycerin base.

27 The ordinary morphine syrette can only be used if it is carried in a shirt pocket next to the skin. Glass containers will not be broken by freezing, provided that an airspace of a third the contained volume remains, and that the glass is not too thin.

28 Selection and Training of Personnel

Strict attention must be paid by all ranks to the increased necessity for care of arms.

29 A high standard of leadership is required in order to maintain morale and discipline. This is particularly true for junior leaders.

30 In order to carry out operations without an indoctrination phase on the care and use of Arctic equipment, teaching in the use of tentage, lamps, cookers, and such equipment must be carried out in the yearly training syllabus. Training in these subjects need not be done in Arctic areas, nor under winter conditions.

31 All troops participating in northern training should have attained corps training standards prior to proceeding on an exercise.

32 It was evident throughout the exercises that the troops had not been trained to maintain their equipment, a situation that might well result in casualties, or even the failure of an exercise or operation.

33 Clothing should be carefully fitted, and the minimum clothing requirements should be clearly known by all ranks.

34 Good march discipline is necessary to obviate fatigue and exhaustion.

35 Night training in northern conditions cannot be over emphasized. Every effort should be made to include as much night training as possible during the basic and indoctrination training, mainly for speed and the elimination of noise. The use of lights must be avoided.

36 More practice is required in marching and hauling, and rucksacks should be worn frequently during indoctrination training. Pt and hardening exercises should be included.

37 It is important that participating troops "marry up" for group training prior to the exercise. Team work between all arms is essential.

38 A one week period of environmental indoctrination should be conducted in the exercise area.

39 Administration

The wastage in Arctic clothing and equipment during extended exercises is considerable. Adequate stocks for replacement of these items must be maintained at the exercise base. Wastage can be reduced by proper maintenance.

40 Arctic clothing and equipment should be held by units of the MSF, and not issued just prior to departure on an exercise or operation.

41 It became fully evident by the end of these exercises that the maximum load carrying and pull capacity was 150 lbs per man, if the man was to be fit to fight at the end of the march.

42 The toboggan dumping point will normally become the area in which the administrative group is established.

43 The weight of rations now being carried appears to be excessive and capable of reduction.

44 It was recommended by the medical officers attending these exercises, that rum ration should be provided for nightly issue to all troops.

45 The OC exercise group should have authority to issue, on medical advice, an extra meal when it is warranted.

46 Opportunity should be taken to chew a cookie or candies from the day's rations at some of the halts.

LESSONS LEARNED - EQUIPMENT

47 Modification to Existing Equipment

The two-man fibre glass toboggan was unsatisfactory as it wore out very quickly. Magnesium two-man toboggans were satisfactory.

48 The ten-man British tent, in its design characteristics, proved successful for use by company HQ and the medical section.

49 It is considered that breech and muzzle covers would have been useful as a protection against snow and ice crystals. The present breech cover was inadequate. The following suggestions for improvement were made:

- (a) a light nylon cover capable of being removed by zipper.
- (b) an elastic type sleeve capable of being pulled back over the mechanism to the small of the butt.

50 No trigger mechanisms were available for testing on these exercises. It was agreed that difficulty was experienced in firing weapons. Some of the suggestions were:

- (a) use of a trigger mechanism.
- (b) enlargement of trigger guard to allow the insertion of a trigger finger mitt.
- (c) a more adequate anti-contact glove.

51 The [consensus] of opinion of all company groups was that a light automatic weapon was required. The British EM 2 rifle seems to fulfill the requirement.

52 The shovel, snow, Arctic, did not prove of value. Almost all of those in use were broken within three days. A more durable design is required. Shovels, miner, and

snow saws, should be issued on the scale of two per tent group. The present scale of one snow knife per tent group is adequate.

53 It was suggested that the present type of Coleman stove is inadequate. Not only were the wastage figures on these stoves high, but great difficulty was experienced in lighting them under conditions of cold, due to the fact that they function on the generator principle. Research is required to provide a suitable, light, efficient stove for northern operations.

54 The Coleman lamp, particularly the 500 candle power variety, is too large for use in a five-man tent. It is considered that investigation should be initiated with a view to producing a lamp of lesser candlepower, more rugged construction, and smaller size.

55 At low temperatures, the arms and eyepieces of the goggles, brow rest, became brittle and broke. Wastage figures were high. It is considered that these goggles were too fragile and that a more suitable type goggle should be provided.

56 A requirement exists for an expendable patrol container. The present two gallon container is expensive, liable to damage, and the tops are easily lost.

57 All company groups agreed that the thermos container was not satisfactory. Consideration should be given to the provision of:

- (a) a larger thermos to be issued as tent group equipment, rather than as an individual item.
- (b) a limited number of a more suitable type of small thermos, for use by individuals on patrol and sentry duty.

58 In many cases punctures occurred in the pads, inflatable. The air escaped through leaking seams or by the cork tearing away from its rubber loop. These pads should be checked on issue for possible leaks and irregularities of manufacture, and a puncture repair outfit should be provided on the scale of one per company group.

59 New Developments Required

It is strongly recommended that No. 88 sets should not be used on future northern operations until a cold weather battery has been developed.

60 Pack boards were not used on the exercise, but it is considered that a limited requirement exists for this type of equipment, particularly in handling the loads of supporting arms which may be dropped after the main body.

61 The principle of radically reducing weight should be constantly under review. The following are notations made on personal equipment:

- (a) Towel - should not be carried. Paper towels are provided in ration packs.
- (b) Tooth brush - this should be taken, but not paste. The latter freezes. Dental advice is that salt provided in the ration pack is equally as good, if not preferable, to many pastes.
- (c) Soap - is not necessary, as it is provided in the 5-in-1 pack.
- (d) Powder - is essential, and should be provided in small, light, non-crushable containers. It is useful in maintaining hygiene of the feet, crotch, arm pits, and body surfaces. It prevents excessive sweating of the feet when liberally dusted into socks, and limits blistering. It can relieve blistering when present, if dusted into gloves it facilitates the slipping on and off of gloves in extreme cold.
- (e) Knife, Fork, Spoon and Mess Tin - should not be taken. The ration pack is self-sufficient.
- (f) Mug - is necessary.

62 With communal equipment, weight reduction is also important:

- (a) Tent and Toboggan Repair Kit (15 lbs) - this weight was pulled by some teams, and is out of proportion to its usefulness. Only light tools and bare essentials are required, carried on a scale of one per company.
- (b) Axe - is heavy, but is necessary for falling trees.
- (c) Kettle (2 lb 5 oz) – was used by some troops. A thin aluminum kettle would be preferable.
- (d) Tea Pots – were taken by some groups. They are not needed. Tea can be made in the individual's mug from tea-bags provided.

63 The parka should be produced with varying sleeve lengths to fit varying lengths of upper limbs. The parka hood should be fur trimmed, the metal ends of hood cords should be replaced or removed. Parka pockets should be reinforced, and parka cuffs should not be held in by elastic.

64 A gauntlet on the outer mitts should be produced.

65 Trousers camouflage should be made looser.

66 The peaked cap prevents closure of the parka hood over one's face during severe wind chills and the balaclava is then recommended under these conditions.

67 The housewife should be taken to repair clothing.

68 Tests should be made on tentage camouflage on the barrens.

EXERCISE "SUN DOG THREE"

LESSONS LEARNED

GENERAL

1 Exercise "SUN DOG THREE" was a two-sided joint exercise:

(a) Dates: 4 Feb 52 to 14 Feb 52

(b) Area: CHIMO, LABRADOR

(c) Troops Participating:

(i) Friendly Force - 1 Coy Gp 1 R 22e R
Det 23 Fd Sqn
Det AF Bde Gp Sigs Sqn
One Air Supply P1, 23 Tpt Coy
Det 27 Fd Amb
Det 28 COD

(ii) Enemy Force - One reinforced P1 1 RCR
One Det 23 Fd Sqn

(iii) The RCAF provided tactical and transport support to the friendly force.

- (d) Aim: The aims of the exercise were set out in the Department of National Defence, Joint Exercise Directive No 1, dated 11 Jul 52. They were:
- (i) To practice an operation to destroy an enemy force which has captured one of our northern airfields.
 - (ii) To practice restoring a northern airfield for our own purposes when it has been retaken from the enemy.
 - (iii) To exercise Canadian Army/Royal Canadian Air Force staffs in winter, Arctic, airborne operations.
 - (iv) To exercise the 1st Battalion, Royal 22e Regiment, and supporting arms in airborne operations on a company group scale.
 - (v) To exercise Royal Canadian Air Force units in offensive and transport air support.
 - (vi) To test the “Standard Operating Procedure” and the “Logistics Support Plan” for the Mobile Striking Force.

LESSONS LEARNED - OPERATIONAL

2 Planning and Preparation

Existing staffs at Eastern Command and Tactical Air Group can successfully plan and conduct an exercise of this nature. But the task, in addition to many other duties, necessitated working under pressure for several months, and the normal functions of both headquarters suffered accordingly. Additional planning staff would appear to be required at both headquarters, both for the planning of such exercises, and for other purposes, such as the planning of operations or mobilization.

3 A senior operations staff officer, fully conversant with all phases of the exercise, is needed as conductor of the observer party.

4 If an exercise is to be held in the north in winter, then the decision must be made in ample time to permit the movement of heavy equipment during the previous summer.

- 5 Representatives of the units from supporting arms and services must be consulted during the very early stages of planning to ensure the consideration of their special requirements. Operating Air Force units should be similarly consulted at an early stage to ensure the possibility of last minute airlift requirements.
- 6 Directives for future winter exercises should be issued as early as possible. It is considered that Tactical Air Group can conduct a maximum of two major exercises a year.
- 7 Commanders of units required to provide resources should participate in initial planning conferences.
- 8 The umpire organization should provide for one umpire per platoon and an umpire to assess aircraft casualties during air to ground attacks.
- 9 Planning should include functions for the Canadian Rangers and local inhabitants.
- 10 The enemy should be provided with an increased scale of automatic weapons and mortars. In particular, some form of anti-aircraft weapon, such as 20 mm guns, should be included.
- 11 The present capabilities of the Mobile Striking Force are such that a considerable time will be taken, after the first warning of a lodgement, before effective action can be taken to destroy the enemy. It appears, from this exercise, that a typical time-table for an operation in eastern Canada will be:

D Day	Initial Warning
D plus one	First Air Reconnaissance
D plus three	First Air Strike
D plus eight	Ground Reconnaissance
D plus ten	Ground attack, providing enemy can be dealt with by the reconnaissance party without further reinforcement.

Reasons for the comparative slowness of this time-table appear to be:

- (a) The tactical reconnaissance aircraft cannot be available for a sortie before D plus One, owing to distance.
- (b) Offensive air support slow in becoming organized as crews are from Reserve units.

- (c) Ground forces neither equipped nor trained to a high enough standard.
- (d) Communications in eastern Canada are unreliable.

12 Organization

It is not necessary to stage the airborne troops through a rear base, so long as the “war base” of the unit is close to a suitable airfield.

13 If the Army Main Base is situated at Command Headquarters then a very small number of personnel can perform the required functions. RCAF representatives can be limited to an Air Transport Command Liaison Officer, a small air movement staff and one Flying Control Officer for operations of short duration.

14 The organization at the Advance Base, as suggested in Standard Operating Procedure, is generally suitable. Reductions can be made by merging the staffs of the Operations Commander RCAF and the Commander, Mobile Wing, though both Commanders are personally required. The Army component can be materially reduced.

15 Where feasible, plans should provide for the airlift of the airborne force directly from its war station to the Advance Base.

16 Command and Control

The new Standard Operating Procedure should provide for the senior RCAF officer at the Advance Base taking charge of operations until the designated Operations Commander arrives.

17 The responsibility for administration of the Advance Base should be borne by the RCAF if the base is at an RCAF station.

18 Agreement should be reached as to the standard organization for an airborne company group for Mobile Striking Force operations. A suggested minimum organization is shown at Appendix “A”.

19 Offensive Support

An airstrip is difficult to neutralize by bombing alone. The indication is that with our present equipment neutralization will be more easily and effectively accomplished by the destruction of fuel in bulk storage.

20 One Ground Liaison Officer is not sufficient for carrying out the essential functions of reconnaissance, offensive support and transport support.

21 Transport Support

The limited payload of Dakota aircraft necessitates exact load planning, and may even force reductions in the size of the assault force. There is a need for tables of weights and other data relative to equipment, which would facilitate the planning of the airlift. There is also need for the provision of RCOC personnel as specialists in packaging and maintenance duties.

22 Tent group toboggans were not tactically loaded at the home station, and were not clearly marked to facilitate clearing of the DZ. All tent groups should mark their toboggans "A" and "B". The contents of each should be the same within each tent group.

23 The emplaning officers should be drawn from the unit employed. Two such officers are necessary, one at the Main Base and the other at the Advance Base.

24 The uncertainty of sub-Arctic weather and its ruling unsuitability for airborne assault make it imperative that forces arrive at the Advance Base in complete readiness for the assault, to which they may be despatched with the minimum of delay. Briefings at the Advance Base should be limited to acquainting the troops with their immediate part in the operation, and Assault Force Commanders should be free of all other tasks to concentrate on detailed planning of the assault.

25 All company officers in airborne battalions should be trained in the duties of unit emplaning officers.

26 The method of packaging supplies for airdrop used on this exercise should be adopted for future operations.

27 When commands indent for parachutes for Mobile Striking Force exercises, the forecast date for the drop should be specified. Regulations regarding the shelf-life of a packed parachute should be reviewed.

28 Reconnaissance

Mobile Striking Force plans should contain provision for the use of any aircraft available at an Advance Base to carry out visual reconnaissance, until proper reconnaissance aircraft can take over this task.

29 Owing to tree cover and rough terrain it appears doubtful if air reconnaissance will be able to produce all the information required.

30 When reconnaissance aircraft may have to be diverted, the operations plans should be to divert them to an airfield equipped with photo developing and reproduction facilities. In such cases, a photo interpreter should accompany the aircraft.

31 The small ground reconnaissance party is not a reliable means of obtaining full battle intelligence. The party must be strong enough to protect itself against any attack the enemy delivers.

32 Assault Tactics

Because of the difficulty of obtaining detailed information it will seldom be possible to drop an airborne force with plans already made for a set-piece attack.

33 The minimum strength for a Parachute Platoon in a Mobile Striking Force operation is considered to be thirty. The company group must also have command, support and administrative elements.

34 Ground Battle

A mechanical carrier is essential where heavy support weapons have to be transported over long distances. Until some form of carrier is available these weapons should be delivered by parachute to the vicinity of the fire position after it has been secured.

35 Emergency rations must be carried by the man when operating in the north.

36 The use of local inhabitants and facilities would help considerably in clearing the DZ, and in shortening the time absorbed in the approach march. Such facilities, including dog-teams and guides, should be organized by the reconnaissance party.

37 The concept of the deliberate attack, mounted from a firm base and preceded by normal reconnaissance patrolling, should be accepted as a basis of tactical planning for Mobile Striking Force operations.

38 Communications

The present communications between Halifax and Goose Bay are too unreliable to support a Mobile Striking Force operation.

39 Analysis of the exercise traffic indicated that one good communication circuit is adequate to support an operation of this type. If this circuit is a shortwave wireless circuit, it should be backed up by means of a longwave wireless circuit.

40 Meteorology & Topography

An adequate meteorological staff, suitably trained for Arctic forecasting, must be provided for any exercise and the size of this staff will be determined by the local DOT facilities at Main and/or Advance Base.

LESSONS LEARNED - EQUIPMENT

41 Modification to Existing Equipment

The present equipment of the parachutist is so bulky that it makes even moving, far less boarding an aircraft, an exhausting and a slow matter. A study to reduce equipment and to facilitate emplanement is regarded as necessary.

42 The signal equipment in the glider used on this exercise was not successful. However, it is considered that it did not have a fair test period before being placed on the exercise.

43 New Developments Required

The Commander of the ground forces in the assault area must have communications to the Advance Base so that he can report his situation or request reinforcements, air support and supplies. He must also be able to communicate with aircraft in the air.

44 A mechanical carrier is essential where heavy support weapons have to be transported over long distances. Until some form of carrier is available these weapons

should be delivered by parachute to the vicinity of the fire position after it has been secured.

45 A study should be undertaken to determine the organization and scale of equipment needed for the Mobile Field Photographic Section, and the Air Photographic Interpretation Section, for Mobile Striking Force operations.

46 As soon as possible, units of the Mobile Striking Force, both ground and air, should be equipped to war scale for Arctic operations.

47 A development project should be initiated for a wireless set, which can be parachuted and set up as a ground station within one hour, capable of working back to the Advance Base up to a distance of 500 miles.

48 Action should be taken to procure portable wireless sets capable of reliable communication from ground units to aircraft. These sets must be of a size suitable for carriage on the man in a parachute crop.

Appendix “A” to “Sun Dog Three” Lessons Learned

RECOMMENDED MINIMUM ORGANIZATION

OF A RIFLE COMPANY FOR NORTHERN OPERATIONS

ORGANIZATION

1 It is recommended that the following organization be adopted for an Infantry Rifle Company earmarked for operations similar to those carried out during this exercise:

(a) Company HQ

(i) Command Group - Two tent groups

Company Commander	- SMC
CSM	- Rifle
2 Signallers	- 2 SMCs
6 Riflemen	- 1 LMG and 5 Rifles

Note: Riflemen to provide runners and toboggan haulers.

(ii) Administration Group - Four tent groups

Company 2IC	- SMC
CQMS	- Rifle
8 Riflemen	- 1 LMG and 7 Rifles
2 Medical Officers	- 2 SMCs
8 Medical Orderlies	- 8 SMCs

Note: Riflemen to supply personnel for recovery and stacking of stores.

(iii) Support Group - Five tent groups

<u>MMG Section</u>	- 2 MMGs
Section Commander	- SMC
9 Gun Numbers	- 9 Rifles
<u>3-in Mortar Section</u>	- Two 3-in Mortars
Section Commander	- SMC
4 Pioneers	- 4 Rifles

(b) Three Rifle Platoons - Six tent groups each

(i) Platoon HQ

Platoon Commander	- SMC
Platoon Sergeant	- Rifle
2 Mortar Numbers	- 2 in Mortar, SMC and Rifle
Runner	- Rifle
Med Orderly	- SMC

(ii) Three Sections, each

Section Commander	- SMC
3 LMG Numbers	- LMG and 2 Rifles
4 Riflemen	- 4 Rifles

SUMMARY OF ORGANIZATION

Detail	Offrs	OR	MMG	3" Mor	2" Mor	SMC	LMG	Rif	Tents
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)
Coy HQ Comd G	1	9				3	1	6	2
Adm Gp	3	17				11	1	8	4
Sp Gp		25	2	2		3		22	5
Three P1 HQs (each)	1	5			1	3		3	6
Nine Rifle Secs (each)		8				1	1	6	
Total Coy Group	7	138	2	2	3	35	11	99	29

LEFT OUT OF BATTLE

3 To be of any use LOB personnel must be available as soon as possible after the initial airborne assault. It is recommended that approximately 30 OR be landed with the resupply delivery and be held in the DZ area as a pool of reinforcements.

EXERCISE "DEER FLY"

LESSONS LEARNED

1 A programme of summer training in northern Canada, for selected sub-units of the Mobile Striking Force, was held in the Fort Churchill area, based upon a directive produced by Army Headquarters.

- 2 (a) Dates: (i) "DEER FLY I" 1 Jun - 29 Jun 1952
(ii) "DEER FLY II" 6 Jul - 3 Aug 1952
(iii) "DEER FLY III" 10 Aug - 7 Sep 1952

(b) Area: FORT CHURCHILL and CHRISTMAS LAKE area.

(c) Troops Participating:

“DEER FLY I” - Friendly Force

One reinforced pl, 2 RCR
One det AF Bde Gp Sigs Sqn, RC Sigs
One det Arctic P1, 18 Coy RCASC
One det AB P1, RCASC

Enemy Force

One reinforced sec, 2 RCR

“DEER FLY II” - Friendly Force

One reinforced coy, 2 PPCLI
One Tp AF Sde Gp Sigs Sqn, RC Sigs
One det Arctic P1, 18 Coy RCASC
One det AB P1, RCASC
One sub-sec, No 1 Airborne Med Sec, RCAMC

Enemy Force

One reinforced pl, 2 PPCLI

“DEER FLY III” - Friendly Force

One reinforced pl, 2 R 22e R
One det AF Bde Gp Sigs Sqn, RC Sigs
One det Arctic P1, 18 Coy RCASC
One det AB P1, RCASC

Enemy Force

One reinforced sec, 2 R 22e R

(d) RCAF: RCAF provided tactical and transport support as follows:

- (i) 4 Jun - 5 Sep - aircraft based at Fort Churchill (JSES Unit)
- (ii) 10 Jul - 1 Aug - aircraft based at Fort Churchill, supplemented by one Dakota.

(e) Aim: The aim of this programme was:

- (i) To train elements of the Mobile Striking Force in their role of reducing enemy lodgements in northern Canada over diversified terrain.
- (ii) To assess the standard of troops taking part.
- (iii) To determine the personnel and equipment requirements for future summer northern operations and training.

(f) Outline Schedule:

Each “DEER FLY” exercise conformed to the following schedule:

- (i) D Day - D plus 2 - Staging in.
- (ii) D plus 3 - D plus 8 - Indoctrination, including both lectures and field work.
- (iii) D plus 9 - D plus 19 - Field training to practice infantry skills under summer Arctic conditions.
- (iv) D plus 20 - D plus 25 - Main exercise in two phases.
- (v) D plus 26 - D plus 27 - Staging out.

LESSONS LEARNED

GENERAL

3 In particular, this exercise supports lessons learned on the following:

(a) “SHOO FLY I” (Original Report)

(i) environment	Para 24
(ii) personnel	Para 25
(iii) training	Para 26
(iv) movement	Para 27 (a) (b)
(v) navigation	Para 30
(vi) helicopter	Para 31
(vii) camouflage	Para 34

(b) "SHOO FLY II" (Original Report)

(i) environment	Para 1 (a) (e) (f)
(ii) air	Para 2 excl (c)
(iii) movement	Para 1 (g) (j)
(iv) camouflage	Para 4
(v) medical	Para 5
(vi) clothing	Para 6 excl (d)

OPERATIONAL

4 Planning and Preparation

It is apparent that MSF operations are greatly dependent on the RCAF. For dropping heavy weapons an operational aircraft is required. Anything less than a Dakota is unrealistic. Close support aircraft, such as light bombers or fighter bombers, would add considerably to the value of the exercise. A helicopter would increase the reconnaissance ability of the ground troops and would add efficiency and realism to the current medical concept. Finally a photographic reconnaissance aircraft, plus a processing unit with an interpretation team, would be a decided asset.

5 Organization

The normal company, platoon and section organizations were found to be satisfactory under conditions encountered on these exercises with the exception of:

- (a) Company HQ should include one intelligence section representative.
- (b) Delete two privates - cooks.

6 Transport Support

Norsemen type aircraft is highly suitable for up to company scale operations for both aerial reconnaissance and supply, excluding supporting weapons. Only the helicopter could be more suitable and, if the helicopter could stow casualties internally in winter, it would be excellent for casualty evacuation as well.

7 Resupply by air permits the full force to concentrate on the enemy. Porters are not necessary to return to the original DZ to collect rations and ammunition, and energy of the troops is not expended man-carrying these loads.

8 Fire Support

Weapons such as the 3" mortar, which are too heavy for man-packing for any distance, can be air dropped into their fire positions and may be retrieved after the battle by helicopter or by man-pack to nearby lakes for recovery by normal air lift.

9 Engineer Support

There are many eskers and raised beaches where hasty airstrips can be used by Norseman type aircraft without any skilled labour. There are several eskers and raised beaches where makeshift airstrips for Dakota type aircraft can be used in an emergency after labour with a minimum of plant.

10 Logistics

During the fighting part of the exercises it was found that platoon groups require 360 lbs resupply each day, and company groups require 1900 lbs.

11 Reconnaissance

To date no suitable photographic reconnaissance aircraft have been used. The six-inch lens in the Lancaster can not provide a clear photograph with a scale more detailed than 1 over 6000, which is not adequate to pinpoint defences.

12 Owing to adequate maps not being available for other than small areas of the Canadian north, gridded vertical photographs may be necessary.

13 Mobility

General reference to vehicles have been made in the past. As the concept of this exercise was based on an air assault, no operational vehicles were used. Until different aircraft or vehicles are produced, references to the mobility and influence of vehicles are not pertinent.

14 There was no example where a waterway impeded infantry movement. In no case was even a poncho improvised to move a dry load. Few lakes are deep enough to warrant any special training.

15 Assault Tactics

Summer darkness in the Arctic, while not black as long as in the South, at least takes away all colours and restricts the visibility of movement a great deal. It is

difficult but could be possible for well disciplined troops to achieve considerable surprise. However, it must be assumed that the enemy would be alert after an airborne operation nearby.

16 A well dug in enemy, even without a bonus of extra supporting weapons, is such a formidable target that with or without air support a maximum amount of supporting fire is required plus an assault force at least four times the enemy strength. Troops frequently underestimate the time to reach their destination.

17 Ground Battle

From this series, it appears that a company group, without adequate supporting weapons, is not sufficiently strong to overcome an enemy platoon well organized for defence on the barrens. It may be that offensive air support would weigh the scales in favour of the attacker but a heavy scale of supporting weapons seems essential. This is particularly true if the enemy surrenders some manpower weight for an increment of automatic weapons.

18 Camouflage, Concealment and Deception

Vehicle tracks and well used foot tracks particularly in wet terrain, were generally visible from the air. The lower and slower an aircraft is moving the more likely the pilot/observer is to pick out the tracks. There is no guarantee that a well-disciplined enemy will leave tracks that our Air Force can find.

