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EXERCISE MUSK OX: LOST OPPORTUNITIES

by

Kevin Mendel Thrasher, B.A.

A thesis submitted to the Faculty of Graduate Studies
in partial fulfilment of the requirements for the degree of
Master of Arts

Department of History
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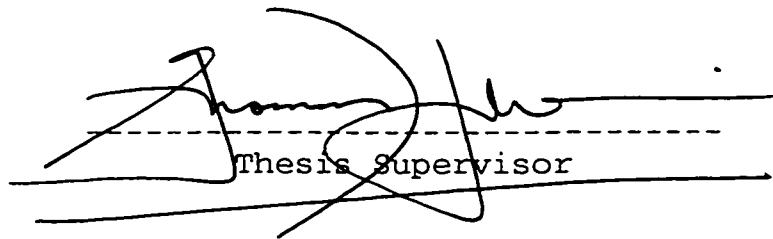
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Abstract

This thesis examines, in detail, the Canadian Army Winter Exercise Musk Ox which travelled across nearly the entire Canadian Arctic in 1946. Musk Ox marked the first attempt at crossing the northern latitudes by vehicle, and was designed as a non-tactical exercise to test the soundness of military equipment and its application to peace time pursuits. While the peaceful exploration of the Arctic was an admirable goal, Musk Ox was not the proper vehicle to promote it. The scientific and military (and indeed political) potential of the exercise was not fully exploited and in the end, Musk Ox yielded only limited results.

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Introduction

On February 15, 1946, a group of 45 men set out in 12 vehicles from Churchill, Manitoba heading northwest into the Arctic. This Canadian Army endeavour, "Musk Ox", was a non-tactical exercise, developed to test the maintenance and the mobility of a small moving force travelling across almost the entire Canadian Arctic. Musk Ox stretched for over 3000 miles, most of which was travelled in modified versions of an armoured snow vehicle. Because most of the journey was through remote frozen desert, the operation relied exclusively on air support, the Royal Canadian Air Force (RCAF) spinning a supply web over the vast Canadian north. In the experimental and cooperative spirit of the exercise, scientists and military observers from the United States and Britain were invited to accompany the expedition. The expedition arrived in Edmonton on May 6, completing the first mechanized crossing of the Canadian barren lands and the most extensive northern mission ever undertaken by the Army.

Canada's military interest in the north began four years before Musk Ox. Canada and the United States initiated programs to develop cold weather equipment following a request by Britain in 1942 to assess the potential for a limited allied invasion of Norway. The British military had been exploring the possibility of military operations in Norway as a diversionary tactic to draw German attention away from a main allied force landing in Normandy.¹ The operation was code named "Plough". Britain could not afford to devote precious resources to create the specialized cold weather equipment that would be needed to operate in Norway. The National Research Council (NRC) helped to develop an amphibious over-snow vehicle

¹ Interview with Graham Rowley in Ottawa, August 19, 1996.

in co-operation with the American Army, known as the M-29 or "Weasel".² Canada also produced its own specialized vehicle for Arctic operations, the "Penguin" which was developed for the Army in conjunction with Armand Bombardier, the inventor of the Ski Doo. Drawing on the expertise of several Arctic experts, the Canadian Army came to the conclusion that military operations in extreme northern climates placed inordinate demands on resources and that any operation in Norway would not be feasible without a huge logistical reorientation by the allies. The Canadian experts thus recommended to the British that there could be no limited Norway engagement, and Britain quashed the idea.³ Canada's military, on the other hand, was not yet through with the Arctic.

Despite the end of Plough, the military continued to carve out a niche in the realm of cold weather expertise.⁴ The extensive cold-weather testing of equipment in 1942-43 was expanded the following year and carried out in a variety of locations by all branches of the services. By 1944-45, Canada had developed a solid repertoire of equipment and experience to meet the vigorous demands of the north, but much of that knowledge had not been tested in field manoeuvres. The next step was to design exercises that would join soldiers with the specialized technology and test them in an uncontrolled environment. In the winter of 1944-45, three military exercises, "Eskimo", "Polar Bear" and "Lemming", were planned and executed in the north. Each endeavour was designed to test a unique aspect of the Canadian

² D His DND, 81/758, Kenneth Charles Eyre, "Custos Borealis: The Military in the Canadian North", Ph.D. Thesis, The University of London, King's College, Department of War Studies, 1981, 151.

³ Interview with Graham Rowley in Ottawa, August 19, 1996.