19 During the Arctic summer twilight, troops are easily skylined to an observer who keeps to low ground. Movement can be seen at distances well beyond MMG range.

20 Communications

Until a man-pack long range set is available the only reliable means of communication from the exercise area to the advance base is the use of orbiting aircraft. This was done by use of a No 88 set on the ground and duplicated in the aircraft which flew over the exercise area on timed missions twice a day.

21 The WS No 88 is not normally handled by RC Sigs personnel and when handled by the infantry alone quickly becomes unreliable. A reasonable pool of reserves is required. The WS No 58 is not suitable.

22 Wireless communication within a platoon is necessary. Additional wireless sets are required for use by patrols.

23 Reserve batteries are required for all walkie-talkie type wireless sets using dry type batteries.

24 Medical

There was no increase of sickness despite the dampness.

25 Troops must be dentally inspected and treated at unit home stations prior to dispatch to the exercise area.

26 Selection and Training of Personnel

Fear of the north, which has been emphasized in several reports, can be controlled by skilled indoctrination. However, this indoctrination must stress the three special problems of the Arctic in summer:

- (a) requirement for skilfull navigation.
- (b) appreciation of increased fatigue.
- (c) seriousness of poor planning.

27 Officers about to come on exercises must read and discuss with the troops the report on the last similar exercise.

28 It is imperative that troops be prepared for navigation problems. Since adequate maps of the barrens are not available, a high standard of basic photo reading is required by all officers and NCOs. An adequate standard of dead reckoning, as demonstrated during this exercise, can be reached only if troops in their home areas practice the recommended techniques.

29 The buzzing of mosquitoes and other insects does not cut down a man's auditory ability and does not make it difficult to ascertain direction and distance of sound. Vision is impaired to some extent when mosquito nets are worn. Troops can be familiarized with this new factor during the environmental training period preceding the operation or exercise.

30 To ensure that troops do not bunch in movement across open spaces or immediately prior to crossing an obstacle, training and capable leadership are required.

31 Emphasis should be placed on navigation, overland travel and camp routine during the indoctrination phase carried out at unit home stations. Special emphasis should be placed on discipline. Officers and NCOs, before reaching the exercise area, must know the use of the magnetic compass, maps, and protractors in detail. Principles and use of dead reckoning, log keeping in detail, and basic photographic reading must also be known.

32 Full protection against biting insects is completely theoretical, but “Fly-Bye” repellent provides reasonable protection in most cases. Some adaption is required to suffer local insect life but at no time during the exercise did it appear to limit the efficiency of the fighting troops.

33 Administration

The Arctic 5-in-1 ration pack was excellent. It is obvious however, that the pack must be subdivided into five equal parts, one for each man, so that no items are carried by one man for others. In addition, it may be that for the short period up to the success signal a lighter ration may be possible.

34 Two-man pup tents made by using two ponchos can be constructed in fifteen minutes.

35 The number of personnel required to prepare supplies and equipment for resupply by air are as follows:

- (a) Platoon groups - Cpl plus 2 RCASC privates.
- (b) Company groups - 1 Sgt, 1 Cpl, 3 RCASC privates.

36 To ensure supplies are available, two days' rations should be carried with the moving force to cater for non-flying days.

37 For a company group proceeding to Fort Churchill for training, an officer is required with an advance party.

LESSONS LEARNED - EQUIPMENT

38 Equipment Generally

For minimum clothing and equipment to be worn or carried see Appendix “A” of this report. This applies to continental North America for Jun-Jul-Aug-Sep. The

only weights which should be available after the parachute assault, but not necessarily before the success signal, are the 2½ lbs of holdall, housewife and two pair of socks.

39 There is some preference for the packboard compared to the rucksack.

40 The issue headgear is not suitable for protection against rain or mosquitoes.

41 There is some support for a shelter half to wrap around the packboard.

42 A 10 oz flynet to cover the sleeping bag was found valuable.

43 Binoculars were most important.

44 The trousers worn should have a string at the bottom of each leg which can be drawn to keep out mosquitoes.

45 The rubber bottom, leather top shoepack is not suitable for tundra operations. It is too heavy, ships too much water, hardens in the water and causes too many blisters. It has, in fact, little in its favour on the soft wet barrens. The shoe required is one which is light and either permits the water to seep out or is made of oil tanned leather. The Canadian Jungle Boot, while somewhat fragile, is in many characteristics a more suitable boot.

Appendix “A” to Exercise “Deer Fly” Lessons Learned

RECOMMENDED CLOTHING AND EQUIPMENT SUMMER

(a)	(b)	(c)		(d)	
Serial	Article	Weight		Total Weight	
		lbs	ozs	lbs	ozs
1	<u>Worn on the Man (X50 Mod)</u>				
	(a) Field Cap Summer		4		
	(b) Necksquare		2		
	(c) Shirts Khaki Cotton		3		
	(d) Shirts Under Cotton		2		
	(e) Shirts Flannel Khaki		14		
	(f) Socks GS (2 Prs)		8		
	(g) Insoles Felt		10		
	(h) Boots Rubber Bottom Leather Top	3	6		

Serial	Article	Weight		Total Weight	
		lbs	ozs	lbs	ozs
	(j) Jackets (X50 Mod)	2	3		
	(k) Trousers (X50 Mod)	1	9		
	(l) Gloves Leather Black		4		
	(m) Knife Clasp		3		
	(n) Nethead Mosquito		2		
	(o) Matchbox w/compass		1		
	(p) One 2 oz Bottle Mosquito Repellent		3		
	(q) Skeleton Web (Water Bottle Full)	4	8	15	2
2	<u>Carried by the man</u>				
	(a) Rucksack US Patt	5	2		
	(b) Sleeping Bag (Outer w/cover)	7			
	(c) Sweater High Neck	1	3		
	(d) Holdall		11		
	(e) Housewife		5		
	(f) Mugs enamelled		4		
	(g) Poncho	3	6		
	(h) Two days' Rations (Cdn 5-in-1)	6		23	15
3	<u>Rifleman including 1 and 2</u>				
	(a) Rifle No 4 w/bayonet	9	4		
	(b) Bandolier (50 rds of .303)	2	14		
	(c) 1 Magazine Bren (28 rds of .303)	2	12	53	15
4	<u>Bren Man including 1 and 2</u>				
	(a) Bren LMG .303	19	8		
	(b) 4 Magazines Bren (28 rds .303)	11		69	9

NOTE: (a) If X51 clothing is worn add 5 ozs to the above.

(b) If Bush Clothing is worn subtract 8 ozs from the above.

EXERCISE “BULL PUP”

LESSONS LEARNED

GENERAL

1 This was a joint Army/RCAF summer exercise, to practice Mobile Striking Force operations in the north. The following assumptions were made:

- (a) CALGARY, the Advance Base, represented FORT NELSON.
- (b) BUFFALO PARK (WAINWRIGHT), represented an isolated area 50 miles South East of NORMAN WELLS.
- (c) The target area in BUFFALO PARK was a weather station and an airstrip represented by six “mock” 5-man tents and a ploughed strip 2000 feet long and 150 feet wide. A gasoline cache of thirty-four 45 gallon drums was located near the airstrip.

2 (a) Area: CALGARY - WAINWRIGHT Area.

(b) Dates: 1 - 14 Jun 52

(c) Troops Participating:

Friendly Force

Coy 2 PPCLI
Det AF Bde Sigs Sqn, RC Sigs
Det 1 AB Med Sec, RCAMC
Det 1 AB P1, RCASC

Enemy Force

P1, 2 PPCLI

(d) RCAF: RCAF participation consisted of:

- (a) One light bomber squadron composed of 12 Mitchell aircraft.
- (b) One fighter squadron composed of 10 Mustang aircraft.

- (e) Observers: Observers from Army Headquarters, Tactical Air Group Headquarters, 18 Wing Headquarters (Aux), Eastern Command and Quebec Command, attended this course.
- (f) Aim: The aims of the exercise were to:
- (a) Exercise Eastern Command and Tactical Air Group staffs in joint planning.
 - (b) Test the Standard Operating Procedure for Mobile Striking Force operations within the limits imposed by the exercise.
 - (c) Exercise 2 PPCLI in airborne operations on company group scale.
 - (d) Exercise RCAF forces in tactical and transport air support.
 - (e) Exercise an Air Contact Team.
 - (f) Test the existing wireless equipment as to suitability for air dropping and providing adequate communication between the Assault Area and the Advance Base.

LESSONS LEARNED - OPERATIONAL

Planning and Preparation

- 3 Officers required to fill MSF appointments at the Advance Base should be previously selected and briefed in the MSF duties. This can be achieved by including these MSF responsibilities in the normal terms of reference of selected staff and unit appointments of Headquarters and units having an MSF role.
- 4 Packaging material for para dropping equipment and stores, both in the initial drop and resupply, must be available at war stations of MSF units. In order to save time, all equipment including grease boards, and pre-packed medical and wireless equipment, must be maintained in mobilization stores of units concerned.
- 5 To save time, and for use as a guide, draft warning orders and skeleton operation orders should be included in the MSF Standard Operating Procedure.

- 6 To obviate the difficulty experienced in maps and air photographs being of different grids, a joint decision is required early in the operation in order to achieve standardization and agreement on the maps to be used.
- 7 The Standard Operating Procedure for the Main Base must detail the functions it will perform prior to the Advance Base being set up and subsequent to the Advance Base becoming operational.
- 8 Very rigid security arrangements must be made for the Main and Advance Bases. All entrances must be guarded. Aircraft must be kept under guard at all times. Guards can be obtained from LOB personnel.
- 9 Proper weather charts, route charts and detailed weather reports are necessary adjuncts to the briefing room. It is essential that the meteorologist be consulted ahead of time regarding weather forecasts, and action planned accordingly.
- 10 A courier service must be established between the Main and Advance Bases as quickly as possible. All despatches, maps, photos, traces, etc, should be collected in the operations room at each base and when aircraft are cleared from one base to another, the bag should be handed to the pilot for onward transmission. It may be necessary under exceptional circumstances to detail a special aircraft or an LO to travel from one base to the other.
- 11 To avoid delays caused by late emplaning, a thorough study should be made of the time interval between the dressing of troops and the emplaning. This will vary depending on the amount of equipment carried and the number of troops involved. It may take anywhere up to three hours.

Command and Control

- 12 There is an unavoidable delay between the time when a lodgement is suspected and the time when reasonable confirmation becomes available that such a lodgement exists. This period of delay must be used as a warning period and all necessary action taken to alert the forces which will be employed in the operation once confirmation has been received. It may be possible during this period to move certain elements to the Advance Base including the original Assault Company.
- 13 It is considered, that for this type of operation, an Air Controller can direct all strikes himself.
- 14 The responsibilities of the GLO can be carried out by the Company Commander if he has been trained in these duties.

15 At the Advance Base the umpires should be provided with a separate office.

16 A neutral camp (ghost area) is an essential part of such an exercise to house the directing staff, neutral signals, medical personnel, umpires, RCAF safety personnel, PRO, press and observers. It requires must planning.¹ Transport, food and bedding are required at odd hours. A senior administrative officer should be in charge of setting up and running such a camp. A notice board is required.

17 To ensure safety precautions on this type of operation, an officer trained in airborne operations is necessary on the DZ prior to the air drop taking place. He should be authorized to cancel the jump if conditions appear unnecessarily hazardous or if the wind is above 18 mph. For this purpose he should be equipped with an anemometer. Red smoke and red Verey Flares must always be available on the DZ to indicate to transport aircraft that the jump is called off.

18 The staff at the Joint Operations Room should be duplicated if the operations are likely to be extended, bearing in mind that there may be other commitments with which they will have to deal.

19 For details and recommendations for layout of an “Ops” room, see Para 40, 41 and Appendix “B” of the main report.

20 Due to the very real possibility that several operations will be conducted simultaneously, the principal Intelligence Officer, GSO II (Int) should be located at the Main Base. The intelligence establishment should be reviewed to ensure that sufficient Intelligence personnel are available within the Command. Separate Intelligence staffs may be required for each operation.

21 The complete Command Headquarters should be alerted. Exercise messages should be handled through normal channels and only that information having a bearing on the planning or conduct of the operation at hand should be passed to the Joint Ops Group. Otherwise the operational staff in the Joint Ops Room will be cluttered up with irrelevant detail.

22 A daily conference is necessary. The conference should be presided over by one or other of the Joint Commanders. The agenda must be prepared jointly to ensure that no points are omitted. All decisions must be confirmed in writing immediately after the conference.

¹ This sentence is reproduced as it appears in the original.

23 A guide for duties of staff officers employed at the Advance Base is given in Part IV of the report on this exercise. Paras 48 and 49 refer.

24 When JAPIS is organized it must include two trained Intelligence specialists. In prolonged operations four would be necessary.

25 A unit emplaning officer must be detailed by the unit to be emplaned. He should report to the Advance Base prior to his unit's arrival.

26 To avoid confusion in case of casualties, key personnel must be covered by nominating reliefs who can take over automatically. For this and other duties around the Advance Base, LOB personnel from the assault company should be moved to the Advance Base with their company.

Offensive Support

27 More practice must be afforded in the dropping of HE bombs.

28 Pattern bombing techniques must be stressed.

Transport Support

29 The section of 1 AB P1, RCASC, was fully employed on packaging equipment for the resupply. No members of the platoon jumped although they accompanied the assault company in order to push out door loads. It is considered that a checker and the spare member of the air crew are capable of pushing out door loads. RCASC personnel are not necessary and do not warrant the space allotted to them in the aircraft in the initial assault drop. A sub-section should be available to jump into the assault base to organize the DZ and handle the resupply. Detailed personnel should be on hand at the Advance Base to load the resupply immediately the air transport becomes available. This will require off-hour feeding arrangements.

30 Load manifests for the resupply should be compiled by the ATLO.

31 To enable aircraft to be tactically loaded more transport type aircraft should be made available.

32 The use of a Check Team comprised of the Unit Emplaning Officer, a senior transport Captain (RCAF), and a member of the loading party should become standard practice. This team should check the parack loading, bells, lights and electrical circuits approximately one hour prior to take off. Delays caused by faulty loading, which are in practice found to be quite frequent, will thus be overcome.

Fire Support

33 For exercise purposes there must be two separate target areas, one for air bombardment and one for ground assault. Safety factors preclude the merging of the two target areas.

34 For this exercise, two 60 mm Mortars were considered to be adequate for organic support. Of the two dropped, one was damaged. Planning for future exercises should provide for spares to replace damaged equipment.

Communications

35 Until a long range air droppable set is available, rear link communications will have to rely on the glider-borne communication equipment. The operators for this and other types of communication equipment must be highly trained and capable of functioning efficiently during periods of interference due to atmospherics. Teams which have worked together should be made available from the Active Force Brigade Group Signal Squadron and should be continually exercised in their role.

36 All signals communications for airborne assaults should be duplicated. In addition 100% spare wireless sets, batteries and spare parts must be held at the Advance Base. A battery charger is essential to keep batteries fully charged. The disadvantage of high aerial masts must be accepted at present if long ranges are to be worked.

37 Radio mechanics must be of a high calibre, capable of repairing all types of sets used in the exercise and must be supplied with tools and a minimum of spare parts to ensure satisfactory maintenance.

38 Line communication was used between the assault base and the patrol base. Assault cable was used, carried by two men and played out from a reel No 3. Due to the difficulty of obtaining a suitable ground, a twisted pair should be used. To simplify laying, cable should be packed in dispenser coils.

39 The frequency allotted to neutral and command signal nets must be checked prior to the operation to ensure no mutual interference is caused. Neutral communications must not be overheard on the operational frequencies.

40 The following information should be passed from the Advance Base to the Main Base on a regular schedule:

- (a) Intrep.

- (b) Sitrep.
- (c) Admrep.
- (d) Forecast of Ops.

41 DRs and Orderlies should be provided at the Advance Base.

42 Additional telephones could have been used to advantage on the airfield, at the arming area, fighter dispersal area, light bomber dispersal area, and transport dispersal area.

43 Only codes as laid down in the operation order should be used. A suitable MSF operation code should be produced.

Medical

44 The Regimental Aid Post consisting of one MO and four Medical Assistants from the Airborne Medical Section, parachuted with the initial assault company. In addition, one stretcher bearer per platoon was provided by the company. Two tents and necessary medical equipment accompanied the drop. This establishment was considered adequate.

45 The surgical team should jump as soon after the initial para assault as possible, ie, with the resupply. The bulk of the equipment could remain packed at the Advance Base ready to be called forward. In view of the uncertainty of weather and communications, it is considered that a better alternative would be to have this equipment duplicated, one set to drop into the Assault Base and a resupply held at the Advance Base to drop onto the battle field if required.

46 The MO and Regimental Aid Post should move with the assault force when an attack is planned.

Meteorology and Topography

47 There is a requirement at the Assault Base for a meteorologist capable of giving a rough met report. One member of the ACT should have a knowledge of meteorology, probably the Air Controller.

Selection and Training of Personnel

48 Troops designated for MSF operations must be practiced in dressing and emplaning quickly. If necessary, additional personnel should be made available to assist in getting the para troops dressed prior to embarkation.

49 Some equipment was lost or dropped free in error during the para drop. This was partly due to equipment being incorrectly put on. More practice is required in lowering equipment during the descent. One stacker is required per aircraft in order to inspect equipment. This cannot be done by the stick leader as he is too heavily loaded. The checker can also be used in dispatching door loads. The checker should be a para unit NCO well acquainted with members of the stick.

50 A number of the wireless sets jumped in during the initial assault failed to function on landing. More training is required in packaging communication equipment for air dropping.

Administration

51 Arrangements must be made at the Advance Base or final emplaning base to give the assault force a substantial meal prior to emplaning for the assault area.

LESSONS LEARNED - EQUIPMENT

Equipment Satisfactory

52 Ponchos should be issued as standard equipment for MSF personnel.

New Developments Required

53 A droppable cross-country prime mover is required to transport heavier ground fire support weapons and their ammunition.

54 Due to the continuous rain the outer cardboard container of the Arctic Ration Pack (5-in-1) became damp and soggy. Outer containers should be waterproofed.

55 There is a requirement for a wireless set capable of operating a distance of 500 miles under all atmospheric conditions. It must be air droppable. Until such a set is available the only alternative appears to be to use a glider for airtransporting wireless equipment of sufficient power to work 500 miles under all conditions.

56 A portable anemometer should be standard equipment with each MSF battalion.

57 A wireless set suitable for use by the ACT is not yet available. Such a set should have the following characteristics:

- (a) Be within frequency range of the aircraft set installed in fighter bombers.
- (b) Be man-portable.
- (c) Have a minimum range of 10 miles (15 miles or more are desirable with the increased speed of aircraft).
- (d) Be capable of being air dropped.

This development should be given a high priority.

EXERCISE "BULL DOG"

LESSONS LEARNED

GENERAL

1. Exercise "BULL DOG" was a two-sided, joint exercise.

- (a) Dates: 18 Feb 53 to 1 Nov 53
- (b) Area: FORT NORMAN, NWT
- (c) Troops Participating:
 - (i) Friendly Force (Army)

Bn HQ and two rifle coys (reinforced) 2 PPCLI
One officer and one NCO from
1 AB Tp RCR
Det AF Bde Sig Sqn
One Sec 1 AB P1 RCASC
Det 1 AB Med Sec RCAMC
21 Coy Cdn Rangers

(ii) Friendly Force (RCAF)

18 Dakota aircraft – 435 (T) Sqn, 412 (T) Sqn and CJATC
3 North Stars - ATC
1 Hadrian Glider - ATC
2 Lancasters - 408 Sqn RCAF
8 Mitchell Bombers
Air Contact Team (less GLO)
Joint APIS (attached to 468 Sqn)
RPS (attached to 418 Sqn)

(iii) Enemy Force

70 all ranks - 2 R 22e R

(d) Aim: The aims of the exercise were as follows:

Main Aims

- (i) To exercise 2 PPCLI in airborne operations on a battalion group scale.
- (ii) To exercise: RCAF forces in tactical and transport air support.
- (iii) To test Mobile Striking Force - Standard Operating Procedure (30 Sep 52) and Western Command Mobile Striking Force Plan.

Subsidiary Aims

- (iv) To determine the extent to which non-service personnel can be integrated into the Mobile Striking Force concept.
- (v) To practice casualty evacuation from the Assault Area to the Advance Base.

LESSONS LEARNED - OPERATIONAL

2. Planning and Preparation

All Mobile Striking Force exercises should take place in an area where a Mobile Striking Force operation may have to be conducted. This is particularly desirable from an army standpoint.

3. In future Mobile Striking Force exercises Army Headquarters, Air Force Headquarters and Air Transport Command should be actually practiced in their operational roles.
4. To ensure maximum training is obtained from Mobile Striking Force exercises the Exercise Director, together with a small joint staff, umpires, neutral personnel and the enemy all be provided from sources outside the command being exercised. This would allow the Command responsible for the exercise to function as it would in an actual emergency.
5. Once the cease fire had been announced there was a tendency to “stampede” for home. This action made the collection of training stores and orderly movement of troops and their equipment very difficult. The urgency of an evacuation will depend upon the future roles of the troops and/or aircraft. The evacuation of the troops from the assault area is a part of the operation. Future exercises should be expanded to include this phase.
6. It is very desirable that sufficient aircraft should be immediately available to lift infantry elements to the Advance Base. However, the need for providing alternative means of moving troops from their unit home station to the Advance Base other than by air should also be catered for in the Mobile Striking Force Standard Operating Procedure.
7. If the enemy makes lodgement(s) in the Canadian North, he will have in each case a local purpose. Speed in launching an assault to destroy the lodgement is essential. The most important factor in these operations, after the initial strike and reconnaissance action, is to place an infantry force on the ground in the close vicinity of the lodgement as quickly as possible. This movement is now dependent on transport available firstly to move troops from War Station to the Advance Base (either by air, road or rail) and subsequently to move them again from the Advance Base to the target area. On this exercise the time between the first warning of an enemy lodgement and the arrival of the first company group in the assault area was almost exactly four days.
8. In order to speed up the reduction of an enemy lodgement it would appear to be logical to station a “duty” parachute company group at each of the selected Advance Bases, as soon as a state of emergency becomes apparent. It would also be necessary to station tactical air support elements in Eastern Canada. Otherwise any speeding up gained by stationing troops at GOOSE BAY would be lost because of the time required to move tactical support elements to this area from their present bases.

9. Target area brochures should be produced in two copies, one for the Main Base and one for the Advance Base. Information for both summer and winter should specifically state cover, routes, fordability of streams, degree of movement possible over certain terrain, and through wooded areas, etc. Rates of travel for all seasons should be properly established. In addition, copies of aerial photographs should be available to Ranger companies.

10. No knowledge existed as to what the Rangers intended to do when their settlement was attacked. Thus immediately after the initial para drop, a fire fight took place between the Rangers and the friendly force. The general plan of action of each Ranger Company should be known and appreciated by the Command concerned.

11. Organization

It is very desirable that briefing rooms should be set up at each Advance Base in addition to normal office accommodation. This room should be maintained by the Joint Intelligence Staffs.

12. Nearly all the RCAF portion of the joint briefing is of no value to the company commander and attendance is a waste of his time.

13. Command and Control

When all RCAF squadrons operate from the Advance Base airfield it is considered that a Mobile Wing HQ is not required.

14. In accordance with the present Standard Operating Procedure the Army Operations Commander at the Advance Base is an officer nominated by the General Officer Commanding. This is normally the 2 IC or the senior company commander of the Mobile Striking Force battalion to be employed. This procedure eventually results in the commanding officer of the battalion being committed to a plan evolved by one of his subordinates which he does not have a hand in preparing or approving. Once the operation is launched, however, the Army Operations Commander at the Advance Base assumes a minor role, which can be taken over by a subordinate unit officer. As a result of this exercise, it appears advisable that the Army Operational Commander at the Advance Base be the battalion commander who should plan the operation. If there is a likelihood that a second company will be required to reinforce the initial company group, he or his representative, accompanied by a tactical headquarters, should proceed either with the initial airborne assault or prior to the launching of the second company in order to control operations in the lodgement area.

15. Throughout the exercise there was a tendency to use too much paper. Orders and information were all passed or confirmed on paper. This led to a tendency to wait for receipt of written operation orders before commencing to take action. While some involved detail must be committed to paper, this should be the exception.

16. Separate situation and intelligence reports contained much duplication and imposed an unnecessary load on communications. A combined sitrep and intrep passed from Assault to Advance Base and from Advance Base to Main Base twice daily should suffice. This could be augmented by flash reports as information is available.

17. Offensive Support

Once word of a lodgement is received, immediate consultation with Tac Air Gp permits early joint examination of the problem, early joint selection of the Advance Base and selection of immediate course of action. This ensures that air strike action is brought to bear upon the target to neutralize it and keep it neutralized from the earliest possible moment. Also air photographic reconnaissance should get over the target as soon as possible. This immediate action could make the difference between the enemy failing or succeeding in his mission.

18. Transport Support

One quarter of the number of troops involved in an operation should actually be weighed with their equipment. The weight of the parachute assembly should then be added and an average weight established on which aircraft loads can be based.

19. It must be appreciated that an MSF operation is NOT a routine air transport task. Therefore, the prime consideration in aircraft loading must be the tactical requirements and not the employment of the maximum airlift potential. Only in this way will the troops be free to function tactically as soon as they hit the Dropping Zone. This is essential to the sound and orderly launching of the ground operation.

20. A definite basic figure for aircraft payloads must be established and tactical loading planned accordingly. These loading plans must be firm and not subject to change at the last minute. A consolidated manual of staff tables should be prepared covering winter and summer operations. It should contain load tables of standard stores and equipment for C-119 aircraft. These load tables should be worked out for a radius of action of 750 nautical miles.

21. There is a definite army requirement for transport to assist in loading stores onto aircraft. A minimum of four 3 ton trucks or their equivalent should be available at the Advance Base at the disposal of the Mobile Striking Force ground elements.

22. Fire Support

In operating at a distance of 600 miles from the airfield on which air support is based, coordinating an air strike with an infantry assault is most difficult. If the moment is propitious for the assault, it should not be delayed to await the arrival of air support which may be held up for a variety of reasons. It is most evident that in spite of any difficulty in ground movement, 81 mm mortars must form part of the armament of an Mobile Striking Force company group because of their accuracy, range and hitting power. They should be additional to the 60 mm mortar. In addition, the desirability of using heavy mortars must not be ignored in future planning and development.

23. Engineer Support

In most Mobile Striking Force operations there will be specific tactical features that will require engineer techniques. Since tasks will vary in magnitude it is impractical to allot a definite quota of engineers to every operation. RCE requirement should be decided by:

- (a) A careful study of maps and photos of the area concerned to determine likely engineer tasks.
- (b) An engineer reconnaissance party consisting of one officer and one or two NCOs dropping with the assault troops.
- (c) Decisions based on sub para (a) above would be sufficiently accurate to move to the Advance Base estimated number of men and equipment of 1 Airborne Tp RCE needed for tasks.
- (d) The reconnaissance party would decide exact requirement to be dropped into the assault area.

24. Reconnaissance - Visual

Ground Liaison Officers must be most aggressive and impress on all aircrew the necessity for visual reconnaissance.

25. Reconnaissance - Photo

The photographic interpretation of ground weapons, tactics and defensive positions requires personnel who are intimately familiar with them and the photographic interpreter's task is one which requires several years of study to attain proficiency.

26. The main virtue of intelligence is the speed with which it is given to those who are making the operational decisions. The reconnaissance element must have direct access to and be controlled by the highest joint operational Headquarters.

27. The reconnaissance element should be directly controlled by the Advance Base Joint Headquarters as it was during the later stages of this exercise.

28. Reconnaissance - Ground

It is an essential part of the Army plan that local Ranger organizations give early warning of enemy activity or lodgements. This was done on the exercise as the enemy were slow in attacking the wireless facilities. Rangers must be thoroughly trained to appreciate the importance of passing early and accurate warning to the Command concerned.

29. Movement

If the Staff Captain A & Q, Unit Emplaning Officer and Commander of 1 AB P1 RCASC Detachment are familiar with the normal duties of an Air Transport Liaison Officer then an Air Transport Liaison Officer is redundant in the Army element of the Advance Base Joint Headquarters. The officer responsible for taking over the Air Transport Liaison Officer duties must work in close cooperation with the Air Movement Unit Officer at the Advance Base if confusion and misemployment of aircraft is to be avoided.

30. In the road move from the War Station to the Advance Base "A" Coy moved in separate transport from their stores. The late arrival of the latter materially affecting the timing of the initial para assault. On Mobile Striking Force operations troops and their operational stores must never be separated.

31. Assault Tactics

The descent was well executed but some personnel and stores were carried well beyond the Dropping Zone area. A parachute drop made from 1000 feet results in

considerable dispersion of troops on the Dropping Zone. Consideration should be given to having Mobile Striking Force exercise drops made from 600 feet.

32. The leading company commander felt he did not have sufficient forces on the ground to hold the Dropping Zone, patrol vigorously and establish a patrol base. He therefore decided to dispense with the latter. It is considered that a minimum of the force available should remain to hold the Dropping Zone and that a patrol base as close as possible to the enemy should be established. This eases the fatigue in patrolling and consequent medical problems especially in severe cold weather.

33. Patrols

Offensive action by fighting patrols is necessary at the earliest possible moment, when an enemy position has been spotted, in order to make the enemy divulge his fire plan and any weakness in his position. Reconnaissance is also necessary to discover the best lines of approach, forming up places, etc, for subsequent assault.

34. Rangers were used to accompany friendly patrols and act as guides. However, their advice was sometimes misleading as they did not appreciate the problem of troop movement at night with heavy sleds. Active co-operation with Rangers is the only solution to the learning of each other's problems.

35. Ground Battle

No procedure apparently exists for handling Prisoners of War and this aspect of training was not given a practical test. A procedure for handling Prisoners of War should be developed and incorporated in the Mobile Striking Force Standard Operating Procedure or Advance Base (Standard Operating Procedure) and practiced in future operations.

36. The battalion commander, who landed with the second company group felt, after briefing by the leading company commander, that there was a lack of information on which to base a sound plan of attack. It is most evident, that where there is a possibility of the employment of more than one company group, the battalion commander or his representative with a small tactical headquarters, should be dropped at the same time as the leading company group or some hours before the drop of the second company group. This gives him an opportunity of early control of the battle and personal reconnaissance, all of which will save time in launching the final assault(s).

37. Communications

The Dropping Zone on this exercise was a large frozen lake. It was therefore possible to land the glider on the Dropping Zone and also to tow it out again on the conclusion of the exercise. It is difficult however to visualize how it could be safely landed in summer conditions. For this reason consideration should be given to airtransporting the rear link wireless set in a suitable aircraft, such as the Otter or long range helicopter and off-loading it at the required place.

38. The rear link from the assault area to the Advance Base was maintained by a low frequency set (PV 500) in a glider and a high frequency set (C52) which was dropped by parachute. By this means it was possible to maintain solid communications under adverse ionospheric conditions. Both an LF and HF set are necessary for rear link communications. This has the added advantage of providing two operational circuits from Assault Base to Advance Base under favourable ionospheric conditions and reasonable assurance of communications under unfavourable conditions.

39. Difficulty was experienced in forming an efficient integrated signals team because personnel used on the exercise came from several widely scattered units. It was only through intensive pre-exercise training that communications were made to work. In operations this training time would not be available.

40. To ensure teamwork amongst signals personnel from the commencement of the operation, and to enable operators to be brought up to the standard required for a Mobile Striking Force operation, signals personnel required for Mobile Striking Force employment should be:

- (a) Earmarked.
- (b) Instructed in Mobile Striking Force procedures.
- (c) Trained to the required technical standard.

Upon the individual being posted, his successor should be immediately briefed in his Mobile Striking Force responsibilities.

41 Considerable difficulty was encountered in the selection of frequencies just prior to the exercise. Interference by commercial and fixed military stations rendered large portions of the spectrum unusable. Good frequencies should be selected and reserved for Mobile Striking Force operations. These frequencies could be used on unimportant circuits between exercises and operations to hold them open for an emergency.

42. Once the glider is on the ground, glider pilots contribute little to signals operations. Should the glider continue to be used, glider pilots should be trained in some suitable signals trade, eg, cipher or operator (W&L).

43. Present tentage accommodation for rear link operators is cramped. The glider should be equipped with one ten man instead of two five man tents. The rear link 52 set detachment should be equipped with one ten man and one five man tent in lieu of two five man tents.

44. Book cipher is too slow and machine cipher is not practicable in the Assault Base on Mobile Striking Force operations. A suitable cipher or code should be developed to meet this need.

45. There is a requirement for a set at the Dropping Zone having a greater range and more channels capable of being coordinated with RCAF aircraft than the present Pye VHF set now installed in the glider. A SCR 542 set is recommended.

46. The air controller (RCAF) of the ACT did not net his wireless set with the aircraft at the Advance Base. This may have been the reason why he was unable to contact some of the aircraft over the Assault Area. Netting at the Advance Base should become standard drill.

47. The WS Cdn No 58 set is not satisfactory for use by Mobile Striking Force units. It is recommended that the AN/PRC/10 set should be issued to the Mobile Striking Force infantry units to replace WS Cdn No 58.

48. Considerable delay was encountered in passage of information from Advance to Main Base. The reasons for this delay were found upon examination to be:

- (a) Necessity to protect the traffic with security classification requiring enciphering.
- (b) Umpire traffic with "Operational Immediate" priority being handled by the same crypto staffs.
- (c) Circuits were not reclassified for exercise purpose - eg, teletype circuit could have been classified to handle up to "Secret".
- (d) Low frequencies circuits could have been classified to handle up to "Restricted" since wave would have been dissipated before it reached our actual enemies.

- (e) Many messages were overclassified. Other messages could have been down graded in classification by some re-wording.
 - (f) Of 22 messages passed from Air Ops Staff, Advance Base, to Air Ops Staff, Main Base, 13 were franked "Operational Immediate". It was considered that this was a misuse of this priority classification.
 - (g) Intelligence and Public Relations traffic between Advance Base and Main Base contained considerable duplication in content of messages. Only new and pertinent information should be passed.
49. (a) In future exercises action should be taken to remove the bottle-neck of cipher traffic which existed between Main Base and Advance Base on this exercise.
- (b) Should a backlog of traffic develop in the various communications centres, the signal officer responsible should immediately inform the Senior Officer at the base, so that corrective action can be taken.
- (c) Air Despatch Letter Service between Advance and Assault Bases should be used where possible.
- (d) To prevent traffic delays every effort must be made to reduce the volume of classified traffic.

50. It is most undesirable to create new addresses for signal messages for each exercise or operation such as "BULL DOG EDMONTON" or "BULL DOG UMPIRE EDMONTON". It is sufficient for identification purposes if the text is prefixed by the name of the exercise or operation.

51. Consideration should be given to the supply of small ground to air sets to Ranger detachments.

52. Medical

Mobile Striking Force battalions must ensure that they have at all times trained paratrooper stretcher bearers on a minimum scale of one man per platoon.

53. The following lessons were learned on air evacuation of casualties:

- (a) Casualties should be tagged at the Medical Inspection Room for the tier in the aircraft they are to occupy, eg, lower tier, middle tier and upper tier. The most serious casualties should be assigned to lower tier positions, as these are the first to be removed from the aircraft.
- (b) Army should be responsible for placing the patient on the stretcher supplied from the aircraft, and for loading the patient into the door of the aircraft. The Army loaders should not enter the aircraft.
- (c) Each aircraft should carry a supply of casualty bags. Casualty bags can then be exchanged, the patient remaining in the bag in which he arrives at the aircraft.
- (d) Aircraft should arrive prepared to lift its complete load of casualties.

54. Meteorology and Topography

Because of the lack of weather reporting stations in the North, all means by which the weather picture can be ascertained are important. All crews flying in the area of operations should be briefed to record weather observations and transmit them from the air if possible.

55. Training

The prairie conditions encountered during pre-exercise training were very different from those subsequently experienced during the exercise. The terrain all through the McKenzie valley is dense bush and muskeg, which makes movement in summer or winter difficult and exhausting except in cleared areas, along tracks or on the edge of the river (when frozen). A high degree of individual and collective infantry skills and individual mobility is required combined with the climatic and topographical indoctrination. All this has an effect on tactical operations. In order to practice for Northern operations, units concerned should train under reasonably similar topographical conditions to those that they will be called upon to face on operations. Conventional methods of forming up and assault must be adjusted to conform to these surroundings. Deployment in line and a deliberate advance is hardly suitable since overwhelming HE fire support will never be available. It would appear more appropriate to aim at a quiet approach, and sudden, close in assault by individual platoons, using fire and movement in the assault. Each platoon should be given a separate objective within an enemy locality and the whole coordinated by a common timing.

56. The jump, no matter how well executed, does not defeat the enemy. It is the subsequent ground action which wins the battle. It should be emphasized in the training of parachutists that the jump is only a means to an end. The lack of training in the fitting and wearing of airborne equipment was particularly noticeable. Some of the troops had not been instructed in the method of attaching rifle valises and preparing them for dropping. All personnel being prepared for jumping in the North must be thoroughly trained in the wearing and fitting of airborne equipment.

57. It is evident that the parachutist is overloaded. Some drill must be devised whereby the parachutist drops with his personal weapon and ammunition only, and his pack is dropped separately, possibly in section or platoon bundles, but at the same time as the stick.

58. Since on Mobile Striking Force operations he can never expect the same fire support which would apply in conventional warfare, the infantry parachutist must make up this lack by perfection in the infantry skills. The parachutist must be far better trained, collectively and individually, than his counterpart in a line battalion.

59. Both sides on this exercise were much too noisy, particularly at night when they imagined themselves safe from the enemy. It must be emphasized during training that well disciplined troops should live and move quietly when contact with the enemy is even remotely possible.

60. 21 Ranger Company was not too effective in applying guerilla tactics to the situation. The opportunity for such action is self evident. Training in small scale raids and ambushes should be given to Ranger groups.

61. Administration

Assault scales of rations are luxurious with the result that the more desirable items in the 5 in 1 ration pack are often used up and the rest of the box is wasted. Wasting food is both a matter of training and discipline and must be severely discouraged.

62. Blankets were supplied to the company group on their arrival at the Advance Base. Blankets are NOT required at the Advance Base for the assault element. Sleeping bags will suffice.

63. Miscellaneous

When a state of emergency was declared steps were taken by the Rangers to block the runway. These steps could be countered by the enemy by capturing a bull dozer. There is a requirement, therefore to prepare fuel stocks so that they could be rendered unusable very rapidly. This might be achieved by releasing into the fuel a chemical already contained in a small tank built within the main storage tank. Opening drain cocks is too slow and unreliable.

LESSONS LEARNED - EQUIPMENT

64. During the exercise both 5 man and 10 man tents were available for trial. It is recommended that the 10 man pattern be adopted as the standard Mobile Striking Force tent.

65. The type of Jerry cans used on BULL DOG for carrying naptha gas were designed for carrying water. They were painted white on the inside and had a large pouring opening. The type of flip lid on this style of can does not form a firm seal against leaking. RCAF regulations require that gasoline containers be of the screw lid type for transporting in aircraft. Naptha gas cans should have screw lids.

66. It was found that the Rangers easily outdistanced and outpaced the enemy. This was partly due to the narrower snowshoes used by the former. During various patrols and on the approach march many snowshoes were broken. It is possible that storage or maintenance of the snowshoes is at fault as well as lack of practice by individuals.

67. During the approach march on the night 20/21 Feb the 60 mm mortar crews were unable to keep up with the rest of the column. Every effort must be made to produce a prime mover capable of being dropped. This will reduce the exhaustion caused by portage of heavy man loads and the hauling of sleds.

68. In the long approach march through deep snow and thick deadfall, the system of evacuation of casualties broke down. Whilst the lack of a forward patrol base was a contributing factor in this breakdown, it is considered that manpower and toboggans allocated to the move of medical equipment forward and to the evacuation of casualties, is insufficient. A requirement exists for an airdroppable prime mover for use in evacuation of casualties to a location where they can receive medical attention.

EXERCISE "PRAIRIE TUNDRA"

LESSONS LEARNED

GENERAL

1. During the winter 1952-53 two reinforced company groups of the Mobile Striking Force (MSF) were rotated through Fort Churchill for a four week period of intensive Arctic training under the direction of the Commandant, Fort Churchill. The area where the training was conducted was north of the treeline although there were scattered scrub forests. No vehicles were used in a tactical role, and all tactical movement was carried out on foot. On D Day everything in the exercise area was parachuted to the ground from a Dakota aircraft, with the exception of the participating troops. A detachment of photographic reconnaissance aircraft plus a photo interpretation team supplied the photo map and photo cover in lieu of maps.

2. The training schedule for each company was as follows:

- (a) Administration and staging - 9 days
- (b) Indoctrination training - 6 days
- (c) Field training - 8 days
- (d) Exercise - 7 days

3. (a) Dates: PRAIRIE TUNDRA I - 12 Nov - 12 Dec 52

PRAIRIE TUNDRA II - 14 Jan - 15 Feb 53

(b) Area: FORT CHURCHILL

(c) Troops Participating:

(i) PRAIRIE TUNDRA I

Friendly Force (Army)

Coy 2 R22eR	123
MMG Section 2 R22eR	
3" Mortar Section 2 R22eR	
4.2" Mortar Section 1 Lt Bty (Para)	66

Detachment 57 Fd Sqn RCF	1
Detachment AF Bde Gp Sigs Sqn	9
Detachment Airborne P1 RCASC	5
Detachment No 1 Airborne Med Sec RCAMC	<u>5</u>
TOTAL	209

Friendly Force (RCAF)

Air Coordinator	5
Lancaster	6
Dakota	5
JAPIS	8
Ground crew etc	<u>18</u>
TOTAL	42

FORT CHURCHILL

Participation from Army and RCAF

Enemy Force

P1 2 R22eR	40
Detachment 57 Fd Sqn RCE	<u>2</u>
TOTAL	42

(ii) PRAIRIE TUNDRA II

Friendly Force (Army)

Coy RCR	123
MMG Section RCR	
3" Mortar Section RCR	
4.2" Mortar Section 1 Lt Bty (Para)	66
Detachment 57 Fd Sqn RCE 1	
Detachment AF Bde Gp Sigs Sqn	9
Detachment Airborne P1 RCASC	5
Detachment No 1 Airborne Med Sec RCAMC	<u>5</u>
TOTAL	209

Friendly Force (RCAF)

Air Coordinator	5
Lancaster	6
Dakota	5
JAPIS	8
Ground crew etc	<u>18</u>
TOTAL	42

FORT CHURCHILL

Participation from Army and RCAF

Enemy Force

P1 RCR	40
Detachment 57 Fd Sqn RCE	<u>2</u>
TOTAL	42

AIM

4. The aim of the training programme was to:
 - (a) Train elements of the Mobile Striking Force in their role of reducing enemy lodgements in Northern CANADA over diversified terrain during winter.
 - (b) Emphasize all aspects of Arctic training within the limits of the current Mobile Striking Force Standard Operating Procedure and experiment to improve this procedure.

LESSONS LEARNED - OPERATIONAL

Planning and Preparation

5. Prior to participation in Northern exercises, troops should be familiarized with the contents of the following:
 - (a) Arctic Manuals CATP 9 (1) (2) (3) (4)
 - (b) Lessons Learned on previous Northern exercises.

6. All Officers of MSF Battalions must have read the current Standard Operating Procedure (SOP) on Mobile Striking Force operations.

7. More liaison is required between the battalion participating on exercises and the staff at Fort Churchill, particularly regarding the background of the troops to take part. Commanding Officers should visit Fort Churchill at least two months prior to the arrival of their troops to plan the indoctrination and exercise phases of the training. A team from Fort Churchill should visit the units at their Unit Home Stations to give detailed instructions on what will be expected of them during the training in the Fort Churchill area.

Command and Control

8. When errors are committed, troops must be stopped and constructively criticized and made to repeat that particular phase of the operation. This applies to both the elementary training carried out during the indoctrination and the tactical training carried out during the latter part of the exercise training.

Offensive Support

9. Without offensive air support a company group loses a tremendous advantage. Aircraft were not available for this purpose on these exercises. There is some doubt that without offensive support two company groups could overwhelm a well entrenched enemy platoon.

Transport Support

10. When supplies are being dropped, troops have a great tendency to run out onto the Dropping Zone (DZ) too early and are apt to be injured by falling packages. This especially applies when stores or rations are being free dropped.

Fire Support

11. For security of the gun area, whenever possible gunners must take advantage of the infantry positions. However the gunners must retain one Bren gun per tent to be used for local protection.

12. Fifty-three all ranks are required for Northern operations to efficiently operate a 4-gun troop of 4.2" mortars.

13. All mortars with their associated equipment and ammunition can be para dropped into the gun positions. Accuracy within 100 yards could be attained with practice.
14. The ten man tent is required as a Command Post.
15. The gun position officer should parachute early in the operation to confirm recce and lay out his gun area.
16. By actual trial it takes from 60 to 90 minutes to prepare each mortar position.
17. It was found that special cushioning of branches or packed snow is required to protect the baseplate of the 3" mortar.
18. Of the 8 MMGs dropped, two were damaged when the packing was knocked off the cross head and the elevating screw. The two which were damaged were ejected from the door which caused too much oscillation during the parachute descent, rather than being dropped from pararacks. Those dropped from pararacks suffered no damage.
19. 3" and 4.2" mortars were dropped 16 times into fire positions and no damage was reported. Ammunition/bombs must be dropped in the same pass as the mortar/MMG.

Engineer Support

20. As a result of this exercise it appears that the extraction of igniters and detonators from mines and booby traps when used under conditions of extreme cold is impossible. They should be destroyed in situ.

Reconnaissance - Photo

21. Photo reading requires increased attention. In many areas where MSF operations may take place no maps are available. All officers and NCOs must be completely confident of their photo reading. To this end a special two-week course will be conducted at the Canadian School of Military Intelligence for MSF personnel.
22. The Land Camera was a great success. When first used its prints were not clear and if dropped too soon (while they were still wet) they freeze in the container. A coating of special wax may make the prints more permanent. The value of these photos is impressive. Within five minutes of a request from the company commander the photos were taken, developed and air dropped.

Movement

23. The tendency to string out in single file when moving on the barrens must be condemned. As a formation it offers minimum protection.

Assault Tactics

24. Except for communications there appears to be no firm reason for insisting upon a permanent DZ. The labour in going back for supplies is excessive. The Surgical Team, supporting weapons and spare equipment can be dropped where and as required. If properly planned and coordinated, only the OP Party need be dropped on the initial drop. This party can recce the gun area, the main body to follow on subsequent airlifts.

Patrols

25. The importance of patrols is so great and the requirement of coordination so exacting that a patrol master is recommended, possibly the battalion sniper sergeant.

26. Patrolling is a most important skill and takes a good portion of the time required for an operation. All automatic weapons will have to be pinpointed, all minefields and trip flares found, all sentries and scouts located, all shelters and HQs known, and if possible, all enemy "alert" procedures studied before an attack is launched. Patrols should not only recce in detail the Assembly Area, FUP and SL, they must also mark them in some foolproof manner, probably by tape, and record the distance and direction for confirmation later by dead reckoning.

Defence

27. The defence of the company group area is an unsolved problem. If the windchill is high a sentry can only remain alert for approximately 15 minutes. With such a turnover everyone in the company group is up at least once each night, and with restricted fuel, cannot get warm until breakfast. In these two exercises there was an average of 16½ hours of darkness. If a half-hour exposure is the maximum a sentry can stand without relief, a roster is essential. If a tent group goes on duty it can operate in three ways. The first is, by all five at once. This is the coldest system. The second is, by four men at once, leaving one man to light a stove to warm the other four men on their return. This reduces the number of sentries. The third method is by operating in pairs with one-half hour on sentry duty followed by one-half hour in the tent. This is most fatiguing. A defence platoon was considered but rejected. The possible use of dogs was considered. Quiet sentry dogs may be an answer. Trip flares may also supply an answer but they freeze and cannot be easily moved. The company

groups tried to minimize the danger of enemy mortar fire by adopting platoon boxes but these could not be defended or patrolled. The best solution appears to be:

- (a) Select a site to take maximum advantage of the ground.
- (b) Move by night and rest by day.

Camouflage, Concealment and Deception

28. Snow walls should not entail too much work despite the added comfort. They should be built about three feet high, on the North West side of tents (in the Fort Churchill Area). They should slope to lift the wind. If more time than necessary is spent on the construction of snow walls it detracts from the time required for the construction of tactical defences.

Communications

29. The WS 88 has insufficient range for operation from the OP to the mortar positions and should be replaced by the WS 31.

30. One of the Battalion Signal Officers should attend each exercise of a company group or larger.

31. Constant and strict supervision is required of all operators if reliable communications are to be expected.

32. The WS 62 operated by five RC Sigs personnel was a suitable link from the company HQs back to the DZ. There were problems of weight, fuses, batteries, and the operation of the chorehorse generator, but the set operated well, even after being hauled 12 miles in one day over very rough terrain. A lightweight high powered set is required.

33. Assault cable should be laid between the Patrol Base and the DZ, and between the gun position and the Forward Observation Officer. The best type of cable appears to be twisted assault cable supplied on dispenser coils. The weight is 22 pounds per thousand yards.

34. When the Force Commander wishes to speak to an aircraft using voice procedure he should be on the set himself. Special care must be taken to use only words, phrases and procedures known to both Services.

35. Messages were not encoded during these exercises. Since it would be possible for an enemy to carry an appropriate set and monitor our transmissions regarding location of DZs, assembly areas, patrols and avenues of approach, an "Arctic" slidex card is considered necessary.

Medical

36. Stretcher bearers are required on the scale of two per Infantry Platoon. They should be trained at the Medical Corps School on a special course conducted for MSF stretcher bearers. Each stretcher bearer should be equipped with one new type casualty bag, carried on a two-man toboggan.

37. The RAP should be composed of:

- (a) Medical Officer and four RCAMC personnel.
- (b) Two five-man tents (holding and examination).

38. The Treatment Centre carried in a subsequent airlift should be composed of:

- (a) Surgeon plus four medical assistants.
- (b) Three ten-man tents.

39. The method of operating found best was:

- (a) RAP parachuted and remained with the company group.
- (b) RAP eventually set up in Patrol Base.
- (c) A Surgical Team parachuted with equipment when called for, probably in Patrol Base, or possibly on captured objective.

40. The gasoline stoves used for heating and cooking purposes on these exercises caused considerable irritation to the eyes. Symptoms of the irritation were redness of the eyes, watering, puffiness, gritting in the eyeball, fuzziness of vision, sensitivity to light, especially glare, accompanied by headache and bad temper. It was common twenty to twenty-four hours after the campsite was established and was more prevalent during blustery weather and low temperatures. Application of ointment gave quick relief but did not improve vision. A total of 97 out of the Company Group complained officially. The fumes did not appear to affect the lungs but the malady was exaggerated by an undue amount of cigarette smoking.

Training

41. A training cadre from the troops participating should precede the main body to Fort Churchill. This cadre should be given a two-week indoctrination course under the direction of the Commandant, Fort Churchill. After receiving this indoctrination training they could be employed as instructors to indoctrinate the main body. A cadre for the indoctrination of a Company Group should include Company Commander, CQMS, three Officers and three Senior NCOs. Personnel selected for this cadre should have had previous Northern experience.