⁴ D His DND, 81/758, Kenneth Charles Eyre, "Custos Borealis: The Military in the Canadian North", Ph.D. Thesis, The University of London, King's College, Department of War Studies, 1981, 151.

north and how men and equipment responded to it. These exercises were executed to advance the Army's cold weather operational knowledge. The first of these exercises was Eskimo.

Eskimo set out to explore the effect of winter dry-cold on men and equipment.⁵ The manoeuvre was carried out in the sub-Arctic latitudes of northern Saskatchewan where relative humidity during the winter months remains very low. Eskimo was developed under a research program of the General Staff of the Canadian Army, and was primarily a tactical manoeuvre executed in the mid-winter months between January and February. Starting from the railhead at Prince Albert, a skeleton brigade-sized force of some 2000 men advanced northward 183 miles. Eskimo Force then withdrew along the same path.⁶

The men marched through bush-covered rolling hills and across the many lakes and muskegs of northern Saskatchewan in temperatures that ranged from a low of minus 48°F to a very mild, plus 38°F.⁷ In addition to the ground force, an air support unit was provided by the RCAF. Observers from the United States and the United Kingdom accompanied Eskimo Force on their brief sortie and their observations were included in a final report, a collaborative effort between the Canadian Army and the RCAF.⁸ National Defence published the Exercise Eskimo report in September 1945. A portion of the analysis from this first

⁵ D His DND , 746.013 (D2) Ex "Eskimo" - 1944-45, "Exercise Eskimo: Dry Cold", a report issued by General Staff, Department of National Defence, September 1, 1945, iii.

⁶ Ibid.

⁷ J. Tuzo Wilson, "Winter Manoeuvres in Canada", Canadian Geographical Journal , Vol. XXXII, No. 2, (February 1946): 95.

⁸ D His DND , 746.013 (D2) Ex "Eskimo" - 1944-45, "Exercise Eskimo: Dry Cold", a report issued by General Staff, Department of National Defence, September 1, 1945, iii.

exercise foreshadowed the direction of the succeeding exercises:

Possibly the most important lesson of this Exercise is the close relation which defence research in the Canadian Arctic and Sub-Arctic bears to economic development of these same northern regions. . . .

The rapid economic development which the USSR has attained in north-eastern Siberia (north of the 56th parallel and east of Lake Baikal) where population is reported to have increased from, during the period 1929 to 1944, from 40,000 to 250,000, illustrates what can be achieved in northern Canada. . . .⁹

The second exercise, Polar Bear, set out to test military tactics and equipment in the alternate extreme of the Northern Saskatchewan climate. In the wet-cold along the northwest coast of British Columbia, 1,154 men set out in February 1945 on a 55 day trek of some 626 miles through the Coast Range Mountains between Williams Lake and Bella Coola.¹⁰ Polar Bear, like its predecessor, was another tactical manoeuvre which ". . . made possible the study of a number of problems associated with winter operations of a force of all arms in rugged forest terrain."¹¹

There were some similarities between Eskimo and Polar Bear. Elements from the RCAF supported the ground force by air supply. Observers from Great Britain and the United States accompanied the moving force and contributed to the final report. However, conditions during the test ranged more widely than in Eskimo, with temperatures reaching a low of minus 31°F and a balmy high of plus 54°F and the terrain climbed from rolling

⁹ Ibid., xix.

¹⁰ Wilson, Canadian Geographical Journal, Vol. XXXII, No.2, (February 1946): 95.

¹¹ D His DND, 746.083 (D20) CAORG Rept 28- "Polar Bear"- d/15 Jul 45," Exercise Polar Bear: CAORG Report No. 28", a report issued by Canadian Army Operational Research Group (CAORG), July 15, 1945, Introduction.

plateau to rugged mountain sides.¹² Furthermore, unlike the previous manoeuvre, Polar Bear was sponsored by an organization known as CAORG, the Canadian Army Operational Research Group.

Modern "operational research" refers to the study of the general effectiveness of all aspects of a particular operation. The term was first coined in 1939 by the Royal Air Force for their Stanmore Operational Research Section, a group focussed on fighter aircraft research.¹³ It was not until 1944 that the Canadian Army established its own "Directorate of Operational Research" at military headquarters in Ottawa. This Directorate created and oversaw the operation of CAORG, whose primary function was to conduct field work and tackle specific scientific problems as they related to the military. CAORG was a predecessor of the Defence Research Board, established after the war in 1947.¹⁴ The Canadian Army Operational Research Group was the parent of three of the original four northern exercises: Polar Bear, Lemming and Musk Ox.