42. Navigation by dead reckoning must be mastered at the Unit Home Stations. This skill requires detailed preparation beyond ordinary compass reading. Full details are included in the hand book "Navigation by Dead Reckoning" TB FNG 90.

43. All weapons must be inspected daily. Strict discipline will be required to ensure weapons are not carried strapped to toboggans.

Administration

44. When rations are free dropped from a Dakota, the aircraft must fly at less than 110 knots and below 200 feet to prevent damage to the ration packs.

EXERCISE "LOUP GAROU"

LESSONS LEARNED

GENERAL

1. Exercise "LOUP GAROU" was a two-sided, joint exercise.

(a) Dates: 18 Feb 54 to 1 Mar 54

(b) Area: Seven Islands, Quebec

(c) Troops Participating

(i) Friendly Force (Army)

1 R22eR (Bn HQ and two coy gps)

Tp Z Bty, 1 RCHA

1 AB Tp, RCE
Tp 1 AB Sqn, RC Sigs
Sec 1 AB P1, RCASC
Sub-Sec 1 AB Med Sec, RCAMC
4 Coy Cdn Rangers

(ii) Friendly Force (RCAF)

9 C-119 aircraft - 436 & 438 Sqns
8 Mitchell Bombers - 406 & 418 Sqns
2 Lancasters - 408 (P) Sqn
2 Otters - ATC
4 Dakotas - ATC & 1 TAC
ACT (less GLO)
APIS (from 408 Sqn)
RPS (from 408 Sqn)

(iii) Enemy Force

One coy - 1 RCR

(d) Aim: The aims of the exercise were as follows:

- (i) To test the standard of training of 1 R22eR and certain MSF supporting arms and services in an airborne operation, under climatic conditions encountered in the Canadian North in winter;
- (ii) To exercise the RCAF in tactical and transport air support;
- (iii) To test further the SOP for MSF operations and examine certain modifications therein suggested as a result of previous exercises;
- (iv) To exercise Quebec Command and 1 Tactical Air Command Staffs in carrying out their respective roles in the event of MSF operations.

LESSONS LEARNED

2. Planning and Preparation

Planning and preparation for a northern airborne operation must be complete before the operation commences. In temperate climates the omissions of the planners

can often be rectified in the field. This is seldom possible in the Arctic, where reinforcement and resupply depend largely upon the coincidence of favourable flying weather. Likewise, the initial launching of the operation is also dependent upon good flying weather. Its timeliness will often depend very largely on the readiness of the force to seize fleeting opportunities. From this it follows that an operation must be mounted from the very start in adequate strength, adequately equipped and with the troops prepared to assault on very short notice at the earliest advent of favourable flying weather. This involves lifting the total force to be employed in one lift, together with its immediate resupply, tactically loaded from the start in aircraft which had no other prior commitments. No reloading of these aircraft should be necessary between war station and assault area otherwise the force will not be capable of seizing the fleeting opportunities of good weather which present themselves, nor will the troops gain the maximum rest en route.

3. It is axiomatic that Headquarters should be split to prevent the total loss of command and control if aircraft become unserviceable for any reason. This principle, which is so well understood in amphibious combined operations, must be applied equally to MSF airborne operations.

4. As a guide it may be taken that a force consisting of battalion headquarters and two inf coy groups, with supporting arms and services, will be required in the assault lift whenever the enemy lodgement is estimated as being between platoon and company strength.

5. Reconnaissance

Very early and accurate information on the location and strength of the enemy is essential to ensure the effort expended in mounting the operation is commensurate with the task in hand. This is of prime importance since it has proved necessary to employ at least battalion headquarters and two inf coy groups, together with their requisite supporting arms and services, to destroy an enemy lodgement in greater than platoon strength. To estimate the enemy strength as quickly as possible, the following action is necessary:

- (a) very early air recce, both photographic and visual;
- (b) the dropping of a wireless team into the area during the information phase to contact the local defence force and provide detailed information to orbiting aircraft;
- (c) the establishment of a simple ground/air code for use by the local defence force prior to the arrival of the air dropped wireless team.

6. The importance of early and accurate information cannot be overstressed.

7. Mobility

Once on the ground, an urgent requirement exists for a prime mover, droppable and capable of towing full loaded sleds. The carrying forward of equipment, ammunition and casualties places a great strain on personnel and depletes the available fighting strength of a company. Further, in the gaining of contact phase, the towing of sleds by each sub-unit of the forward element, advancing under tactical development, is difficult, slow and most dangerous.

8. Medical

This exercise again emphasized the requirement for aircraft evacuation of casualties. It is recommended that the Otter aircraft be used. Casualty evacuation aircraft should be based on or near the DZ and should evacuate casualties to the nearest airstrip or lake where a heavier type of aircraft could be used to carry out the evacuation to the advanced Base. Fuel for the Otter aircraft should be included in the resupply or brought in by heavier evacuation aircraft. If the distance to the airstrip or lake is too great, refuelling points could be established at intervening points where Otters could stop and refuel en route. It is considered that evacuation of casualties should be speedy and immediate, not only for the morale factor, but also to free the assault force of this additional responsibility with the least possible delay.

9. Rations

It was again confirmed on this exercise that efforts must be made to reduce the bulk and weight of pack rations. For short periods a reduction of calorie intake may be accepted without ill effect or drop in efficiency.

10. Communications

The need for communications between the local defence force already in the target area and the airborne MSF force has already been emphasized under the heading "Reconnaissance". Past experience has shown that reliance upon air reconnaissance alone is not likely to be sufficient. The assault force commander needs reports from the local defence force if he is to make a sound plan prior to leaving the Advanced Base. In particular, information from the local defence force will confirm the strength of the enemy lodgement. This is most essential in order to ensure either that adequate force is used against the lodgement or alternatively, that too much force is not wastefully expended against small parties of enemy.

11. Long Range Communications

It is clear that efforts must be made to reduce delays in transmission of messages between Advanced Base and Main Base, and also between Main Base (Montreal) and 1 Tactical Air Command. The major causes of delay are

- (a) Between Advanced and Main Base
 - (i) Enciphering and Deciphering
 - (ii) Ionispheric conditions
- (b) Between Main Base (Montreal) and 1 Tactical Air Command
 - (i) Enciphering and Deciphering

12. The use of pre-arranged code words, slidex cards and other similar expedients will reduce in part the use of cipher. Apart from this, especially on peace time exercises where long term security must be enforced, little else can be done other than intensive training of cipher personnel to speed traffic. Cipher personnel must not be required to operate a set at the same time that they are employed on cipher work.

13. To overcome ionispheric conditions development work must continue on a set capable of producing reliable communications.

EXERCISE BULLDOG II

LESSONS LEARNED

GENERAL

1. Exercise BULLDOG II was a two-sided, joint exercise.

- (a) Dates: 1 - 14 Dec 54
- (b) Area: Fort Churchill, Man.
- (c) Troops participating

(i) Friendly Force (Army)

1 RCR
Tp (less one sec) Z Bty (Para) 1 RCHA
Tp 1 AB Sqn, RC Sigs
Sec 1 AB P1, RCASC
Sub-Sec 1 AB Med Sec, RCAMC
1 APIS
24 Coy CDN Rangers, Fort Churchill

(ii) Friendly Force (RCAF)

10 C119 aircraft - 435, 436 Sqns and CJATC
2 Lancasters - 408 (P) Sqn
2 Otters - ATC and RCAF Unit, Fort Churchill
4 Dakotas - ATC and 1 TAC
JAPIS
RPS from 408 (P) Sqn
ACT (less GLO)

(iii) Enemy Force

One coy - 1 R 22e R

(d) Aim: The aims of the exercise were as follows:

- (i) To exercise 1 RCR and the participating MSF supporting arms and services in the conduct of MSF operations in winter;
- (ii) To exercise participating units, both Army and RCAF, in carrying out the drills contained in their respective SOPs;
- (iii) To exercise the RCAF in aerial recce and transport air support;
- (iv) To exercise the staffs of HQ Western Command and Tactical Air Command in carrying out their respective roles in the event of an MSF operation.

LESSONS LEARNED

Meteorology and Topography

2. A Meteorological SOP is a necessary adjunct to the MSF SOP. Provision of the best possible meteorological advice is important to the success of a MSF operation and confers increased flexibility of plan on the Assault Force Commander.
3. A Staff Meteorologist (Army) is required at Advanced Base Joint Headquarters as an adviser to the Army Commander, particularly for the interpretation of meteorological information received and to assist in the selection of suitable DZs. This latter function is important because physical terrain conditions affect surface wind speeds considerably. Selection of a DZ must be made with this factor in mind and due regard must be paid to the formation of neighbouring ground features. Failure to consider the meteorological factor when selecting a DZ may lead to serious mishap during the drop owing to purely local wind speeds over the DZ being far in excess of the surface speeds predicted generally for the area.
4. In order to assist accurate general weather forecasting the RCAF should be prepared to fly special aircraft weather reconnaissance missions as may be necessary. Weather reconnaissance may be considered a normal requirement in support of northern airborne operations.

Training

5. Advanced Base Joint Headquarters is an 'ad hoc' formation brought together for each operation/exercise. The smooth functioning of the Headquarters from the outset cannot be expected unless adequate training is carried out. The personnel involved are subject to the normal posting policies in effect within both services. This results in periodic rotation of the staff. Signals and planning exercises should be conducted from time to time for the training of the staff and to improve the organization of the Headquarters.
6. Whenever possible a full scale dress rehearsal exercise should precede the exercise proper. This will permit the ironing out of minor procedural details within the Bn Gp and will allow the various elements forming the Assault Force to become familiar with one another. Continuation training exercises should also be used for this purpose.
7. Adequate training must be carried out to permit the mounting of an operation by night. The short winter days coupled with adverse weather conditions may well necessitate a night parachute descent, particularly as night wind speeds in some areas tend to be lower than those prevailing during daylight. Aircrews likely to be assigned to the MSF should be trained in night formation flying and night navigation. Army MSF units should carry out night parachute training. All unit parachutists should

complete at least one night jump per year. DZ drills must be efficient and must be practiced to ensure that control is not lost should a night operation be necessary.

8. Continued emphasis must be placed on the fact that parachuting is only a means to an end. Good ground drills and sound tactics are most important and must become a second nature.

9. Parachutist tension and fatigue presents a serious problem. A number of measures have been recommended to minimize the effects of each. These should be observed by units as part of their normal training. Research should continue with a view to the more complete elimination of conditions leading to tension and fatigue.

Preparation and Planning

10. This exercise again confirmed the requirement for sufficient aircraft to lift the Assault Force consisting of Bn HQ, two Coy Gps and essential supporting elements tactically loaded in one lift from War Station via Advanced Base to Target Area. In addition, the exercise indicated that maintenance difficulties with the C119 under the severe weather conditions likely to be encountered during a winter operation call for a higher than average percentage of standby aircraft in order to ensure that the number operational at any time does not fall below the required minimum.

11. A study should be made to determine ways and means of reducing the aircraft unserviceability factor. This applies particularly to aircraft becoming unserviceable at the last moment when the force is already assembled for take-off.

Command and Control

12. A system of Decision Schedules was developed to prevent needless alerts for the troops and aircrews, followed by subsequent aborting of the operation due to adverse weather. This system is a good one and should be continued.

13. Factors to be considered when preparing the Decision Schedule for each operation are:

- (a) Location of Advanced Base in relation to Target Area;
- (b) Season of the year;
- (c) Hours of daylight;

- (d) Local conditions at Advanced Base, ie, distances from assembly area, briefing rooms and personnel accommodation to aircraft.

Organization

14. The Assault Force is heavily loaded down with the present scales of ammunition, rations and survival equipment. Efforts must be made to reduce these scales in order that greater mobility may be achieved. This should result in bolder manoeuvre. A small prime mover is urgently required and development work should be continued to produce a vehicle capable of year-round use. The prime mover must be airdroppable.

Reconnaissance

15. The requirement for aircraft weather reconnaissance missions has already been stated in para 4.

16. This exercise again confirmed the importance of good air photos. They should not be relied upon as the sole means of information however. Winter photographic light is generally poor and in northern latitudes the duration of daylight is extremely short in mid-winter. Increased night and low light photographic capability must be developed. Until this is achieved more emphasis should be placed on visual reconnaissance reports by Rangers or any other local defence force elements that may exist, relayed through a wireless contact team placed in the area by the infantry battalion involved. In addition, pilots of strike or other aircraft capable of flying to and from the Target Area should be briefed on the information required in order to provide an additional means of obtaining information.

17. The Bn Commander and/or Senior members of the Assault Force should be prepared to take advantage of delays caused by weather unsuitable for para dropping, or the unserviceability of aircraft, to carry out visual reconnaissance of the Target Area using such light aircraft as may be available. In addition annual visits by unit commanders should be paid to the Target Areas within their area of responsibility in order that target brochures may be kept up to date and outline plans be made in advance.

Communications

18. "The CPRC 26 wireless set was designed for use between coy and pls, for which it is entirely suitable. It has not sufficient range for use between bn and coys and should not be employed in this role. The CPRC 10 or 510 should be issued for bn to coy communications as soon as these sets have been accepted and are available."

19. A study should be made of the wireless communications required by the medical sub-section. A requirement has been indicated for communications between RAP and Air Evacuation Post (AEP), and between the AEP and the Otter aircraft carrying out casualty evacuation. In addition, it may be necessary to provide communications between RAP and Bn HQ, should these become separated for any reason.

Administration

20. Accommodation at the Advanced Base should be allocated whenever possible by aircraft loads. This will enable personnel to be called for briefing or emplaning with a minimum of confusion and delay. For exercises only, friendly force officers should be quartered separately from press representatives, air crews, observers and umpires. The activities of personnel not engaged in the operation will in this way cause no interference to members of the Assault Force and will not interfere with their rest prior to take-off. In addition, the grouping of friendly force officers in one place will simplify calling them for briefings and O groups as necessary.

21. A study should be made of the practicability of preparing standard survival and personnel monorail aircraft loads. Insofar as is possible tent group loads should be interchangeable throughout the force. These common loads should be hung on the forward hooks in each aircraft leaving the rearward hooks available for special equipment loads such as mortars, signal and medical, etc. If this practice is followed the difficulties of exchanging special loads from one aircraft to another in the event of unserviceability will be kept to a minimum.

22. A drill must be established within each unit to check monorail loads daily in the aircraft whenever the weather is unsuitable for dropping for any length of time. If this is not done loads left unchecked may stretch their A7A containers, resulting in free fall when the opening shock of the cargo chute strikes the load.

2. A Guide to the Planning and Execution of Operations in the North (c1956)

Department of National Defence (DND), Directorate of History and Heritage (DHH) 112.3M3 (D2)

A GUIDE TO THE PLANNING AND EXECUTION OF OPERATIONS IN THE NORTH

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FOREWORD

1. This guide has been compiled from information extracted from the reports of Mobile Striking Force (MSF) and other Northern exercises conducted in Canada during the period 1945-55 inclusive. Basically the document is an edited consolidation of the lessons learned on these exercises. Its scope has been limited, however, by the limitations of the exercises themselves. Although fairly numerous, many of these exercises have been of small scale and short duration. All have had limited aims, and some have been more in the nature of trials than tactical manoeuvres. From these exercises collectively a great deal has been learned. Nonetheless, this publication does not claim to set forth doctrine. No actual operations have ever taken place in the Canadian Northland, or elsewhere in the North where identical conditions have prevailed.

2. The purpose of this guide is to present in convenient form a summary of the lessons which appear to have been proved valid. It is hoped thereby to assist the staffs of MSF formation Headquarters and the commanders and officers of MSF units in the planning and execution of Northern exercises and operations in the future.

3. It is suggested that all officers connected with the MSF use the guide as an aide memoire, extracting from it such items as are of particular concern to themselves and to their own jobs within the MSF. Sufficiently wide distribution is being made to permit this. Since the document is not exhaustive, and is supplementary to regular training pamphlets, it is not intended to replace individual initiative or in any way to restrict action. It should serve merely to guide it in the light of past experience.

SECTION I

TOPOGRAPHY AND METEOROLOGY

PART I

TOPOGRAPHY

1. The Canadian Northland includes both Arctic and sub-Arctic regions. By normal definition these terms describe climatic zones, using mean seasonal temperatures to differentiate between them. However, for military purposes it is more convenient to use the tree line as the dividing line between the two. Thus, militarily, the Arctic is the barren region north of the tree line, and the sub-Arctic is

the forested and scrub-covered region to the South of it as far as the upper limit of the warmer and more developed temperate zone.

2. This publication uses the tree line as the division between the Arctic and the sub-Arctic. This line skirts the north coast of Labrador, crosses Northern Quebec and stretches northwest from the coast of Hudson Bay, in the neighbourhood of Churchill, to near the mouth of the Mackenzie River. To the South is the Canadian sub-Arctic. To the North is the Canadian Arctic - a total area of barren grounds of 1,100,000 square miles representing 32 percent of the Dominion's area including all the Arctic islands.

3. In both of these zones there is a wide variation of topographical features including hill and mountain ranges, lakes, river valleys and flat-lands. Seasonal variations are extreme, posing different problems at different times of the year.

4. For practical purposes the Arctic proper may be regarded generally as flat, barren land. During winter, when the snow coverage exceeds one foot, it is often impossible to distinguish lake from land without digging. In contrast, no such generalization may be made of the sub-Arctic. In this region the country is heavily wooded and broken. Much of it, particularly in the west, is mountainous. Average winter snowfalls vary exceedingly from district to district. Great depth of snow is common in the forests. The recognition of lake from land seldom presents a problem. Wide temperature fluctuations within a single season may be expected.

5. Of extreme importance is the action of the wind, not only for its effect on visibility as it whips the snow cover into the air in winter, but also for its serious affect on the comfort and well-being of troops.

6. Drifting snow hinders movement during military operations. The expression "Drift" is normally used, for blowing snow. "Ground Drift" snakes along the ground. "High Drift" fills the air with flying snow to a height of 30 or more feet. The velocity of wind required to raise a given amount of drift varies throughout the year. A wind of about 12 mph will generally start ground drift. However, in midwinter a 4 or 5 mph wind will do this. Drift affects visibility considerably. A wind of about 18 mph cuts visibility to approximately a mile; one of 25 mph, to 100 yards. Winds of gale force, particularly in midwinter, can reduce visibility to 10 yards or less, even when no fresh snow is falling. In the Barrens there are high, steady winds which may average 20 mph for long periods. Also there is no vegetation to break the wind. This aspect cannot be stressed too much. In sub-Arctic Canada below the tree line, temperatures may be low but the windchill factor is low too. Even though wind records show appreciable figures there is always the bush present to break the wind and produce relatively still air, so that frequently wind records from

the bush country should be halved to give the true wind chill value at ground level. In the barrens natural shelter is completely lacking.

7. A brief explanation of the windchill factor is: "Temperature alone is no criterion of the effect of weather on the human body, which keeps warm and active only by the retention of a layer of warm air around it. The Windchill, ie, the combined result of temperature and wind, has been scientifically worked out to show the dry shade atmospheric cooling effect on the body expressed in kilogram calories per square meter per hour."

8. Throughout the North the horizontal component of the magnetic field is weak. This makes compass reading difficult in as much as it reduces the lateral pull on the magnetic needle rendering it sluggish, hesitant and slow to settle. Particularly when the weather is cold, oil compasses are much affected. The colder the liquid the thicker it becomes, and the slower the needle moves in its search for magnetic north. To overcome this every care should be taken to keep liquid compasses warm.

9. Compasses are also much influenced by nearby metal objects. The magnetic variation may change radically from place to place. Both these phenomena result from the weak horizontal component mentioned in the previous paragraph. When taking bearings they must be borne in mind. Serious compass errors will result if these points are not remembered and suitable corrective action taken.

PART II

METEOROLOGY

GENERAL

1. Weather forecasts have been found to be reasonably accurate for up to twenty-four hours. They are essential for commanders and staff for both tactical and administrative planning.

2. Because there are but comparatively few weather reporting stations in the North all means by which the weather picture can be ascertained are important. Aircrew flying in the area of operations should always be briefed to record weather observations and transmit them from the air if possible.

3. All meteorological instruments to be used in the North in winter should be thoroughly arcticized.

MSF OPERATIONS

4. A Meteorological SOP is a necessary adjunct to the MSF SOP. Provision of the best possible meteorological advice is important to the success of a MSF operation and confers increased flexibility of plan on the Assault Force Commander.
5. A Staff Meteorologist (Army) is required at Advanced Base Joint Headquarters as an adviser to the Army Commander, particularly for the interpretation of meteorological information received and to assist in the selection of suitable DZs. This latter function is important because physical terrain conditions affect surface wind speeds considerably. Selection of a DZ must be made with this factor in mind and due regard must be paid to the formation of neighbouring ground features. Failure to consider the meteorological factor when selecting a DZ may lead to serious mishap during the drop owing to purely local wind speeds over the DZ being far in excess of the surface speeds predicted generally for the area.
6. There is a requirement at the Assault Base for a meteorologist capable of giving a simple met report. One member of the ACT should have a knowledge of meteorology, probably the Forward Air Controller.
7. In order to assist accurate general weather forecasting the RCAF should be prepared to fly special aircraft weather reconnaissance missions as may be necessary. Weather reconnaissance may be considered a normal requirement in support of northern airborne operations.

EXERCISES

8. It is essential that the meteorological aspects be considered when determining the setting for a peacetime exercise. Weather records for each Target Area are available on request. The weather factor should be considered in conjunction with the other factors in determining the exercise Target Area best suited to bring out the lessons desired.

SECTION II

PREPARATION AND PLANNING

GENERAL

1. Preparation and planning for Northern operations must be as complete as possible before operations commence. This is particularly true of a Northern

Airborne operation. The omissions of the planners, which can often be rectified in the field in temperate climates, generally prove disastrous in the North. In mounting a Northern operation, nothing may be left to chance unless a carefully calculated risk is being taken. To leave things to chance is to invite defeat, not necessarily by the enemy but by the climate itself.

2. The environmental conditions encountered present few new problems in the conduct of small scale operations beyond those inherent in any undeveloped region. Lack of developed communications, the great distances involved and the nature of the terrain itself necessitate reliance, to a great extent, on air supply. This enhances the need for good planning since weight, quantity and bulk of supplies must be reduced to a critical level.

MSF OPERATIONS

3. All plans for an operation must evolve from a conference of the Joint Commanders (Army/RCAF) and their staffs. This does not preclude essential pre-planning by battalion commanders, who should at all times have skeleton plans available for all the Target Areas in their area of responsibility. It does mean that acceptance or alteration of an outline plan should be a joint decision based upon the circumstances prevailing at the time.

4. Target Area brochures should be produced in five copies as under:

Inf bn responsible 2 copies
APIS1 copy
Comd HQ (Main Base) 1 copy
File & working copy 1 copy

Information for both winter and summer should specifically state cover, routes, fordability of streams, suitable DZs, degree of movement possible over certain terrain and through wooded areas, etc. Rates of travel for all seasons should be established. In addition, to supplement maps, copies of aerial photographs should be available to Ranger companies in the area or such other local defence forces as exist. These brochures must be kept up to date.

5. Planning for MSF operations/exercises should include functions for the Canadian Rangers. Operational plans should aim to derive maximum benefit from the presence of local inhabitants.

6. Airborne operations in the North are particularly dependent upon favourable weather conditions. Re-inforcement and re-supply depend largely upon the

coincidence of favourable flying weather. Likewise, the initial launching of the operation itself is also dependent upon good flying weather. Its timeliness will often depend very largely on the readiness of the force to seize fleeting opportunities. From this it follows that an operation must be mounted from the very start in adequate strength, adequately equipped and with the troops prepared to assault on very short notice at the earliest advent of favourable flying weather. This involves lifting the total force to be employed in one lift, together with its immediate resupply, tactically loaded from the start in aircraft which have no other prior commitments. No reloading of these aircraft should be necessary between war station and assault area otherwise the force will not be capable of seizing the fleeting opportunities of good weather which present themselves, nor will the troops gain the maximum rest en route.

7. A study should be made to determine ways and means of reducing the aircraft unserviceability factor. This applies particularly to aircraft becoming unserviceable at the last moment when the force is already assembled for take-off. New run-up procedures are being used to overcome this weakness. However, until the hazard is reduced to more normal proportions a greater than normal percentage of stand-by aircraft should be provided. It is essential to ensure that the number of aircraft operational at any time does not fall below the required minimum.

8. It is axiomatic that Headquarters should be split to prevent the total loss of command and control if aircraft become unserviceable for any reason. This principle, which is so well understood in amphibious combined operations, must be applied equally to MSF airborne operations at least at battalion HQ level.

9. As a guide it may be taken that a force consisting of battalion headquarters and two inf coy groups, with supporting arms and services, will be required in the assault lift whenever the enemy lodgement is estimated as being between platoon and company strength.

10. During MSF operations/exercises it may be necessary to establish an air courier service between Main and Advanced Bases. If this proves necessary all despatches, maps, photos, traces, etc should be collected in the Operations Room at each base. When aircraft are cleared from one base to another the bag should be handed to the pilot for onward transmission. Under exceptional circumstances it may be necessary to detail a special aircraft to take an LO from one base to the other.

11. When possible, exercises should take place in an area where a MSF operation may have to be conducted. This is particularly desirable from an army standpoint. It is also preferable that exercise security be maintained to the extent that troops taking

part receive no prior warning of the exact location of the target. This should not be made known until the exercise commences.

12. Prior to participation in Northern exercises troops should be familiar with the following:

- (a) Arctic Manuals CATP 9(1)(2)(3)(4)
- (b) Lessons Learned on previous Northern exercises.

All officers of MSF units must be familiar with the current Standing Operating Procedure (SOP) for the MSF.

SECTION III

SELECTION AND TRAINING OF PERSONNEL

GENERAL

1. In Northern theatres, particularly in winter, the ordinary function of survival demands more time, energy and skill than under temperate conditions. Inexperienced troops may require up to ten hours a day in winter just to make and break camp and to carry out normal housekeeping duties. On the other hand, well-trained, winter-adapted troops, properly equipped, can cut this time to less than three hours. From this, it is evident that much training is required before troops can be considered combat-efficient in Northern operations.

2. During summer, mosquitoes and other insects pose a special problem. Although the buzzing of these insects in flight does not cut down a man's hearing or make it difficult to ascertain direction and distance of sound, vision is impaired to some extent (about 27%), as mosquito nets have to be worn to protect the face and neck. Full protection against biting insects is completely theoretical, but repellent provides reasonable protection in most cases. Some adaptation is required to suffer local insect life, but it should not limit the efficiency of fighting troops.

PERSONNEL SELECTION

3. In general, a soldier who is fit for active service is fit for duty in the North, but those who have a history of frostbite should be referred for medical assessment. Commanding Officers must ensure that personnel with severe domestic problems are not included in a Northern draft. Usually such men are poor psychological risks.

TRAINING

4. Both individuals and units must have attained Corps training standards and be fully combat-trained for operations in temperate climates before progressing to the specialist training required for operations in a Northern theatre.
5. Prior to an operational exercise in the North, indoctrination training must be undergone. Much of this can be undertaken at home station. It should be aimed at teaching all troops the proper care and maintenance of personal clothing and equipment and tent-group equipment, and to dispelling the fear of the Arctic and the cold inherent in most men. It is essential to build confidence. Additionally, specialist training must be given to all tradesmen and specialists relative to the carrying-out of their work under Northern conditions. Body-conditioning and hardening training must also be undertaken, and morale must be raised to a very high point.
6. First-aid in the North, camp routine, bushcraft, navigation, march discipline, sanitation and hygiene, feeding and, in particular, normal unit discipline, are all subjects that must be learned during the unit indoctrination phase.
7. Leadership and management of a very high order are required, particularly of junior officers and NCOs.
8. All officers and NCOs must be skilled map readers capable of navigation by dead-reckoning and practiced in the use of air photographs which will frequently be required to supplement or replace maps.
9. Tradesmen must be experts. Mechanical equipment suffers unduly under the increased rigours of Northern operations and working conditions likewise are bad. Great skill is required to keep equipment in sound working order. The success or failure of an operation may well depend on this. To achieve the necessary standard, special training will be required:
 - (a) Drivers and vehicle fitters must be highly skilled;
 - (b) Signals personnel must be capable of operating wearing gloves, must be familiar with the sets being used and able to maintain them, and must be physically fit and able to operate without error under the worst conditions;
 - (c) Medical personnel must be familiar with the problems peculiar to the North. Their training must include the evacuation of casualties and the equipment used to do this, the erection of tentage and shelters, sanitation and hygiene

in the North, and the treatment of ailments brought on specifically by Northern conditions.

10. Night training must be given adequate attention. Northern operations will frequently have to be undertaken at night or during periods of poor visibility in order to benefit from the effect of surprise that this permits. Since confusion and mistakes can be truly disastrous in cold weather, a very high degree of proficiency must be reached.

11. Prior to an operation or an exercise, a period of familiarization training should be undergone, if at all possible. This is in addition to home station unit indoctrination training and must be conducted in an area where conditions are similar to those that will be encountered during the operation or the exercise.

12. In summary, the key to mobility in the North is fitness and endurance on the part of troops and knowledge of Northern conditions, so that survival tasks (the business of living) require the minimum of time and effort.

MSF OPERATIONS

13. Some additional lessons peculiar to airborne operations are given below.

14. Troops designated for MSF operations must be practised in dressing and emplaning quickly. If necessary, additional personnel should be made available to assist in getting the paratroops dressed prior to embarkation. On past exercises, equipment has been lost or dropped free in error during the para drop. In part, this has been due to equipment being incorrectly put on. Training in the fitting and wearing of airborne equipment must be thoroughly given to all personnel who will be required to jump.

15. The jump, no matter how well executed, does not defeat the enemy. It is the subsequent ground action which wins the battle. It should be emphasized in the training of parachutists that the jump is only a means to an end.

16. Every effort must be made to reduce the load carried by the parachutist.

17. Since troops on MSF operations cannot expect the same fire support which they would receive in conventional warfare, the infantry parachutist must make up this lack by perfection in the infantry skills. He must be better trained, both collectively and individually, than his counterpart in the line battalion.

18. Adequate training must be carried out to permit the mounting of an operation by night (as distinct from operating on the ground by night). The short winter days coupled with adverse weather conditions may well necessitate a night parachute descent, particularly as night wind speeds in some areas tend to be lower than those prevailing during daylight. Aircrews likely to be assigned to the MSF should be trained in night formation flying and night navigation. Army MSF units should carry out night parachute training. All unit parachutists should complete at least one night jump per year. DZ drills must be efficient and must be practiced to ensure that control is not lost should a night operation be necessary.

19. Advanced Base Joint Headquarters is an 'ad hoc' formation brought together for each operation/exercise. The smooth functioning of the Headquarters from the outset cannot be expected unless adequate training is carried out. The personnel involved are subject to the normal posting policies in effect within both services. This results in periodic rotation of the staff. Signals and planning exercises should be conducted from time to time for the training of the staff and to improve the organization of the Headquarters.

20. Parachutist tension and fatigue presents a serious problem. A number of measures have been recommended to minimize the effects of each. These should be observed by units as part of their normal training. Research should continue with a view to the more complete elimination of conditions leading to tension and fatigue.

EXERCISES

21. Whenever possible a full scale dress rehearsal exercise should precede the exercise proper. This will permit the ironing out of minor procedural details within the Bn Gp and will allow the various elements forming the Assault Force to become familiar with one another. Continuation training exercises should also be used for this purpose.

22. The selection and training of umpires for MSF exercises should be made early in the planning stage. Selection should be governed by past experience. All umpires should have had Northern experience prior to their participation in an exercise as an umpire.

23. When serious errors are committed, troops must be stopped and constructively criticized and made to repeat that particular phase of the operation. This applies both to the elementary training carried out during indoctrination and the tactical training carried out during the latter part of the exercise training.

SECTION IV

COMMAND AND CONTROL

GENERAL

1. Commanders at all levels must learn to appreciate the difference in time values that apply in cold weather operations. In order to maintain morale at the level required for effective performance, every item and every minute of the twenty-four hours of each day must be ordered and controlled. Double, or even treble, the time will be required for the completion of housekeeping duties, care of equipment and for the conduct of operations.

MSF OPERATIONS

2. Operations of this nature are Army/RCAF joint operations. The closest cooperation must be maintained between the two services from the commencement of planning until the completion of the operation. To this end, joint headquarters are established both at the Main Base and at the Advanced Base. In the Assault Area a Forward Air Controller is available to assist the battalion commander.

3. During operations/exercises a daily joint conference at the Advanced Base is essential to the effective coordination of Army and Air Force actions.

4. All key personnel must nominate reliefs who can take over immediately in case of casualties.

5. A system of Decision Schedules has been developed to prevent needless alerts for the troops and aircrews, followed by subsequent aborting of the operation due to adverse weather. This system is a good one and should be continued.

6. Factors to be considered when preparing the Decision Schedule for each operation are:

- (a) Location of Advanced Base in relation to Target Area;
- (b) Season of the year;
- (c) Hours of daylight;
- (d) Local conditions at Advanced Base, ie, distances from assembly area, briefing rooms and personnel accommodation to aircraft.

EXERCISES

7. During exercises, a neutral camp (ghost area) is essential to house the Directing Staff, neutral signals, medical personnel, umpires, RCAF safety personnel, PRO, Press and observers. It requires much planning. Transport, food and bedding are required at odd hours. A senior administrative officer should be in charge of setting up and running such a camp. A notice board is required.
8. To ensure safety precautions on Airborne Exercises an officer trained in airborne operations is necessary on the DZ prior to the air drop taking place. He should be authorized to cancel the jump if conditions appear unnecessarily hazardous or if the wind is above 18 mph. For this purpose he should be equipped with an anemometer. Red smoke and red Verrey Flares must always be available on the DZ to indicate to transport aircraft that the jump is called off.

SECTION V

ORGANIZATION

CONVENTIONAL GROUND OPERATIONS IN NORTHERN THEATRES

1. Existing brigade, battalion and other unit organizations, with modifications, should be retained for Northern operations. Transport and plant of a special nature must in some cases be provided, necessitating changes in establishments as regards numbers of drivers and operators. Because of the reduction of efficiency of personnel in the cold, the additional maintenance required, and the increased hazards of driving, a spare driver should be allotted to each vehicle and workshop facilities must be increased to allow for heated shelters for vehicles and repair crews.
2. On account of the long line of communication it is necessary to establish an advance Ordnance Depot in the forward base area. This must be done irrespective of the size of the force involved, and it must carry substantial stocks of rapid turnover items. A reserve of vehicles must also be held forward.
3. There appears to be a requirement for a light aircraft for use before proper lines of communication are established.
4. For the defence of the Alaska Highway and its installations a fully mobile group has been recommended as being most suitable. The force should be mounted in light personnel carriers or vehicles of a similar nature and should be well supplied with

LMGs and also with a certain proportion of heavy machine guns, such as the Browning .50. Armoured cars or light tanks should be an intrinsic part of the group. Field artillery or mortar support should be provided.

5. Full use should be made of local inhabitants who know the country, irrespective of their ages, to act as guides.
6. A movement control section should be formed as part of the administrative headquarters when large numbers of troops are being concentrated.
7. A forward rest area should be established. This is necessary as the maintenance of morale is a problem that will face all commanders. Relief from the rigours of frontline soldiering must be provided.

MSF OPERATIONS

8. The Assault Force is inevitably heavily laden with ammunition, rations and survival equipment. Efforts must be continuous to reduce the bulk and weight of accompanying stores, consistent with the task in hand, in order that greater mobility may be achieved. This should lead to bolder manoeuvre.
9. A small prime mover is urgently needed. Development work should continue towards the production of a vehicle capable of year round use. The prime mover provided must be capable of being air-dropped and must not be wasteful of aircraft space.

SECTION VI

GROUND BATTLE

GENERAL

1. Planning must be extremely detailed and thorough. The need for a simplified plan is even greater than ever because of the adverse conditions under which troops are required to operate. To carry it out, ample time must be allowed for operation and deployment -- perhaps as much as two to three times that normally required.
2. No radical changes from accepted combat principles or tactical doctrine are imposed by conditions of snow and extreme cold. This conclusion is based directly on the premise that the force is so equipped and trained that it can attain and retain mobility. However, experience gained on exercises suggests certain changes in the

method of application of accepted tactical doctrine in the advance, attack, defence and withdrawal.

- (a) In the assault, speed is reduced by difficult footing in soft, deep snow and movement is very exhausting. Particular attention should be given to closing with enfilade fire the interval between the cessation of high trajectory supporting fire and the arrival of troops on the objective.
- (b) Attacking troops should be given early relief by reserve troops.
- (c) Reorganization should be carried out by reserve troops to permit the bringing up of survival stores to protect fatigued assault troops from the cold. This must commence at once to lessen the likelihood of a successful enemy counter-attack.
- (d) Exploitation should be the role of reserve units.
- (e) Although ground is still of paramount importance, the location of defensive positions may often have to be decided by the location of deep snow since excavation of frozen ground is rarely possible. In hard snow defences will have to be built up rather than dug down.
- (f) Particularly in the barren lands, conditions tend to favour the defence so that a superiority in the attack of three or four to one is necessary for success. For example, it appears that a Company group, without adequate supporting weapons, is not sufficiently strong to overcome an enemy platoon well organized for defence on the barrens. Possibly offensive air support may weigh the scales in favour of the attacker but an adequate weight of supporting ground weapons seems essential. This is particularly true if the enemy is in possession of an increased increment of automatic weapons.

CONVENTIONAL GROUND OPERATIONS IN NORTHERN THEATRES

- 3. Artillery or mortar support will be essential to any operation larger than a small raid.
- 4. Oversnow vehicles will be essential for the carriage of heavy support weapons.

MSF OPERATIONS

5. When paratroops or airlanded troops are used, a longer than normal reorganization period on the DZ or LZ must be granted. In order to achieve this troops must land some distance from an enemy position. They must be at least out of range of small arms fire. A distance of from three to five miles from the enemy position is the best.
6. Until some form of weapons carrier is available, support weapons must be delivered by parachute to the vicinity of the fire position after it has been secured.
7. Where the target area is close to a Northern habitation the use of locals to help clear the DZ should be considered. Guides and dog teams might be made available and their provision might be an additional task for the local Rangers if such exist.
8. The concept of the deliberate attack mounted from a firm base and proceeded by normal reconnaissance patrolling should be accepted as a basis for tactical planning of MSF operations.
9. Within units a procedure must be worked out for the handling of prisoners of war.

SECTION VII

ASSAULT TACTICS

GENERAL

1. Great physical and mental effort is required to remain aggressive under conditions of extreme cold and high windchill. The cold and unusual conditions of life can, if allowed, impose a heavy strain on morale. Every opportunity must be taken to seek out the enemy in order to increase this strain upon him, to deprive him of rest and time to prepare food, and eventually to destroy him.
2. In the Yukon and Alaska, tactics to be used are similar to jungle and mountain warfare tactics, with consideration of the added feature of frozen ground and snow. In the barren lands, desert tactical principles apply virtually without change. Operational techniques and procedures however call for considerable modification.

3. Night operations are practicable under Northern conditions but thorough training therein is a necessity. In fact, the night attack offers many advantages over the daylight attack, particularly in the barren lands.
4. Complicated tactics have no more likelihood of success in the North than in any other area. Assault plans must be simple, and the rules which apply in normal climates and terrain must be followed in even greater detail.
5. Although security measures in general are similar to those employed in any operation, the need for silence and track discipline should receive added emphasis.
6. The slower rate of movement imposed upon troops by snow and rough terrain will necessitate modification of present concepts of supporting fire and assault distances. Timings will be increased and greater emphasis placed upon fire from a flank.
7. Prior to launching an attack, detailed ground reconnaissance of the enemy position, possible forming up areas and start lines is essential in order to ensure that timings will be accurate. This is especially important when operating at night or in bad weather. Men waiting unnecessarily long in the open are liable to become casualties from the cold. As many junior commanders as possible must be given the opportunity of viewing the ground providing that it will not prejudice the operation.
8. Detailed planning and careful control are essential if the attack is to be a success. A navigating party must mark clearly the axis of advance and start line using coloured tape, sea dye, infra red equipment or some other suitable means. If the advance is long, it is suggested that intermediate bounds be marked as well, care being taken that such markings are not placed out too far in advance of the attack thereby prejudicing surprise. For a successful attack to be carried out under such conditions troops must be well trained and junior leadership must be of the highest order. Control must be maintained at all times to ensure that the attack goes in at the right time and at the right places.
9. During Northern Winter operations, deployment for the attack requires more time than in other seasons and in settled areas. The slower pace due to cold; the obstacles of windfall, muskeg and drifted snow; the care required in describing and defining assembly areas, positions and unit boundaries in a country which lacks the normal means of orientation; the exacting demands of bush navigation; the short hours of daylight; all of these and other factors require intensive pre-training of commanders, staffs and troops to appreciate properly the factors of time and space. During the attack the use and effect of support weapons is limited by the factors outlined, and also by the deadening effect of snow on artillery shell and mortar bomb.

10. Attacks by small airborne infantry, or light armoured raiding detachments, especially when directed at L of C installations, offer special advantages and may be regarded as normal in this type of operation.

11. In snow, even where only a foot deep, the present smoke projectiles of the 25 pounder are smothered by the melting water when they burn. On the barrens conditions unsuitable for the use of smoke are often encountered due to the strong wind prevailing. This is also true regarding the use of chemical weapons.

12. The use of flame weapons in the attack will tend to destroy any shelter existing that could be used by our own troops on re-organization. It is considered that such weapons should be used with reserve, and only when the attack is beginning to falter and other means of helping it forward have been tried unsuccessfully.

13. Due to the lack of tactical features in the barren lands it will usually be necessary for re-organization to be carried out on the enemy position. In spite of the obvious disadvantages, it is considered that this course is more acceptable than attempting to re-organize elsewhere, as even the most hastily constructed defences are a laborious and time-consuming problem. The nature of the ground seldom offers other nearby positions of tactical importance. Resolute follow-up of a retreating enemy by fresh troops will therefore often ensure their complete destruction.

CONVENTIONAL GROUND OPERATIONS IN NORTHERN THEATRES

14. A proportion of armour should be included in any sizeable force detailed to operate in the North. This is necessary in order to provide reconnaissance and close support for infantry. Armoured action may be carried out in some localities.

15. The principles to be considered in the advance-to-contact do not differ from those which apply in normal circumstances. It is only when they are ignored that the nature of the country and climate are likely to make the result disastrous. Advance-to-contact must be carried out under cover of a protective force which must be fully mobile, have oversnow mobility and be armoured, or lightly armoured if airtransportable. It must have sufficient firepower to eliminate minor opposition.

16. The assault will often be best delivered at night owing to the impaired alertness of sentries. Surprise becomes such an important factor that it may be preferable to deliver the assault without previous artillery support. The assault should be made down-wind if at all possible, as it will materially assist the attacker and add to the problems of the defender. Sentries will normally have their backs to the wind. It may be necessary to wear snowshoes for the actual assault but troops will generally

prefer to discard them if the “going” permits. It will often be advantageous to attack in inclement weather.

17. On arrival on the position, troops who have become heated in the attack will be more liable to the effects of cold. During the reorganization phase, it will be necessary to bring up tentage and packs. Care must be taken not to weaken the troops on the objective in carrying out such tasks to the point that they are unable to withstand counterattack. In general, it will be the task of reserves to carry out reorganization and exploitation.

18. Where a force relies on a single line of communication and where its axis passes through defiles or bush and forest, as in the case of the Northwest Highway System, it is particularly susceptible to guerrilla action. However, one of the first necessities of this type of action is that there should be local inhabitants who are capable of being organized as guerrillas and who, by their knowledge of the country, are capable of rapid concentration at the point of attack and rapid dispersal thereafter. On dispersal it is important that they should leave no trace of their movement. This might well be a function of Rangers in support of ground operations.

19. Action against the enemy line of communication should take the form of raids against specific objectives, the raiding force being completely withdrawn as soon as possible after the attack. Such a force might be night-landed or dropped on a lake adjacent to the target and can move by ski or snowshoe to the attack. No particular risk is involved until the attack is carried out, and several days might elapse before a favourable opportunity presented itself. Once the attack has been delivered the force can be followed up either by air reconnaissance or on foot. Attacks could be delivered against bridges, or against enemy aircraft on landing grounds in the same manner as those so successfully carried out by Special Service patrols in the desert.

20. The dependence of the enemy on tents and vehicles for survival and the importance of destroying his gun positions offer suitable objectives for armoured assault if outflanking movement can be effected. The country in the Yukon lends itself to the employment of close range, recoilless anti-tank weapons. The effectiveness of armoured assault will therefore depend largely on the degree of surprise which can be obtained and the extent of development and employment by the enemy of recoilless weapons.

21. Survival stores such as sleeping bags, tents and heaters, rations and fuel should be carried in “A” echelon vehicles. In certain circumstances they will be carried on, or towed behind, “F” echelon vehicles, or even be man-packed.

MSF OPERATIONS

22. Because of the difficulty of obtaining detailed information it will seldom be possible to drop an airborne force with plans already fully made for a set-piece attack. Flexibility of plan must be retained.

23. The overhead landing method visualized by many, when speaking of “smothering” tactics, is considered most hazardous under northern conditions and not practicable. It should only be employed when conditions of weather, ground and enemy disposition ensure successful conclusion of the operation. Generally speaking, the best method is to drop as close as possible, but out of small arms range. A distance of 3 to 5 miles is best, if it can be achieved.

24. The administrative DZ must be secured before resupply takes place. This applies to any airborne operation but is particularly important to northern operations due to the requirement for survival equipment.

25. Personnel parachuting in the Arctic should do so with a minimum of equipment.

26. The airdrop can only achieve momentary surprise. Tactical surprise must be obtained by normal ground methods, ie, the night attack, the direction of the attack, the scale of the attack, etc.

27. Summer darkness in the Arctic, while not black as long as in the South, at least takes away all colours and restricts visibility a great deal. It is difficult, but could be possible, for well disciplined troops to achieve considerable surprise. However, it must be assumed that the enemy would be alert after an airdrop nearby.

28. A well dug-in enemy, even without a bonus of extra supporting weapons, is such a formidable target that, with or without air support, a maximum amount of ground supporting fire is required plus an assault force at least four times the enemy strength. The practice of fire and movement is particularly important.

29. Except for communications, there appears to be no firm reason for insisting upon a permanent DZ. The labour of going back for supplies is excessive. The Surgical Team, supporting weapons and spare equipment can be dropped where and as required.

SECTION VIII

NAVIGATION

1. Due to the inaccuracy of maps and the lack of detail thereon, and in some cases the complete lack of maps, operations in the Canadian Northland call for a high degree of navigational skill. Navigation by dead-reckoning must be mastered thoroughly, particularly in the case of operations conducted on the barren lands.
2. Maximum use must be made of vertical air photography to supplement existing maps. Gridded mosaics provide the best coverage. If full use is to be made of them, the photographs must be taken during the same season that they are to be used. Distribution of air photographs must reach down to the platoon level, and they must be issued in time to be of use.
3. On the battalion level, it is considered that navigation should be the special responsibility of the Intelligence Officer who may, under special circumstances, be assisted by an attached navigator. All officers and NCOs, however, must be capable of navigating. Minimum aids required are:
 - (a) Map or air photograph;
 - (b) Oil-bearing prismatic compass;
 - (c) Service protractor and pencil;
 - (d) Pace counter, or other means of distance measurement (calibrated length of cable, etc).
4. Major causes of difficulty when navigating arise from:
 - (a) Lack of landmarks on the barren lands on which to take bearings and set course;
 - (b) Inefficiency of the magnetic compass in Northern latitudes (weak horizontal component of magnetic field);
 - (c) Difficulty in judging distance due to the lack of perspective, particularly on the barren lands;
 - (d) The necessity to make detours around areas of thick bush, creeks and stream-beds to avoid becoming bogged down. This makes

direction-keeping difficult;

- (e) Errors in distance measurement caused by differences of “going” underfoot when marching, and by inaccuracy of mileometer (odometer) measurement due to track slip when travelling by vehicle over long distances;
- (f) The reluctance of personnel when travelling in vehicles to dismount sufficiently often to take accurate bearings.

5. Some of the most useful methods of overcoming these difficulties are given below: It must always be remembered that the object of navigation is not merely to get from “A” to “B”, but to get there by the best route and with the minimum of delay and fatigue.

(a) Direction-keeping

- (i) Keep the compass warm. This will greatly speed-up the taking of bearings. A cold liquid compass becomes very sluggish and the needle “hesitates” in its search for magnetic north. If time and patience are not used, the navigator may well mistake a momentary “hesitation” for an actual magnetic reading and thus steer a wrong course.
- (ii) When the terrain offers no easily-recognizable landmarks along the line of march to aid in fixing a bearing taken (ie, provide an aiming mark on which to march), rearward landmarks may be used as aiming marks and back bearings taken; or, if visibility is a matter of some miles (ie, on the barrens), two artificial aiming marks may be created on the desired bearing - the first at one’s present position and the second 500 to 1000 yards ahead. A forward course set to keep these in line behind one may then be taken. Whilst they remain visible, the compass need not be used;
- (iii) When only poorly-defined forward aiming marks exist, such as small bushes, scrub, etc, which look very much alike, the navigator should keep his eyes fixed on the chosen aiming mark once he has taken his bearing, so as not to lose it. As he will generally have his weapon or some other metal about him which he must remove before taking the bearing, he should do this so as to discard the metal objects

in front of him in the general direction of the course being taken. The navigator should then move back some distance from the metal, take his bearing, select his aiming mark and keeping his eyes on it, move forward, retrieve his discarded equipment and move off on the set course. If this is done, delays will not result whilst bearings are taken two or three times owing to the fact that the navigator has lost sight of his aiming mark. Taking a simple bearing in extreme cold may take as long as three to four minutes. The delay caused by having to check a bearing three or four times speaks for itself.

- (iv) When visibility is poor, only close-in aiming marks will be available. This will necessitate the taking of bearings frequently. However, much can be done to speed the process of navigation and avoid keeping troops waiting in the cold if the navigator, whenever he can take a straight course to his aiming mark, whilst closing upon it looks for continuing aiming marks further along the direct line from himself to the original mark. When this can be done, it is not necessary to take a new bearing on reaching the original mark, as the navigator can continue to move on a further mark which subtends the same set course. This process should not be carried out more than three or four times before a check-bearing is taken, to ensure that the course is still the true one. It is emphasized that this method can only be used when the aiming marks can be approached in a straight line. A glance backwards at one's own tracks will often confirm whether one's approach has been straight or not.
- (v) A close watch on the prevailing wind, especially if it is causing snow "drift", can help to cut down the number of bearings to be taken. Practice is required before accuracy can be achieved by using the wind as a direction marker.
- (vi) Emergency moves in extremely poor visibility should be treated as night moves. Night use of the compass must be practiced until perfection is achieved.

(b) Distance Measurement

- (i) Pace counting is only of value if the counter knows the length of his own pace. This will vary as ground conditions vary. It can only be learnt with practice. Use of a mechanical pace-counter helps to keep track of the number of paces taken but it does not help in translating this figure into yards.
- (ii) A calibrated length of cable and markers can be used to give accurate measurement of distance. This method is tedious and slow but is at present the most accurate. There is a need to improve upon it.

6. Dead-reckoning navigation can only be undertaken from a known starting point. For all dead-reckoning marches, a carefully-worked out route must first be plotted and then an accurate log be kept to record actions taken. From this log, any deviations from the planned route can be ascertained and one's position be accurately plotted on either a map or a vertical air photograph of known scale.

7. Small military bodies operating in unmapped territory, or in mapped territory of poor relief in Winter-time, should be commanded by officers who can handle and calculate position from a Bubble Sextant of type 9 or 9A, if any great distance is to be covered; ie, long range patrol.

8. A sun compass is a valuable check on the magnetic compass in areas close to the magnetic pole, where large local areas of variation are suspected. The CHICHESTER sun compass appears to be satisfactory and suitable for such use.

SECTION IX

PATROLS

1. Owing to the increased difficulty of maintaining control imposed by the effects of cold and fatigue patrols should be kept as small as possible. If the snow is particularly deep, however, it must be remembered that trail-breaking will have to be undertaken and additional men may have to be included for this task.

2. If patrolling is to take place by night, the time allowed should be doubled to cover the greater difficulties of moving quickly over snow in the diffused light and maintaining direction.

3. The size and composition of a long range patrol will be governed by the task. Details of loads to be carried require careful calculation in order to ensure that the efficiency of the patrol is not impaired by carrying an excess of equipment. For special long range patrols, the use of dog teams is a possibility.
4. Patrolling is a most important skill and occupies a good portion of the time required for an operation. When an enemy position has been located, offensive action by fighting patrols should commence at the earliest possible moment in order to make the enemy divulge his fire plan and any weaknesses in his position. Reconnaissance is also necessary to discover the best lines of approach, forming-up places, etc, for the subsequent assault.
5. Before an attack is launched an attempt should be made to pinpoint all enemy automatic weapons, mine-fields and trip-flares, sentry posts, shelters and headquarters, and, if possible, to discover the enemy "alert" procedures. Patrols should also recce in detail the Assembly Area, FUP and SL and mark them in some agreed manner, probably by tape or sea dye. The distance and direction to them, and between them, should be recorded for the purpose of dead-reckoning movement later.
6. Night patrolling, which permits use of all the deceptive and camouflage methods available combined with the lowered efficiency of the enemy's defence, is particularly effective. Effectiveness can be increased by taking advantage of the wind, which should blow toward the enemy and be at the back of the patrol.
7. The evacuation of patrol casualties is especially difficult. It may be necessary for a patrol to take a two-man sled equipped with casualty bag. In any case, patrols must always be equipped with survival kit (minimum only) in case they become lost or are forced to stay away from their base of operations.

SECTION X

RECONNAISSANCE

GENERAL

1. The necessity for detailed reconnaissance, both prior to and during an operation, is increased in Northern warfare in order to avoid misdirection of effort, delay, confusion and the subsequent unnecessary exposure of troops to cold and fatigue.

AERIAL RECONNAISSANCE

2. One of the distinguishing features of sub-Arctic terrain, particularly in the Eastern and Central sub-Arctic, is the vast expanse of treed area devoid of readily recognizable landmarks and so flat that observation from the ground is very restricted. This factor, taken together with the absence of accurate maps, makes the location and identification from the ground of targets and dropping zones difficult, and necessitates increased air co-operation for the following tasks:

- (a) Aerial photography to supplement existing maps;
- (b) Air observation for artillery;
- (c) Aerial road reconnaissance for engineers;
- (d) Visual reconnaissance.

3. In most cases the initial location of the enemy will be the result of air recce. Thereafter continued air recce, both visual and photographic, will be required to provide much of the information necessary to a commander for the formulation of his plan.

4. Aerial photographs are useless unless the area photographed can be recognized. Photo coverage must therefore include at least one recognizable landmark with which to orientate the photograph. This sometimes presents a problem in the North. Despite the obvious nature of this fact, it has sometimes been overlooked in the past, with the result that excellent photographs have been taken of defensive positions with no possible means of relating the area to the ground.

5. Once photographs have been taken, their interpretation requires personnel intimately familiar with the task. Skill at interpretation is gained only after long study. Interpretation is the job of an expert. On the other hand, a knowledge of photo reading is required of all officers and senior NCOs. In the North it assumes great importance for many of the likely areas of operations are unmapped or very inaccurately mapped. All officers and senior NCOs must be trained in photo reading and be confident of their ability.

6. Arrangements must be made for the early delivery of photographs to the users, together with their interpretation reports, if they are to be of value.

GROUND RECONNAISSANCE

7. Ground reconnaissance of the enemy position, and of routes to it, will nearly always be necessary. In addition it will generally be necessary in the North to include

such tasks as the preparation and marking of trails to assist in subsequent movement, either in the attack or withdrawal. Ground reconnaissance under Northern conditions will require more time to complete than in temperate climates and allowance should be made for this.

8. Even when visibility is excellent, as is often the case in the Arctic, detailed reconnaissance will still be essential. Without it the danger of troops being directed on to the wrong objective, using unsuitable routes or miscalculating timing and distance is too great to be accepted.

9. In the Yukon and Alaska, the country along the Northwest Highway System lends itself particularly to ambush and delaying tactics. The need for adequate reconnaissance ahead of an advancing column is therefore emphasized. For the conduct of ground operations in the North, just as elsewhere, reconnaissance troops require armoured protection and cross-country (oversnow) mobility in order to carry out their task. Engineers moving with reconnaissance elements will also require oversnow vehicles, and a bulldozer for road clearance. An air OP will be of great assistance especially in providing flank protection.

MSF OPERATIONS

10. Very early and accurate information on the location and strength of the enemy is essential to ensure the effort expended in mounting an operation is commensurate with the task in hand. This is of prime importance since it has proved necessary to employ at least battalion headquarters and two inf coy groups, together with their requisite supporting arms and services, to destroy an enemy lodgement in greater than platoon, but not greater than company strength. To estimate the enemy strength as quickly as possible, the following action is necessary:

- (a) very early air recce, both photographic and visual;
- (b) the dropping of a wireless team into the area during the information phase to contact the local defence force and provide detailed information to orbiting aircraft;
- (c) The use of a simple ground/air code by the local defence force prior to the arrival of the air dropped wireless team.

11. Air photos should not be relied upon as the sole means of information. Winter photographic light is generally poor and in northern latitudes the duration of daylight is extremely short in mid-winter. Increased night and low light photograph capability must be developed. Until this is achieved more emphasis should be placed on visual

reconnaissance reports by Rangers or any other local defence force elements that may exist, relayed through a wireless contact team placed in the area by the infantry battalion involved. In addition, pilots of strike or other aircraft capable of flying to and from the Target Area should be briefed on the information required in order to provide an additional means of obtaining information.

12. The Bn Commander and/or Senior members of the Assault Force should be prepared to take advantage of delays caused by weather unsuitable for para dropping, or the unserviceability of aircraft, to carry out visual reconnaissance of the Target Area using such light aircraft as may be available. In addition annual visits by unit commanders should be paid to the target Areas within their area of responsibility in order that target brochures may be kept up to date and outline plans be made in advance.

SECTION XI

MOVEMENT AND MOBILITY

DISMOUNTED MOBILITY

1. Movement on foot in the Arctic and Sub-Arctic will generally be slow and fatiguing. The distance a dismounted force can travel per day in any season of the year (excluding specially trained ski troops in winter) will not normally exceed 8 - 10 miles. Forced marches of up to 15 - 20 miles per day are possible for short periods by trained troops; and lightly equipped patrols might be capable of covering this greater distance for extended periods. Adverse weather in winter will curtail, and sometimes prevent completely, the movement of troops.

2. In winter both skis and snowshoes have their uses in the varying conditions of snow and terrain to be found. Skis are best in open country, such as the Prairies, and in the foothills of the Rockies. In bush country snowshoes are more suitable owing to the great depth of snow. On the barren lands in mid-winter the action of the wind combines with low temperature to form a very hard-packed snow surface made irregular by snow anvils. Under these conditions neither skis nor snowshoes are required by lightly equipped troops. Men weighed down with equipment or pulling sleds may need snowshoes, but the use of skis is not recommended as the anvils and the gritty texture of the snow in extreme cold make their use difficult. On the barrens snowshoes will normally be required during the early and late winter months however.

3. In summer, movement on foot is possible through most of northern Canada. Most swamps and slews can be waded. Those sections that cannot be waded may be by-passed. The comparatively few rivers or creeks which cannot be portaged may be easily crossed by improvised methods - the inflatable pad is very useful for this purpose. Good, thorough reconnaissance is required.

MOUNTED MOBILITY

4. Wheeled vehicles are completely road-bound in the North. All fighting and unit "A" echelon vehicles, therefore, should be of the over-snow type, able to move cross-country in summer and over snow-covered terrain in winter. In the Sub-Arctic there are usually sufficient roads and tracks to warrant the use of wheeled supply convoys after the expenditure of considerable engineer effort. In the Arctic proper, however, a commander must be able to rely entirely either on over-snow vehicles or on supply by air; otherwise the speed of his movement will have to conform to that of his engineer road-making "tail". This would so limit his mobility as almost to deprive him of it altogether.

5. In all seasons of the year the use of vehicles of any type will necessitate a major engineer road maintenance and repair effort. In winter snow clearance will be the major task; in summer repair of the road surface and bridging will predominate.

6. During the spring and fall it is necessary to restrict traffic to the time when roads are frozen in order to preserve their surface. This is normally at night and in the early morning. Movement along a single axis may be halted completely if this precautionary step is not taken at once after the first thaw or during freeze-up.

7. When vehicles are used, troops tend to become vehicle-bound. The main reason for this is the difficulty of moving dismounted away from the vehicles with the bulk and weight of equipment carried by a mounted force. The decision to move a force mounted should therefore be entirely divorced from the decision to attempt to fight the force from its vehicles. In each case different equipment scales are required. If this fact is not grasped the consequences can be disastrous.

8. Tractor trains, although very slow moving, are specially suited to the establishment of a L of C in winter operations. They can operate under the severest weather conditions and can transport great weights of supplies. A limited number of over-snow vehicles must be provided when operating tractor trains to keep contact with them on the trail in case of mechanical failure or illness of personnel. Unless being used on a much travelled route, each convoy should be equipped with wireless.

9. Shown at Table “A” on page 26 is some data concerning the restrictive effect of snow on certain types of vehicles and on dismounted personnel.

Miscellaneous

10. Water transport has great possibilities during the summer. In general it is unsuited to tactical movement as it permits little freedom of manoeuvre and makes it difficult both to achieve and to guard against surprise. As a medium for the transportation of supplies however it should not be overlooked.

11. For the over-land movement of small bodies of troops in winter the use of dog teams offers certain advantages. They enhance the range and mobility of long range patrols and at the same time enable the essential minimum of supplies and survival gear to be carried. The unsupported range of dog team travel is not far short of the range of over-snow vehicles:

(a) Their advantages are:

- (i) They can follow tracks and move in the worst weather;
- (ii) In emergencies they can travel without food for several days, whereas vehicles cannot move without fuel.

(b) Their disadvantages are:

- (i) Even whilst stationary, dogs consume payload;
- (ii) Specially trained drivers are needed;
- (iii) 40 miles per day is the maximum average distance that can be expected of them, as against much greater distances for vehicles if the “going” is good;
- (iv) They are not readily available.

12. For airborne troops an urgent requirement exists for a prime-mover, droppable and capable of towing fully-loaded sleds. The carrying forward of ammunition and equipment and the evacuation of casualties places a great strain on personnel and depletes the available fighting strength of a company. Further, in the gaining-of-contact phase, the towing of sleds by each sub-unit of the fighting element, advancing under tactical deployment, is slow and most dangerous.

MOVEMENT

13. For the movement of a force across country, either on foot or in vehicles, arrangements must be made for adequate reconnaissance, trail marking and trail breaking. For these tasks a special party must be detailed and sufficient time must be allotted. The provision of special devices may be necessary to mark the trail, particularly at night. It is important to have the trail marked in such a manner that the markers lead on from one to another and will still be visible when the main body reaches them. Weather conditions must therefore be considered in deciding the type of marker to be used.

(NOTE: It is important that the position of markers in relation to the trail be known: eg, Yellow markers one yard to RIGHT of trail spaced at 50 yard (minimum) intervals).

14. The tendency for troops to move always in single file should be resisted. Although this is the least fatiguing formation, it is also perhaps the most vulnerable to ambush anywhere along the length of the column. Within sub-units of not greater than platoon size it is acceptable, but for larger units, when contact with the enemy is expected, an attempt should be made to gain a great width of frontage.

SERIAL	TYPE	RATE OF MOVEMENT (mph) THROUGH DEPTH OF SNOW INCHES						REMARKS
		3"	6"	12"	18"	24"	30"	
1	Men on foot	2½	2	1½	1	immobile ^x		These figures are estimated in relation to one day's march.
2	Men on snowshoes	-	2½	2½	2½	2½	2½	
3	Men on skis	3	5	5	5	5	5	
4	Wheeled vehicles	15	10	5	immobile			
5	Animal drawn vehicles	3	2	1	immobile			Animals other than dogs and reindeer.
6	Tracked vehicles (carriers)	15	15	5	immobile			
7	Tanks	15	10	5	5	5	immobile	
8	Tractor trains	6	6	3	1	1	½	
9	Oversnow vehicles	15	15	15	15	15		

x Restricted infantry movement, confined to small parties, patrols, etc will be possible. Move of main bodies becomes impracticable.

NOTE This table is intended as a guide only. The figures represent average rates of movement.

SECTION XII

CAMOUFLAGE, CONCEALMENT AND DECEPTION

GENERAL

1. Northern operations, by their very nature, place added emphasis on the need for surprise in the attack and good camouflage and deception in defence. To this end, camouflage covers for clothing and sleds are issued, and are being designed for some of the larger equipments. To be of real value, however, all associated equipment, either worn or carried, must also be camouflaged; and intelligence must be used to make this camouflage conform to the background. In other words, white is not always right.
2. Generally speaking, concealment of a defensive position from enemy ground troops is not difficult to achieve with care and good discipline. On the other hand, concealment from the air is a most difficult matter because of the length of shadows in high latitudes and the tell-tale tracks that all movement creates. These are almost impossible to hide. However, these same tracks offer many ideal opportunities of presenting to the enemy false signs of strength and intention by the use of deceptive display. Maximum advantage must be taken of this.

WESTERN SUB-ARCTIC

3. In the Yukon and Alaska camouflage from ground observation is comparatively simple. The existing colour of Northern clothing and tentage combines well with white over-clothing to blend into the background. For the camouflage of vehicles, olive drab and white disruptive painting is suitable. An all-white camouflage paint may also be used because in bush country during static periods natural camouflage can be added.
4. Even though tracks can not be concealed entirely, strict track discipline is necessary about tent sites. During conventional ground operations, and provided adequate transport is available, use should be made of dummy tracks, dummy

vehicles and dummy tents to mislead the enemy both as regards one's strength and one's exact position. This applies even in summer, for vehicles tracks and well-used foot-paths, particularly in wet terrain, are usually visible from the air. This should be remembered despite the fact that they are little evident at ground level.

EASTERN ARCTIC AND SUB-ARCTIC

5. In barren areas the camouflage of tentage, clothing and equipment necessitates the use of all-white camouflage clothing. Snow-walls built around tents will materially help to hide them, as well as giving protection from the wind. However, time spent in doing this must be balanced against the need to construct defences as early as possible after the occupation of a position.

SECTION XIII

DEFENCE

GENERAL

1. The principle of all-round defence is fully applicable to Northern Operations. Attention to this principle becomes even more important because:

- (a) Troops are frequently required to operate in small, detached units and sub-units;
- (b) Arctic conditions tend to heighten the possibility of surprise and, to this extent at least, favour the attacker. (Even in the barrens, where visibility is generally good, wind and cold weather combined impair the alertness of sentries).

2. In Winter, troops are pre-occupied with the ordinary problems of survival, of living and moving in acute cold and windchill, of carrying out normal maintenance under special handicaps, and of more frequent reliefs for sentries. Mental and physiological reactions are seriously retarded. Moreover, the creation of defensive positions is complicated by frozen ground, sometimes alternating with unfrozen muskeg. All of these factors combine to render defence, either on the move or at rest, unusually difficult. Additionally, environmental clothing restricts vision and hearing. At night and in poor weather, therefore, less warning of enemy movement can be expected than is normal. In view of this, and of the time taken to get out of the sleeping bag and out of the shelter, it is for consideration whether the normal practice

should be to sleep by day and work by night. By this system, the defence would have the following advantages:

- (a) Retention of good all-round observation by day;
- (b) Less movement in the defensive position by day;
- (c) The position manned by night when less warning can be expected of an enemy advance.

3. The disadvantages of the system outlined in para 2 are:

- (a) Use of lights will be necessary;
- (b) Greater noise will probably be produced, and will carry further.

Much can be done to overcome these disadvantages by training.

4. Other general lessons are:

- (a) More frequent relief of sentries and provision of sentry shelters is necessary;
- (b) Concealment is difficult in snow-covered terrain. Conversely, more opportunities exist for deception in this terrain than in many other types;
- (c) The use of explosives in preparing defences will be increased;
- (d) Preparation of defences will require greatly increased effort in frozen ground. Ice-crete defences may be used satisfactorily where a position is being held for twenty-four hours or longer.
- (e) On the barren lands, a slight rise in the ground may become a tactical feature of importance. This may be an esker or, due to its better drainage, a lightly wooded area. In the lee of such features, drifts will form. Experience has shown that construction of a defensive position in snow on gravel eskers takes approximately the same number of man hours as in soft earth;
- (f) The main danger by day may well be from the air, requiring a

high degree of dispersion; whereas the main danger by night will be from ground troops infiltrating into the defensive locality. This can be overcome by occupying widely dispersed positions by day, providing the visibility is good, and withdrawing to a closed perimeter by night or in inclement daytime weather;

- (g) When holding ground in close contact with the enemy, it is considered that the present tentage offers a large target, even if dug in, and that it would soon be rendered unserviceable by enemy fire. In addition, the normal practice of changing to alternative positions when the situation demands becomes impracticable as it means abandoning tents and equipment so vital to existence under conditions of extreme cold. Tentage should therefore be regarded as an emergency means of shelter, only to be used on operations while constructing defences, snow caves or other improvised shelters. When these are completed, tents should be struck and packed away. In this way, tentage will be protected from damage and may be made available if it becomes necessary to reorganize on an alternative position;
- (h) Defences have generally to be built up rather than dug down, due to the frozen nature of the ground in Winter and, in Summer, due to the level of perma-frost which exists close to the surface and prevents adequate digging. Removal of sod in the immediate vicinity of the defences should be avoided as this serves merely to give the position away to enemy aircraft.

CONVENTIONAL GROUND OPERATIONS IN NORTHERN THEATRES

5. Operations along a single axis, such as the Northwest Highway System, must inevitably invite interruption in the form of flank attacks. These can readily be undertaken by relatively small hostile elements, using guerrilla tactics. Moreover, every well-frozen lake becomes a potential landing ground for enemy airborne troops. Additional patrols and other protective measures for line-of-communication installations may be necessary. Detached sub-units and installations along the line of communication must therefore adopt and maintain an all-round defence.

6. A large anti-aircraft component must be included in any force which operates along a single line of communication. Light anti-aircraft is of prime importance as low flying fighter bomber aircraft must be frequently engaged. Unit anti-aircraft resources must also be increased. Anti-aircraft protection can be provided only by

guns in situ since these attacks are swift and sudden and no time is available to get equipment into action.

7. Owing to the vulnerability of men sleeping in tents, a company is the smallest force which can make itself secure while affording troops the maximum rest. To maintain control, company localities will have to be small and compact (except on the barrens). Defence will therefore be based on company localities which should be mutually supporting. Ground and approaches between company localities will be covered by defensive fire of artillery, mortars and medium machine guns. Perimeter wire must be put out and fire lanes arranged.

8. As a guide, when in contact with the enemy, one-third of the company must be actually dressed and ready for action, either in their tents, on sentry, or on listening post duty. One-third will be dressed but with boots off and sleeping, and one-third will be off duty. The degree of readiness maintained is necessary owing to the delay incurred in getting dressed and turning-out in the cold and in the dark.

9. The best protection by day will often be adequate dispersion. One angledozer per company group is required to facilitate proper dispersion. The preparation of areas will take time (about two hours per company) and strict road and traffic discipline must be maintained until they are ready.

10. The alternation of wooded areas and expanses of lakes, muskeg and riverbeds, affords particular advantage to MMG defence. The location and destruction of such positions would be a major task for tanks.

11. Counter-attack has additional chances of success owing to the exposure of the enemy to cold during reorganization. This reduction of fighting power is caused by the need to bring up tents and perform other maintenance duties. Trails should be well broken in preparation for counter-attack tasks.

MSF OPERATIONS

12. Whilst a DZ is in use, adequate steps must be taken to defend it. Equally, the patrol base, once established, must be defended. This calls for special measures and cannot be left to chance or taken for granted simply on the basis that troops are occupying the areas and are working there.

13. The defence of a company group locality presents unusual difficulties. If the windchill is high, sentries can only remain alert for approximately 15 to 30 minutes. With such a turnover, everyone in the company group is up at least once each night.

With restricted fuel, men cannot get warm until breakfast. A roster system is essential. A tent group on duty can operate in any of three ways:

- (a) Complete tent group on duty at once. This is the coldest system;
- (b) Complete tent group, less one man to light stoves and keep tent shelter warm, on duty at once;
- (c) Tent groups operating in pairs, with one half on sentry duty, the other half resting. This is fatiguing and necessitates twice the number of tent groups being on duty.

The best system would appear to be (b). A defence platoon has been considered but rejected. The possible use of dogs has been considered and quiet sentry dogs may be an answer. Trip flares may also supply an answer but they freeze and cannot be easily moved. In freeze-up conditions, the alternate freezing and thawing of the ground tends to set off these trip flares.

14. The best solution for the setting up of a company group defensive position appears to be:

- (a) To select a site to take maximum advantage of the ground;
- (b) Whenever possible, to move by night and rest by day. However, this may not always be possible.

The situation must largely dictate the method to be used.

SECTION XIV

WITHDRAWAL

1. Withdrawal drills apply just as much in Northern operations as elsewhere. Certain points should be stressed. These are:

- (a) Reconnaissance parties should be increased in size by the addition of working parties for the preparation of defences and erection of tents;

- (b) Whenever possible, infantry and rearguard should be withdrawn by vehicle, as withdrawal on foot, even on skis, can be slow and very fatiguing;
- (c) The degree of delay which can be imposed by a comparatively small force will depend largely on the enemy's oversnow mobility and the possibility of flank movement;
- (d) Withdrawal will best be effected by night, when enemy reaction will be slowest. Trails should be broken from positions before withdrawal commences and may be booby-trapped as rear parties leave. Mines should be extensively employed.

SECTION XV

FIRE SUPPORT

GENERAL

1. The effectiveness of mortar and artillery fire is considerably reduced by the smothering effect of deep snow, depending to some extent on the hardness of the snow.
2. Little difficulty is experienced with small arms provided they are properly arcticized for northern winter operations. However, proper arcticization is of the utmost importance. Troops must be made to understand the importance of this measure and must be trained to carry it out properly. It is of primary importance for the correct functioning of the FN rifle.
3. Personal weapons should not be taken by troops into tents or shelters as the change in temperature causes condensation which freezes when weapons are taken into the cold again. Emergency weapons may be taken into tents provided the number is kept to a minimum and placed at ground level where it is coldest.
4. There is a general falling-off in range noticeable in all types of support weapons used during Northern winter operations. Some examples taken from past experience are given below:
 - (a) 3" mortars with sites set at 2800 yards fired approximately 1000 yards short with temperature at -20°F;

- (b) VICKERS medium machine guns developed a frequency of first-position stoppages until the coolant became sufficiently heated to produce normal fire. There also appeared a considerable loss of range at -20°F.

5. Weather changes in the Arctic can be frequent and rapid. If artillery is to give the same high standard of fire support that the infantry has come to expect, meteorological reports will be required more frequently than in temperate climates. Due to meteorological changes and inaccuracies of existing maps, predicted shoots in close support of infantry will seldom be possible. This must be realized by commanders and whenever possible registration of targets must be allowed.

CONVENTIONAL GROUND OPERATIONS IN NORTHERN THEATRES

6. As artillery support in sub-Arctic operations will probably be on a reduced scale, the value of any other form of fire support is increased. In bush country, such as is encountered in the Yukon, the limited field of vision and the need to reduce the number of men employed on protective duties reduces the size of the company area in defence. Ground between company areas must therefore be covered by fire. In this and other defensive fire tasks, the value of mortars is enhanced. The high angle of fire of this weapon makes it particularly valuable in close and mountainous country, where crest clearance is a problem. Mortars must be carried in oversnow vehicles to give them the required mobility.

7. Great difficulty is experienced in getting vehicles and guns into positions off the road. This is caused both by deep snow and rough, frozen ground. Often guns will have to be put into action on the road and then manhandled into position when an area has been cleared by bulldozers or work parties. The problem of crest clearance arises constantly, thus accentuating the requirement for a gun which can fire in the upper register.

8. Blowing gun pits with explosive has proved unsatisfactory. An alternative is to build up positions by making a wall of snow, then building a log wall on each side and packing more snow in between. To be effective, these must be from 6'0" to 8'0" thick. The estimated time of preparation is from 3 to 5 hours. A bulldozer is most useful in this task and reduces the time considerably.

MSF OPERATIONS

9. On past exercises, it has proved possible for at least some unit 81 mm mortars and MMGs to move with the units without imposing undue delay even though they carried with them their first-line scale of ammunition. Nonetheless, some type of

mechanical vehicle is required to move them any distance. The 4.2" mortar and first line ammunition is not capable of being moved without mechanical transport.

10. Battalion heavy weapons and also 4.2" mortars are capable of being air-dropped into their firing positions with an accuracy, after practice, of within 100 yards. Ammunition/mortar bombs must be dropped in the same pass as the weapons themselves.

11. Support weapon positions, whenever possible, must be sited so as to take advantage of the security offered by the infantry positions. Support weapon personnel must nonetheless be prepared to use their personal weapons to provide their own local protection.

12. Air support is of particular value in this type of operation, as it will seldom be possible to provide a heavy weight of ground fire support. Nevertheless, if a propitious moment arises for launching an assault it should not be delayed in order to await the arrival of air support which may be held up for a variety of reasons and for considerable lengths of time. Arrangements must be adequate, of course, for cancelling previously arranged strikes or re-directing them.

13. For exercise purposes, there must be two separate target areas, one for bombardment and one for ground assault, if the value of the air support provided is to be assessed. Safety factors preclude the merging of the two target areas.

SECTION XVI

TANK SUPPORT

1. In conventional ground operations in Northern theatres there is a definite place for tanks.

2. The reduced mobility of infantry, and the consequently prolonged period which must elapse between the cessation of artillery support and the arrival of the infantry on the objective, necessitates the much closer support that can be given by tanks in direct fire tasks. Use of the heavier tanks in support of infantry will give improved offensive power but depends upon the availability of a road line of communication. Experience has shown that tanks can be used over almost any type of terrain, and there are few places along the Alaska Highway where they could not be employed provided time was available for getting them into position.

3. Tanks are invaluable for the defence of airfields.

SECTION XVII

ENGINEER SUPPORT

GENERAL

1. In all operations conducted in undeveloped country, units must be prepared to carry out a large variety of minor engineer tasks themselves and to assist engineers when called upon to do so. This applies to operations conducted in Northern theatres.
2. Experience has shown that mines and booby-traps may be used extensively in conditions of snow and extreme cold, but that lifting mine-fields and booby-traps under these conditions becomes impossible. The extraction of igniters and detonators from mines and booby-traps cannot be performed and they should be destroyed in situ.
3. Under winter conditions lakes and wide waterways become suitable airfields for landing light aircraft and may well be suitable also for the landing of larger transport aircraft. In many cases no preparation at all is required, and provided the area is large enough the most that is required is the removal of heavy surface snow.
4. On the barren lands makeshift airstrips for Norseman and Otter type aircraft can be constructed almost anywhere. Larger Dakota aircraft can be landed in an emergency upon the many eskers and raised beaches which abound with a minimum of labour and very little plant.

CONVENTIONAL GROUND OPERATIONS IN NORTHERN THEATRES

5. The tactical employment of engineers will be modified only in so far as greater emphasis, under Northern conditions, is placed upon certain engineer tasks. As movement tends to become canalized along valleys and passes, and is largely restricted to roads and trails, great emphasis will be placed upon road construction and maintenance, fixed bridging, demolitions and the clearing of camp sites, parking spaces and overflow areas for traffic along the sides of roads. To deal with these and other tasks they may be called upon to do, engineer units should be provided increased plant and machinery rather than increased manpower.

6. Some of the major tasks engineers will have to undertake in winter are given below:

- (a) Reconnaissance and reinforcement of ice crossings;
- (b) Maintenance of the main supply routes, involving snow clearance, de-icing of the highways and the clearing of overflow areas and parking spaces along the sides of the supply routes when conditions make this necessary;
- (c) Preparation of airstrips on frozen lakes and rivers for aircraft for air OP, photography and air supply duties;
- (d) Construction and maintenance of roads, tracks and airfields (or airstrips) in snow-covered areas;
- (e) Preparation of warm bases and erection of temporary buildings for service troops, depots and like installations.

These tasks will be in addition to all normal tasks carried out in temperate theatres.

7. During the summer and autumn months the greatest workload will result from the break-up of roads and tracks. Almost continuous maintenance will be necessary. There will also be a heavy demand for bridging and rafting. Again the need will be for plant rather than manpower.

MSF OPERATIONS

8. Since engineer tasks will obviously vary in magnitude for each MSF type operation it is not practical to allot a definite quota of engineers to every operation. The RCE requirement should be decided by:

- (a) A close study of maps and photos of the area concerned to determine likely engineer tasks;
- (b) An engineer reconnaissance party consisting of an officer and one or two NCOs parachuting with the assault troops;
- (c) The extent to which unit personnel and pioneers can be provided to assist regular engineer troops.

SECTION XVIII

COMMUNICATIONS

GENERAL

Line Communications

1. Laying and maintaining lines in snow and bush-covered country demands an increase either in the number of line-laying detachments or in the strength of each. A normal line detachment cannot be expected to lay and maintain, in the snow, the same amount of cable as in more temperate climates. If the normal layout of line is required by units and formations in the North an increase in the number of linemen will be necessary.
2. Due to the difficulty of obtaining a suitable "ground", a "twisted pair" should be used. To simplify laying, the cable should be packed in coil dispensers.
3. Telephone set batteries must be kept warm to maintain their efficiency. However, telephone batteries G2HP Lithium Chloride, cold weather operate at any temperature between +80 and -40F, and likely to much lower temperatures. All types of batteries must be fresh and serviceable when issued.

Wireless Communications

4. Northern climatic conditions increase the difficulties of maintaining good wireless communications. Auroral blackout is a common occurrence in northern latitudes. Operators must be highly skilled and conscientious if good communications are to be established and kept in being. Constant and strict supervision is necessary if good results are to be achieved.
5. Only under certain conditions is the presence of ice crystals and blowing snow in the air a snow static problem. Very seldom is this caused by winds under 35 mph. When this occurs it may reduce the range of the set by as much as 75% of normal operating range.
6. Lead-acid batteries normally used with field type wireless sets do not function normally at temperatures below 0°F. Power to operate wireless sets in sub-zero weather may only be obtained by operating the charger almost continuously with the lead-acid battery serving as a voltage regulator. Lead-acid batteries will not charge when very cold nor will they supply sufficient power to be worthwhile when cold-soaked. This is a serious problem for any winter operation. Cold-soaked batteries

require up to 24 hours to warm up when placed in a temperature of +70F. It is seldom possible during an operation/exercise to provide shelter and this degree of warmth for the required length of time to thaw out batteries. Therefore, a supply of frozen lead-acid batteries is useless. Wireless sets can only be expected to operate satisfactorily if supplied with warm batteries, and then only for so long as the batteries are kept warm (subject to the limitations mentioned in paras 4 & 5 above).

7. Some comments on existing type sets follow:

- (a) WS C-29 - This set operates satisfactorily even under conditions of great cold if an efficient battery charger is provided and the batteries are kept warm. The set must be arcticized;
- (b) WS 62 - As for (a) above. It is not feasible to use the set man-packed, but it can be mounted together with its batteries and charging equipment on one two-man toboggan for winter use;
- (c) WS 31 - As for (a) above. The set can be man-packed or towed by toboggan;
- (d) WS 58 - This set is not suitable for use in the Arctic or sub-Arctic during winter;
- (e) WS 88 - Due to the great degree of dispersion often employed (eg, on the barrens) this set does not have sufficient range. For example, it is generally necessary to use a WS 31 to communicate from the 81 mm mortar OP to the base plate position;
- (f) WS C-52 - This set has proved very satisfactory provided heated accommodation is provided. Efficient battery charging arrangements are necessary. Used with aircraft radio compasses it operates as a homing device within 20-30 miles of the aircraft. However, during Exercise MUSK OX the WS C-52 provided the only radio homing signal for resupply aircraft on a frequency of 1740 Kcs which was consistently effective up to 200 miles range;
- (g) WS CPRC 26 - Has replaced the WS 88 for use between coys and pls. It has worked well and is suitable for this task.

8. New sets currently being developed or submitted to trial are:

- (a) Man pack sets - CPRC 510, to replace the 31 set. Now on user trial.
- (b) Long range sets - AN/GRC 501. Submitted to user trial and found satisfactory. Capable of air drop.
- AN/GRC 503. Not yet submitted to user trial. Not capable of being air dropped.

9. One hundred per cent replacement batteries should be provided for all “walkie-talkie” type wireless sets. The sets themselves should be left outside heated shelters, otherwise condensation will occur within the sets. This will result in freezing when they are again subjected to the cold, causing severe damage. Batteries must always be kept warm. Cold-soaked batteries lose most of their life and will not give reliable communications. Until a vest type battery is on general issue (development is in progress) batteries must be kept warm by carrying them under the parka.

10. Covers should be provided for microphones, otherwise condensation from the breath soon renders them useless.

11. Radio mechanics must be of a high calibre. They must be able to repair all types of sets in use and must be supplied with the necessary tools and a minimum of spare parts if they are to ensure satisfactory maintenance.

12. As in temperate climates, all signals communications for airborne assaults should be duplicated.

13. All oversnow vehicles should be equipped with wireless. Whenever possible the sets provided, or a proportion of them, should be capable of use as homing beacons for aircraft and should be fitted with direction finding loops for navigation.

MSF OPERATIONS

Planning and Preparation

14. For a Mobile Striking Force operation, signals personnel may well have to be provided in part from outside the Command concerned in order to supplement the signals staff at the Main and Advanced Bases. To ensure team-work from the commencement of the operation, and to ensure that operators are up to the required standard, personnel liable to be used should be:

- (a) Earmarked;
- (b) instructed in MSF procedures, and;
- (c) trained to the required technical standards.

Upon posting, their successors should be immediately briefed in their new MSF responsibilities.

15. It will probably be necessary early in the planning stage of an operation to parachute a regular wireless team into the Target Area to contact the local defence force and transmit such information as is available to orbiting aircraft. The need for communications between the local defence force already in the Target Area and the airborne MSF force has already been emphasized under the heading "Reconnaissance". Past experience has shown that reliance upon air reconnaissance alone is not likely to be sufficient. The assault force commander needs reports from the ground if he is to make a sound plan prior to leaving the Advanced Base. In particular, information from the local defence force will confirm the strength of the enemy lodgement. This is most essential in order to ensure either that adequate force is used against it or alternatively, that too much force is not wastefully expended against small parties of enemy.

Air to Ground Communications

16. When voice procedure is being used to communicate with aircraft, officers should use the set themselves. Care should be taken to use only such words, phrases and procedures as are known to both services.

Long Range Communications

17. In the past considerable delay has been encountered in passing traffic between the Assault, Advanced and Main Bases, and between Main Base (Montreal) and 1 Tactical Air Command. An examination of the causes of delay indicates that much of it could have been eliminated if officers originating messages had been previously briefed in the use of the various circuits available and in the correct use of priorities and message classifications. A review of a number of exercises reveals that delays are generally caused by:

- (a) [ionospheric] conditions (unavoidable); need for low frequency;
- (b) The necessity to protect traffic with security classifications requiring enciphering;
- (c) Umpire traffic, with "operations immediate" priority, being

handled by crypto staffs of the force being exercised instead of by separate staffs;

- (d) Circuits not being reclassified for exercises, eg, Teletype circuits might have been classified to handle up to “secret”, and low-frequency circuits to handle up to “restricted”;
- (e) Many messages being over-classified. Other messages could have been down-graded by re-wording;
- (f) Intelligence and Public Relations traffic containing considerable duplication in their content. Only new and pertinent information should be passed.

18. The use of prearranged code words, slidex cards and other similar expedients will reduce the use of cipher. It is unrealistic to try to pass the amount of cipher traffic made necessary by peace time long term security over the small airborne crypto system which is normal to MSF operations or exercises. The solution is to provide for MSF exercises a crypto system large enough to handle the abnormal exercise traffic with the same speed that a normal crypto system could handle normal MSF operational traffic.

Note. It is useless to use code words, etc, unless all likely recipients have been informed of their meaning.

19. Some other points to be remembered are:

- (a) Should a back-log develop in a communications centre, the signals officer responsible must immediately inform the senior officer at the base so that corrective action can be taken;
- (b) Air Despatch Letter Service should be used whenever possible;
- (c) Every effort must be made to reduce the volume of classified traffic, and priorities must not be assigned unless strictly necessary.

20. To overcome ionispheric conditions, development work must continue on a set capable of producing reliable communications.

SECTION XIX

MEDICAL

GENERAL

1. Extreme cold demands that casualty evacuation techniques be highly efficient and capable of [improvisation]. Special oversnow equipment and adequate personnel must be provided as well as arctic casualty bags. The emphasis must be placed on keeping the casualty warm and getting him to qualified medical aid as soon as possible. Air evacuation from advanced landing fields can be regarded as an essential link in the chain of evacuation. Medical authorities should be advised what percentage of casualties may be expected.
2. The training and indoctrination of troops from a medical point of view should stress the methods of preventing snow blindness, frostbite and trench foot. Special emphasis should be placed on maintaining a high standard of hygiene and sanitation. For troops undergoing winter training, personal hygiene, environmental sanitation and the proper use of clothing are most important. The summer phase of training requires a good knowledge of environmental sanitation and insect control measures. Apart from these hazards the health of the troops is in general as good as, or better than, in temperate climates. It is possible, however, that over long periods the incidence of respiratory diseases and foot casualties might be greater than normal since close living is enforced on all troops and because wet feet in Summer, and even immersion to the waist, will be a frequent occurrence.
3. Troops must be dentally inspected and treated at unit home station prior to taking part in Northern operations/exercises.
4. The ordinary morphine syrette can only be used if it is carried in a pocket next to the skin. Glass containers will not be broken by freezing provided that an air space of one-third the volume remains and that the glass is not too thin.

CONVENTIONAL GROUND OPERATIONS IN NORTHERN THEATRES

5. For long distances, aircraft provide the best means of casualty evacuation. Where it is not possible to provide a forward airfield capable of taking heavy aircraft, it may be necessary to use light aircraft of the Otter type from the assault area to the main airstrip, where casualties will be exchanged into transport aircraft. Eventually helicopters may play a large part in casualty evacuation.

6. Casualty Collecting posts may have to be established beyond wheeled transport road head. Several collecting posts or warm-up stations may be necessary along the line of evacuation.
7. Since narrow trails may well be the only means of access to the operational force, the Field Ambulance must be prepared to handle a large proportion of surgical cases and should be reinforced to enable it to do this.
8. The provision of shelters suitable for the temporary holding of casualties or urgent operations is necessary both at the Casualty Collecting Post and at the Advanced Dressing Station. The ten-man tent fulfills some of these needs. Tents, hospital, extending; marquees; or RCAF general-purpose shelters would be more suitable. Such tents will require HERMAN NELSON heaters.

MSF OPERATIONS

9. The current SOP lays down the scale of medical support to be provided and the general method of operation. Some of the main lessons learned on past exercises are contained in the following paragraphs.
10. It is recommended that Otter aircraft be used for Casualty evacuation. These aircraft should be based on or near the DZ and should evacuate casualties to the nearest airstrip or lake where a heavier type of aircraft could be used to carry out the evacuation to the Advanced Base. Fuel for the Otter aircraft should be included in the resupply or brought in by heavier evacuation aircraft. If the distance to the airstrip or lake is too great, refuelling points could be established at intervening points where Otters could stop and refuel en route. It is considered that evacuation of casualties should be speedy and immediate, not only for the morale factor, but also to free the assault force of this additional responsibility with the least possible delay.
11. For the evacuation of casualties by transport aircraft:
 - (a) Casualties should be tagged at the Medical Inspection Room for the tier in the aircraft they are to occupy, e.g., lower tier, middle tier and upper tier. The most serious casualties should be assigned to lower tier positions, as these are the first to be removed from the aircraft. Evacuation aircraft must be supplied with stretchers identical with those used by Airborne troops. This facilitates exchange on a one for one basis.

- (b) The army should be responsible for loading the patient into the door of the aircraft. The Army loaders should not enter the aircraft;
- (c) Each aircraft should carry a supply of casualty bags. Casualty bags can then be exchanged, the patient remaining in the bag in which he arrives at the aircraft;
- (d) Each aircraft should arrive prepared to lift its complete load of casualties.

12. The surgical team should jump as soon after the initial para assault as possible, i.e., with the immediate resupply. The bulk of equipment can remain packed at the Advanced Base ready to be called forward. However, in view of the uncertainty of weather and communications, it is considered that a better alternative is to have this equipment duplicated, one set to drop into the Assault Base and a resupply held at the Advanced Base to drop onto the battlefield if required.

13. The MO and Regimental Aid Post should be established within easy reach of the assault troops. The safety of the RAP must not be jeopardized by siting it too close to the actual assault. Nor must it be left undefended. Consideration should be given to providing communications both to Bn HQ and to the OTTER airstrip.

14. One or more light prime movers with good year-round cross country performance are urgently needed for the evacuation of casualties from their place of origin or RAP to the evacuation airstrip.

SECTION XX

TRANSPORT AIR SUPPORT

GENERAL

1. Transport air support will almost certainly be necessary for the successful conduct of any Northern operation, either in winter or summer. Poor road communications, the immense distances involved and the climatic hazards make this so. The existence of many lakes open to float-planes in summer and ski-equipped aircraft in winter gives added flexibility to transport air support in Northern theatres. For airdropping, no special ground facilities are required other than a suitable dropping zone.

2. Aircraft of the Otter and Norseman type fitted with skis can land almost anywhere in the barrens in winter. The construction of airstrips for larger aircraft on eskers requires little time and a minimum of plant.
3. The rapid evacuation of casualties is a major function of returning aircraft.
4. The development of the helicopter will place added emphasis on the value of transport air support and will make it feasible even for the support of small, detached bodies of ground troops. For instance, air support is often essential for the conduct of long range ground reconnaissance, and air evacuation the only means possible for patrol casualties.

MSF OPERATIONS

5. This type of operation relies entirely on transport air support, both for the mounting of the operation and for its resupply. Evacuation of the troops from the Assault Area is also by aircraft.
6. The MSF SOP sets out the drills to be adopted and the general method of conducting operations. Certain major points need to be stressed:
 - (a) Tactical loading of the aircraft carrying troops is essential from the outset to eliminate reloading at the Advanced Base, with the delays and additional fatigue to troops that this imposes. Additionally, it may well be necessary to seize short spells of good flying weather which might otherwise be lost while reloading is in progress when aircraft do not arrive at the Advanced Base tactically loaded;
 - (b) Briefings at the Advanced Base should be limited to acquainting the troops with their immediate part in the operation, and Assault Force commanders should be as free as possible of all other tasks in order to concentrate on the detailed planning of the assault;
 - (c) All company officers in airborne battalions should be trained in the duties of unit emplaning officers;
 - (d) The Norseman and Otter type aircraft are highly suitable for up to company scale operations for both aerial reconnaissance and supply, excluding supporting weapons. Only the helicopter would be more suitable. One that can stow casualties internally in winter would be excellent for casualty evacuation as well;

- (e) Resupply by air permits the full force to concentrate on the enemy. Porters need not necessarily return to the original DZ to collect rations and ammunition as this can be changed as required and as the operation progresses, providing the communications arrangements permit;
- (f) There is a need within units to work out a proper drill for the clearing of a DZ when supplies are being dropped. If troops are permitted to move on to the DZ before the drop is finished confusion will result and casualties occur from falling packages, particularly when free dropping is being carried out.

7. Since it may be necessary to mount an operation by night, transport aircrews must be proficient at night formation flying and night navigation.

8. Selection of the most suitable formation must be made jointly by the Army and Air Force Commanders. From the Army point of view the shape and size of the DZ will be a potent factor in influencing the decision.

9. Sufficient transport aircraft must be provided to ensure that the Assault Force of Battalion HQ, two company groups and essential supporting elements and re-supply can be tactically lifted at the same time. As stated elsewhere, this will entail the provision of stand-by aircraft in numbers greater than normal because of the higher than average unserviceability rate prevalent in the North in winter.

10. A proper plan, with stated priorities for airlift, must be made to ensure that the evacuation of the Assault Force at the conclusion of the operation is speedily and efficiently carried out. Such a plan is essential if the Transport Squadron Commander is to use his aircraft to the best advantage.

SECTION XXI

TACTICAL AIR SUPPORT

GENERAL

1. Tactical air support for Northern operations is just as essential as it is for operations in other theatres. However, it may well be necessary for ground troops to rely more on general air support than one time-coordinated close support, due to the uncertainty of the weather. Commanders should not postpone an attack in order to

await close air support if the time is right to put in the attack without it. Under these circumstances, they must be prepared to launch the attack with whatever ground support may be available, provided, of course, that reliable facilities exist to cancel the strikes already arranged.

MSF OPERATIONS

2. The MSF SOP lays down the general method of operation to be followed in conducting MSF operations. In brief, once word of a lodgement is received, immediate consultation with 1 Tac Air Command permits early joint examination of the problem, early joint selection of the Advanced Base and selection of the immediate course of action. This ensures that air strike action is brought to bear upon the target to neutralize it and keep it neutralized from the earliest possible moment. Also, visual and air photographic reconnaissance aircraft should get over the target as soon as possible. This immediate action could make the difference between the enemy failing or succeeding in his mission.

3. Carefully time-coordinated air and ground action only becomes necessary once troops have dropped into the area. It is then that close air support takes on such importance. This is so because the weight of supporting ground fire is always light on MSF operations, due to the lack of heavy support weapons. Without close air support, it is almost certain that a single company group could not overcome a well-entrenched enemy platoon. The decision to launch an attack without close air support should therefore be carefully weighed. It is only when conditions indicate that friendly forces have the ground potential to overcome the enemy that it becomes unwise to wait indefinitely for close air support when weather conditions do not permit it to be launched according to the pre-arranged timetable. When close air support is lacking, all possible use must be made of surprise.

SECTION XXII

LOGISTICS

Some figures arising from past exercises are given below:

- (a) A tractor train can supply an average load of 20 tons over 30 miles in 24 hours. When distances of 90 to 100 miles are involved, the net payload is 15 tons, 5 tons being consumed as domestic load;
- (b) For troops in action, it has been determined that an

airborne platoon group requires a minimum of 360 lbs resupply each day, and a company group requires 1900 lbs;

- (c) The number of days that an airborne reinforced company group can move unsupported is limited by the amount of rations and fuel which can be carried by the group. Normally, two days supply is carried. This can be increased to three days and, by operating on a reduced ration scale, a group can operate for a maximum of five days, provided no undue exertion is expected of them. In addition to the two days supply of food and fuel carried, the SOP makes provision for an immediate resupply of four days. However, this additional weight cannot reasonably be hauled and could not accompany a force required to make a long march.
- (d) It is considered that 45 lbs is the maximum load that can be carried by the individual soldier over diversified terrain. It has been noted during exercises that a marked drop in distance covered, rate of march, fitness to fight, and morale, develops whenever weights of over 45 lbs are carried.
Note. The severity of this load can only be appreciated by realizing that in addition to the load carried on his back the individual soldier in the North is also required to haul a sled and to wear bulky and cumbersome environmental clothing.

SECTION XXIII

ADMINISTRATION

GENERAL

1. The importance of sound and accurate administrative planning, in great detail, for all operations in the Arctic and Sub-Arctic regions cannot be over-stressed. During all seasons of the year severe limitations are placed upon the efficiency of all types of transport to the extent that adequate logistic support is difficult to achieve at the best. Sudden, unplanned, demands for increased support to meet unexpected situations are not likely to be met. In winter particularly, deficiencies arising out of poor planning and lack of foresight (or for any other reason) will probably be truly

disastrous. The mistakes of staff planners cannot be rectified by the troops in the field as is so often possible in less extreme climates.

2. To support Northern operations of any size a forward base will have to be established as close to the scene of operations as possible. This will be necessary as units will be unable to transport the scales of spare parts and equipment normally carried by them, and because increased demands for maintenance and repair services will be made upon service units. Moreover, the wastage rates of clothing and equipment will be abnormally high. Although much can be done by training and good discipline to reduce them, they cannot be brought down to the normal level of a temperate climate.

3. Provision should also be made for a forward rest area if operations are likely to be prolonged. Frequent relief from the strain of front-line soldiering must be provided, particularly in winter when little or no luxuries will be available for forward troops and when "housekeeping" duties take up whatever rest periods would normally be possible.

4. At all levels administrative supervision will be required in much greater detail than in temperate climates. Unit officers and NCOs must pay constant attention to the state of clothing and equipment, hygiene and sanitation, care of weapons, feeding, morale and other matters. Correctness and completeness in detail assumes a magnified importance, so that delegation of supervisory responsibility in these matters is less readily acceptable. Particular attention must be paid to the prevention of waste. This is essential not only from the logistical point of view as regards supplies of all natures, but from a health and morale point of view as regards food and water wastage. Arctic ration scales have been carefully drawn up to provide the nourishment required for the maintenance of health by men active in cold climates. Soldiers must be taught to eat all the food provided regardless of their personal tastes. Waste of food is not only a waste of logistic effort but is also an invitation to sickness. It will only be prevented by adequate supervision and good discipline.

MSF OPERATIONS

5. Accommodation at the Advanced Base should be allocated whenever possible by aircraft loads. This will enable personnel to be called for briefing or emplaning with a minimum of confusion and delay. For exercises only, friendly force officers should be quartered separately from press [representatives], air crews, observers and umpires. The activities of personnel not engaged in the operation (exercise) will in this way cause no interference to members of the Assault Force and will not interfere with their rest prior to take-off. In addition, the grouping of friendly force officers in one place will simplify calling them for briefings and O groups as necessary.

6. A study should be made of the practicability of preparing standard survival and personnel monorail aircraft loads. Insofar as is possible tent group loads should be interchangeable throughout the force. These common loads should be hung on the forward hooks in each aircraft leaving the rearward hooks available for special equipment loads such as mortars, signal and medical, etc. If this practice is followed the difficulties of exchanging special loads from one aircraft to another in the event of unserviceability will be kept to a minimum.

7. A drill must be established within each unit to check monorail loads daily in the aircraft whenever the weather is unsuitable for dropping for any length of time. If this is not done loads left unchecked may stretch their A7A containers, resulting in free fall when the opening shock of the cargo chute strikes the load.

APPENDIX "A": LIST OF NORTHERN EXERCISES CONDUCTED 1945-55

(See pp. xxvi-xxvii of this volume)

3. Defence Research Northern Laboratory (DRNL), Fort Churchill, Report No. 9/55, "The Human Factor in Arctic Operations," by M.F. Coffey (26 October 1955)

Defence Research and Development Canada

ABSTRACT

This paper was originally presented at the 6th DRB Symposium and has been revised for publication.

The small-scale winter operation is first discussed, then the human factor in Arctic operations and the problem of what keeps the soldier fighting in temperate theatres is considered and the opinions of a group of officers NCO's with combat service is introduced. In relating their opinions to the Arctic situation it is pointed out that the barriers and vectors which keep the soldier battle-worthy in most circumstances are weakened under Arctic conditions. Methods of strengthening these barriers are discussed.

The increased importance of leadership is analyzed, the maintenance of considered, certain aspects of indoctrination training, the decline of manual dexterity in the cold and improvements in Arctic clothing and equipment which have made this problem area less Important are discussed.

The large-scale operation is considered and possible problems peculiar to this form of Arctic operation are discussed.

THE HUMAN FACTOR IN ARCTIC OPERATIONS¹

1. INTRODUCTION

The purpose of paper is to survey recent research which has been carried out in the Canadian North at the Defence Research Northern Laboratory in connection with human performance on Arctic military operations, and to discuss methods which have been developed to improve human performance under conditions of severe cold and high windchill, for both small and large scale operations. The paper

¹ This was originally presented as a paper at the 6th DRB Symposium in Ottawa, December, 1954.

deals briefly with conditions under which small scale operations would probably be conducted, then considers some detail the problem of combat incentive in the Arctic theatre. It concludes with a brief survey of personnel problems related to morale, indoctrination training, manual dexterity, personal and tent group equipment, and finally personnel problems which may appear with the larger scale operation in the Arctic.

The material presented is based on survey of early Arctic exercises before 1951, as well as observations and data gained on nearly a dozen military winter exercises in the Eastern and Western Arctic by members of the Operational Research Section, DRNL, who lived and moved with the troops as part of the tactical group.

It is emphasized that none of the material presented is intended as a criticism of the officers and personnel of the Canadian Army with whom we have served in the Arctic. They have made a great contribution towards improving the Arctic SOP, and the lessons we have learned from their performances are invaluable.

2. THE CONDITIONS OF THE SMALL SCALE ARCTIC OPERATION

Troops participating on small scale military operations in the Arctic will move in quickly, probably by air, and on short notice. Air-borne personnel will experience, over and above the usual pre-jump stress, additional tension, the result of anticipation of a descent through a bitterly cold sky, into an unknown terrain. They will probably be over-concerned with the additional complications which might result from landing injuries, where simple concussion or broken limbs might indirectly result in death from exposure.

When the group lands and assembles it will find in the Eastern Arctic in winter, a flat, barren land, devoid of landmarks, whipped by winds and blowing snow, and characterized by low temperatures. There will be scant cover, few navigation aids, and existing maps will be of little use because of the sameness of the terrain. Storms will spring up quickly, obliterating trails formed as few as five minutes before, living, as well as fighting, will become a problem. In the Western Arctic there will be relief from high winds, but even colder temperatures will be encountered. The country will be contoured with slippery, difficult hills and movement will be dictated by the terrain to a much greater extent than in the east. Heavy woods clustered with deadfall will hamper mobility and freedom of movement. There will, however, be more adequate cover and more materials for natural protection.

For the present all supplies and equipment, once they are air-dropped, will have to be transported by human means. The added items for environmental protection

will also have to be carried by the man or hauled on toboggans. The mobility and the energy potential of the group will be affected by the load which must be moved, as the unit can travel no faster than the speed of the slowest toboggan.

3. THE PROBLEMS OF COMBAT INCENTIVE

(1) General

Probably the most important single personnel factor in infantry battle in any theatre of war is the amount of operational push; the quantity and strength of the combat incentive possessed by the personnel. This attitude which makes the soldier continue to fight in the battle situation and to face death time after time when, by permitting capture, deserting, assuming injury, or holding back, he may escape serious injury and death is a critical force in any battle.

We propose first to examine the incentives which keep a soldier fighting day after day, as they have been estimated in most theatres of war, and then see how they may be affected in Arctic winter warfare.

Table 1

Combat Incentives Infantry and Field Artillery Officers US Army	
Leadership and Discipline	19%
Solidarity with Group	15%
Sense of Duty and Self Respect	15%
Ending the Task	14%
Vindictiveness	12%
Self Preservation	9%
Thoughts of Home and Loved Ones	3%

Considerable research has been carried out by the US Army on this problem and Table 1 contains a breakdown of opinions of a large sample of US Infantry and Artillery Officers as to the incentives they felt kept men fighting in battle. This data was obtained from *The American Soldier: Combat and Its Aftermath, Volume II*.² The percent of the total responses for each incentive is indicated. From this table it will be

² S.A. Stouffer, Lumsdaine, A.A. , Lumsdaine, Williams, R. M. , et al. *Studies in Social Psychology in World War II. Vol. II. The American Soldiers: Combat and Its Aftermath*. Princeton University Press 1949.

seen that seven forces or areas of incentive comprise almost 90% of all the suggested ones, the remaining 10% being widely distributed.

Table 2

Combat Incentives Canadian Army Officers and NCO's Evaluation		
Leadership and Discipline	4.2	(19%)
Sense of Duty and Self Respect	4.2	(15%)
Solidarity with Group	3.6	(15%)
Confidence in Ability to Survive	2.9	
Feeling of Luck	2.9	
Self Preservation	2.9	(9%)
Ending the Task	2.4	(14%)
Love of Country	2.2	(3%)

Table 2 is a summary of the ratings given by a group of Canadian Officers and NCO's with considerable combat experience to the previously named incentives, along with a few others, which had been suggested in interviews with combat veterans. The figure in the first column represents the mean rating of the importance assigned on a zero to five scale. The second column supplies the corresponding percentage rating of the item as valued in Table 1. The lists are basically in agreement except that "feeling of luck" and "feeling of confidence in the ability to survive", which did not appear in the first table, have been rated as being of intermediate importance.

Accepting these incentives as being the most important, we proceed to examine them to see how they stand up in the Arctic theatre and suggest how they may be affected.

(2) Leadership and Discipline

Examining the first incentive, "Leadership and Discipline", an entire DRNL paper has been devoted to this area as it seems to emerge as the most critical personnel problem in Arctic operations. It was the finding, based on considerable data and experience, that leadership and discipline both seem to weaken in the Arctic. Much of this weakening is attributable to the natural instinct to neglect responsibilities, because of the cold and to relax discipline, because of the stressfulness of the situation. There would seem to be as well among North American troops, an attitude which we have called, "the honourable escape of the cold", which permits

"the cold" to be used as an excuse for shortcomings and failings and for "going a bit easier" in the troops. This attitude seems to be somehow centred on the belief that North Americans are not physiologically fitted for cold climates, and that while it is always a sign of weakness to give up in the face of enemy fire it is not a sign of weakness to give up to the cold.

Table 3

Attitude of Troops to Statement – “ARCTIC FIGHTING SHOULD BE DONE BY NATIVE TROOPS WHO ARE USED TO LIVING IN THE COLD, NOT BY US.”		
	Before Indoctrination	After Indoctrination
Agree	33%	35%
Disagree	67%	65%

Table 3 contains an attitude sample based on the acceptance by troops of the statement, “Arctic fighting should be done by native troops who are used to living in the cold, not by us”. The data is based on samples from five company groups, each sample comprising approximately 75 personnel who were polled in the first days of Arctic Indoctrination Exercises and again near the end of the exercises. The data was obtained in the field in a situation which guaranteed anonymity to the personnel.

It is evident that nearly one-third of the sample were firm in the idea that they should not be required to fight in the Arctic. It is noted that indoctrination training, which was quite adequate, did not improve the attitude.

There is even a greater danger that the “honourable escape” attitude will be encountered on the higher levels of command among the platoon commanders and more senior officers. These leaders are potentially more vulnerable as their actions will not be subject to as close a scrutiny as those of the man in the ranks. Further, their decisions will be greeted mainly with approval and positive acceptance if they assist in reducing discomfort and exposure at the cost of a weakening of discipline and tactical advantage. On the other hand, leaders face considerable group pressure if their commands and decisions increase discomfort.

(3) Duty and Self Respect

The second incentive, “sense of duty and self respect”, may also weaken in cold, and again mainly through the previously discussed “honourable escape of the cold”. Table 4 contains an attitude opinion of the same sample of troops on two Arctic winter indoctrination exercises. The statement, “I don’t give a damn if we win this scheme or not, just as long as we get the hell out of here”, referred to the standard situation

where the attack forces seek out and assault an enemy, where the performance is assessed by umpires, a situation in which considerable rivalry exists. The statement, which seems to reflect a lack of sense of duty and self respect, again has been accepted by nearly a third of the personnel, who similarly did not change their opinion after a period of training. How much of this is normal to any theatre was not determined, but the proportion seems high.

Table 4

Attitude of Troops to Statement – “I DON’T GIVE A DAMN IF WE WIN THIS SCHEME OR NOT, JUST AS LONG AS WE GET THE HELL OUT OF HERE”		
	Before Indoctrination	After Indoctrination
Agree	26%	34%
Disagree	74%	66%

Weakening of the incentive in this area will produce a variety of effects which are quite important. These include neglect of tactical considerations in favour of personal comfort, as well as deterioration of performance because personnel are not sufficiently motivated to suffer discomfort.

(4) Unit Esprit

Appraising the incentive based on unit esprit, the attitude which was reported in the previous sections has also an effect here, as has a general loss of unit support and a loss of regard for the unit leaders. Table 5 contains a breakdown of an attitude statement with respect to acceptance of the idea – “The people who are running this show don’t know any more about it than we do”.

Table 5

Attitude of Troops to Statement – “THE PEOPLE WHO ARE RUNNING THIS SHOW DON’T KNOW ANY MORE ABOUT IT THAN WE DO”		
	Before Indoctrination	After Indoctrination
Agree	14%	16%
Disagree	86%	84%

Approximately 15% of the sample, which was obtained under similar conditions as the previous ones, reflect lack of confidence in the leadership and lack of identification with the group purpose. Much of this weakening of unit feeling may be attribute to a tendency under Arctic operational conditions for the tent group to

become the “social-tactical” unit at the cost of identification with the platoon, company or battalion. A loyalty may develop within this group which can over-ride the common purpose of the larger formation. If morale is particularly bad the decisions and attitudes of the individual tent group, and the loyalty offered to its members, may be stronger than that given to the platoon or company, and if the tent group considers the idea of quitting or laying down on the job it may forget its duty to the platoon. This factor seems to be supported on exercises where “bad” tent groups seem to pop up and stand out in their lack of loyalty to the platoon or company and their lack of general combat incentive and their abnormally low morale. The formation of this “social-tactical” group is the result of the need for the unit to live, sleep and operate in small groups, with a minimum of opportunity for each group to contact the others because of the cold and the difficulty of holding group assemblies.

(5) Skill to Survive

The incentive, “confidence in skill to survive”, seems to be based on the feeling that by using God-given common sense and by being a bit smart, one will survive in battle and will not be killed or seriously injured. It is suggested that while this element of incentive holds in most theatres, where the enemy’s activity is the main challenge; in the Arctic the novice will quickly feel his inadequacy for meeting the many natural environmental challenges which occur. Under the terrific pressure to survive in the face of a second enemy, the beginner will feel quite insecure until he has mastered the skills and tricks of the trade which make up Arctic living.

Furthermore, in most theatres of action men are under heavy stress only while in direct enemy combat. This stress reduces quickly as soon as they move back to comparative safety. In the Arctic there is no let-up, no escape from the cold, which results in constant stress throughout the operation.

(6) Fatalism

The incentive based on the fatalistic, “it won’t get you unless your number is on it”, loses its value as soon as personnel feel the cold breath of the Arctic on their faces. Here, they decide, is a situation where one mistake can be fatal, where it is no longer a “wheel of fortune” chance affair. Usually personnel tend to over-rate the cold until they learn through experience and indoctrination training that things are not as bad as they first appeared.

(7) Self Preservation

The incentive based on self preservation tends in this case to operate against optimum combat performance, and the soldier will especially neglect the longer range tactical demands for the immediate term requirement of keeping comfortable and

warm. However, while under fire there is every hope that the effect of enemy action may re-orient the soldier's thinking, but performance on exercises would suggest that there will still be the tendency to neglect the tactical side of things when the enemy's presence is less obvious.

(8) Get It Over With

Undoubtedly the urge to get things over with will operate strongly in favour of good performance and it is suggested that this incentive is an excellent one to take advantage of when heavy demands have to be placed on troops in the Arctic situation. We have noted evidence of this incentive operating to advantage on a number of Canadian Army Arctic exercises, including Prairie Tundra I, Prairie Tundra II, Prairie Beaver and Exercise Hot Dog II, where troops were willing to extend themselves considerably for the sake of getting things wound up and over with.

(9) Love of Country

The final incentive, "love of country", is a difficult one to comment on. There is considerable difference of opinion among soldiers as to the extent this incentive operates, although personally we feel that it is stronger than most soldiers admit.

(10) Summary

In summary, incentives which might be considered as of importance in general combat have been examined. It is suggested that in the Arctic situation, these might possibly weaken, in that discipline, leadership, sense of duty and self respect will lose some of their effectiveness, especially in light of the "honourable escape of the cold" attitude.

Unit esprit may be affected similarly and as well by the appearance of a new social unit which may compete with the platoon or company for loyalty. Confidence in the skill to survive, and the incentive of luck, may also be weakened. Self preservation will tend to operate towards the neglect of the tactical side in favour of personal comfort. Of the incentives examined, it seems certain that only the desire to get things over with will be unaffected.

4. CORRECTIVE MEASURES

It is apparent that steps are necessary to strengthen these incentives in order to bring the general combat potential to its optimum level. A number of suggestions follow as to ways this might be done and at the same time areas worthy of further investigation are indicated.

(1) The Honourable Escape Concept

The first and perhaps the most important step which must be taken by both senior and junior leaders is to deal with the "honourable escape of the cold" attitude. It is suggested that this is probably the first point which should be impressed on troops - the fact that they are properly equipped to survive, that they are not being asked to do anything which will place their lives or limbs in jeopardy, as far as the cold is concerned, and that using the cold as an excuse for not getting the job done will not be tolerated. Leaders must recognize as well the fact that they must be continually on the alert for the same attitude shading their own performances. They must be reminded to keep pushing, not only the troops, but themselves.

(2) Leadership and Discipline

Considerations of importance in improving leadership and discipline include:

- (a) Instilling confidence in the men in the ability of their leaders to get them through safely.
- (b) Assuring the troops that they are not being led recklessly into a death by freezing and that leaders know what they are doing.
- (c) Selection and, if necessary, on-the-spot training of leaders to ensure that they are well indoctrinated, or at least better indoctrinated than, the men they lead.
- (d) Development of a feeling of pride in the personnel in the ability to put up with discomfort and meet the disciplinary demands cheerfully.

(3) The Sense of Duty

In dealing with the sense of duty and self respect incentive, correction of the original honourable escape concept will again help in changing the attitude of troops. Much emphasis should be placed on the idea that the Arctic situation is not too different from any other theatre and the cold, as stressful as it may first appear, can be licked by anyone who tries. The dangers of the cold should be played down, for the tendency seems always towards extreme over-cautiousness rather than recklessness. It must be impressed on troops that the thing to do is to get the job over with and that there will not be any weakening of tactical performance permitted. Here again, in this area, the value of leaders who understand the limits of cold operations will be of great help in that they can set the demands at a sufficiently high, yet safe, level.

(4) Unit Esprit

Dealing with the problem of unit esprit every effort should be made for greater communication between the leaders and the troops. Commencing from the Commander's "O" group down, "O" group members should be giving instructions to the ranks, commenting on the performance of the unit and accentuating the fact that the unit is working together and liking the situation. Larger size tent groups up to the 10-man, even though they may result in increases in bickering and arguing,³ will tend to help break down the isolated social unit. In the Arctic situation, probably more than any other theatre, it will be profitable for the already over-loaded commander to drop in on "O" groups of platoon level with a word or two to be passed on by the corporals to the men. Such morale-raising practices as shaving, as long as it does not work for a fuel hardship, can be used to build up unit esprit and self respect, especially if the order is prefaced by a statement such as "Able Company X Regiment, shaves regardless of where it goes, and it's not going to be any different here".

(5) Fatalism and Skill to Survive

The extent to which loss of incentive, based on the feeling of skill to survive and the element of luck, can be recovered will depend on the ability of the unit to provide training. Once personnel master the basic skills required to get by comfortably and begin to regain confidence in the ability to survive, personal concern tends to diminish and troops begin to think again in terms of the tactical enemy, rather than of the environmental nuisance, the cold. The ratio of indoctrinated troops to unindoctrinated ones will, of course, play a big part in shaping this attitude. When the unit arrives in the Arctic, section commanders should be told to ensure that full advantage is taken of the indoctrinated personnel in each section. They should see that the indoctrinated pass on to the unindoctrinated as many of the skills as they can before the actual combat situation commences. The ability of a unit in the Arctic to carry out pre-combat indoctrination training will be a big factor in increasing these two areas of incentive. The aspect of self confidence should be stressed in this training.

(6) Self Preservation

With respect to the incentive based on self preservation, it is the opinion of the author that the main problem lies in such tactical conduct as occurs when actual close hand combat is not in progress. Here again the eternal fight against the honourable

³ M.F. Coffey and D.I. Ross, *A Survey of Items of Canadian Army Personal and Tent Group Equipment for Arctic Winter Use*. DRNL Technical Memorandum No, 1/55. Defence Research Board, Canada.

escape must be waged, and by good leadership, constant pushing, leading and encouraging, personnel will eventually concern themselves less and less with the cold.

The reserve burst of effort which can be obtained through raising the "let's get it over with" idea should not be overlooked, for it has already been demonstrated to be an extremely valuable incentive on exercises.

5. MORALE

Considering the problem of morale, we can conclude from the previous discussion that it is of great importance in the Arctic operation, not only because of the basic need in any military situation for good morale but also because, in the cold, morale seems to affect the soldier's performance both psychologically and physiologically. To deal adequately with the problem of morale and leadership requires a full paper in itself. Skimming briefly, a number of points might be raised which will be of help to commanders on the Arctic operation.

- (1) Try to sell troops the idea that the cold is not too bad or too dangerous, reminding them that they have good equipment and clothing and that their tents will provide adequate shelter in the coldest weather.
- (2) Impress on personnel that they have leaders who know what they are doing, leaders who will see them through and make sure that nothing happens to them as far as the cold is concerned.
- (3) Emphasize the fact that with common sense if personnel are reasonably careful and keep their wits about them they will get by comfortably.
- (4) Keep troops moving and doing something. Keep after the men, especially when they are just adjusting to the cold. Keep telling them what to do and how to do it.
- (5) Keep on the "tails" of the men. Keep checking, correcting and directing, and in a pleasant way.
- (6) Supply more than the usual amount of encouragement and praise.
- (7) Keep a firm grip on the men and make sure that orders are obeyed. Let them get the feel that there is efficient, tight leadership.
- (8) Keep troops well informed on what is happening; if possible, where they are going and of how far the move will be. People, especially in

the cold, seem to fear what is going to happen, rather than what is happening.

- (9) See as much of the men as you can. Tent visiting is difficult, but a short visit and few words will pay dividends.
- (10) Make sure that your NCO's keep you well informed on the state of morale. They seem to be fairly good at estimating it, and their information will help you find out when more morale boosting is needed.

6. INDOCTRINATION TRAINING

Indoctrination training has value in increasing not only the professional ability, but also the confidence of the soldier. From the personnel point of view, the aim of the indoctrination programmes should be to make the man proficient first in the basic cold skills and thus increase his confidence in his ability to live comfortably so that he reaches a point where the tactical performance is his main concern. Again the need for well indoctrinated NCO's is emphasized and the goal for every unit should be to have the NCO's trained to a point where there is no doubt as to their superiority to the soldier in the ranks in terms of Arctic skills. If a lower standard for NCO's is permitted, a decline in leadership acceptance by the private soldier may result, when the man discovers his NCO cannot cope with the Arctic survival problems any better than he himself is able to, and cannot offer direction.

7. MANUAL DEXTERITY IN THE COLD

In the area of manual dexterity, present improvements in critical areas have reduced the problem for the time being, as far as the infantry operation is concerned. With the development of such items as trigger mechanisms and magazines which can be filled while wearing mitts, there are fewer critical problems. Such devices as spouts for petrol cans which fit into stove fronts, simplified toboggan covers which minimize the lashing problem, improved ski and snowshoe harness and improved Arctic mitts seem to suggest that more of the manual dexterity problems will be solved by modifications to equipment, rather than by methods which produce physiological or physical changes in the hands themselves. Some manual dexterity difficulties will still be encountered by mortar crews when mitt fur-ruffs and mitts and gloves jam the bomb in the muzzle of the weapon, and crews should be well trained for immediate action for such an emergency. Some difficulty will also be experienced in the priming of mortar bombs as well as the arming of rocket bombs, but slight modifications will probably clear up the situation.

In manual dexterity generally, considerable improvement will be obtained by:

- (1) Encouraging personnel to perform bare handed as long as they can to a point of discomfort.
- (2) Training personnel in planning and laying out the task so that bare hand performance is at a minimum.
- (3) Teaching hand warming methods such as belly-genital warming, so that the fear of getting the hands so cold that warming up is impossible is eliminated.

8. EQUIPMENT AND PERSONNEL

Dealing with personal and tent group equipment, it is the expressed opinion of the majority of troops as well as the officers and scientists who have been concerned with the problem, that the Canadian Army Arctic equipment is, to quite an extent, satisfactory, and will carry a soldier comfortably through an Arctic operation. There are a few items which must be improved, extra weight may be saved, and more battle protection may be provided, but the initial task of turning out at least adequate equipment has been mastered, and time may now be spent on careful improvements.

Very often, however, personnel fail to make proper use of items and suffer. Table 6 contains an example of what can happen when fitting instructions are disregarded and mukluks are improperly sized.

Table 6

Mukluk Fitting and Sore Feet	
Total Reported 31%	
Incidence of Sore Feet By Sizing	
Correctly Sized Group	22%
One Size Too Large Group	35%
Two Sizes Too Large Group	83%

In a survey of over one hundred troops who had completed a seventy mile march over difficult terrain a total of 31% indicated that at some time they had had sore feet. In examining the sizing of the mukluks in the group it was noted that in 98% of the cases they were either the correct size, one size too large or two sizes too large. Of the correctly fitted group 22% reported sore feet, in the one size too large 35 % had foot trouble, while in the group who wore two sizes too large 83% were afflicted. In other words, if men wear mukluks two sizes too large a high proportion, perhaps

eight out of ten, will have sore feet. Care must be taken in making sure that troops understand sizing, correct wear and use of items.

Attention will also have to be paid to vapor barrier boots (boots, rubber, insulated), which make the feet very wet and are disliked for psychological reasons. There will be a need for instruction in the stringing, doffing and donning of mitts in the attachment of snowshoes, the proper handling of pressure cookers. Also it is possible personnel may be affected by stove fumes and precautions should be taken to control this problem.

Difficulty is anticipated as well in connection with the safety of the sleeping bag. This complaint has been particularly noticeable since regiments returned from Korea where two incidents seem to have built up a fear of being trapped and burned in the sleeping bag.⁴ During the past winter, troops from all three MSF battalions expressed concern about the ease of escape from sleeping bags currently used, especially a mummy type bag known as the X-51.

Table 7

Opinions on Ease of Escape From Sleeping Bags		
OPINION	MODEL X-49	MODEL X-51
Can Escape Easily	45%	17%
Takes Some Time	45%	65%
Takes Long Time	10%	18%

Table 7 contains the results of opinions of 250 troops obtained during three Arctic exercises on the ease of escape from two types of sleeping bags. The results seem to suggest the majority felt that the X-49 zipper bag was easier to escape from than the X-51. The results are well supported by written opinions which troops also supplied. Field tests⁵ seem to indicate that there is little if any difference in escape times from the two bags. It would appear that troops formed an opinion without ever attempting to see how easy escape was, probably because of the difficulty of practicing fast escape on arising because of the danger of stepping in the breakfast.

⁴ M.F. Coffey and D.I. Ross, *A Survey of Items of Canadian Army Personal and Tent Group Equipment for Arctic Winter Use*. DRNL Technical Memorandum No, 1/55. Defence Research Board, Canada.

⁵ Coffey and, *Survey of Items of Canadian Army Personal and Tent Group Equipment*.

This then seems to be a problem area which should be cleared up by means of training. The value in removing the fear of the sleeping bag as a death trap, as well as providing a drill for escape should an emergency arise, is obvious.

9. THE LARGE SCALE OPERATION

Applying lessons learned from the small scale one or two company operation to a larger Arctic operation seems fairly acceptable. It would appear, in addition, that the probable appearance of vehicles will present further problems in manual dexterity, and the cold will complicate the operation of heavy ordnance pieces and tracked armored vehicles. The possible use of light-weight, electrically heated suits appears as a possibility as well as the use of electrically heated gloves to be used around equipment with electrical power supply.

Improvement in comforts and amenities for some personnel are seen but it would appear that for front line troops the problems encountered in the small scale type of operation will remain basically the same.

Regardless of the comforts which may be from time to time available, the same basic concepts of combatting the cold, whether they apply to getting a job done behind the lines or during fighting, appear to hold.

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Lessons in Arctic Operations: The Canadian Army Experience, 1945-1956

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DCASS Number 7, 2016



ISSN 2368-4569

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