The man selected to be Director of Operational Research for CAORG was Colonel John Tuzo Wilson. Wilson was a geophysicist but "on account of a man called Hitler..." a soldier.¹⁵ Despite his scientific orientation, Wilson was also well regarded for his abilities

¹² Ibid., 1.

¹³ D His DND, R71/104 DHD312-9.10.96 formerly 952.013(D138), J. W. Mayne, "History of the Canadian Army Operational Research Establishment," Defence Research Analysis Establishment Report, (Ottawa: Department of National Defence, April 1970), 1.

¹⁴ D His DND, 82/34, A10-51(4) 1972, A.M. Pennie, "Defence Research Board, The First Twenty-Five Years", (Ottawa: Department of National Defence, November 1972), 1.

¹⁵ Patrick Baird, "Musk Ox Retold", North, Vol. XXV, No. 5, (September/October 1978): 25.

as a leader and was respected by his military peers as well as his subordinates.¹⁶ He served 4 years as an Army Engineer overseas before being recalled to direct CAORG. The Arctic had long been an area that interested Wilson and he was a founding member of the Arctic Institute of North America (AINU).¹⁷

The Arctic Institute was the brainchild of Raleigh Parkin, a Montreal businessman and staunch Canadian nationalist. In the spring of 1944, a group of Parkin's colleagues met in Ottawa to discuss plans for the future development of the Arctic and the creation of a body devoted to overcoming government and public neglect of the North (Wilson was not part of the initial planning sessions).¹⁸ The group outlined its basic objectives at one of its early meetings:

For some years to come in Canada it will be necessary to stimulate popular interest in the North, and to focus the attentions of government and other agencies on administrative as well as scientific problems. . . .¹⁹

When the Canadian Armed Forces initiated the cold weather equipment program in late 1942 and early 1943, preparations for all aspects of war were essential. After 1944, when it became clear that there would be no need for specialized cold weather equipment for the war in Europe, the Army nevertheless, continued to develop equipment and tactical skills for defending and exploring the north. Polar Bear followed Eskimo and mirrors its tactical

¹⁶ D His DND, 112.3M1009 (D84), US Observers Report on EX "Musk-Ox" 1945/46, 5.

¹⁷ Ibid.

¹⁸ Raleigh Parkin, "The Origin of the Institute", Arctic, Vol. 19, No. 1, (March 1966):13-15.

¹⁹ Shelagh D. Grant, Sovereignty or Security?: Government Policy in the Canadian North, 1936-1950 (Vancouver: UBC Press 1988), 139, quotes minutes from a preliminary meeting in Ottawa, NAC, AINU Records, MG 28 179, vol. 1, file "Organization-Meeting 31 March 1944."

orientation, but also marks the birth of CAORG and the introduction of J. Tuzo Wilson to Army operational research design. Wilson's arrival at CAORG signalled a new direction in operational research and his philosophies regarding the north mirrored those of the AINU. In reading the final report for Polar Bear, it is obvious that CAORG took a more scientific approach to military research than had the designers of Eskimo. This perspective was to dictate the design and execution of the next exercise, Lemming.

Lemming took its name from the diminutive Arctic rodent, reflecting the reduced scale of the manoeuvre. Only 13 men formed the moving force in Lemming. Travelling in six vehicles, and pulling their own petrol and supplies, the men left Churchill, Manitoba, on March 22 and journeyed to Padlei, Northwest Territories, in 10 days, covering a distance of 653 miles.²⁰ There were three different types of vehicles deployed in Lemming: the Canadian Penguin, the American-Canadian designed Weasel (M-29), and the American Army's Half-track (M-7). All of the test vehicles were capable of carrying only a limited amount of supplies even with specially designed trailers they would drag along. The Army had already learned that winter exercises required enormous amounts of supplies. Without air support, Lemming's success depended on speed and had to be completed before the limited supplies that they were able to carry on the vehicles and trailers ran out.

Lemming was the first extensive exercise carried out by the Canadian Army entirely in the far north and sought to extend the Army's winter operational doctrine beyond its previous sub-Arctic limits. Among its goals were to test various over-snow vehicles and

²⁰ D His DND , 746.083 Cold Weather Trials and Exercises, "Exercise Lemming: CAORG Report No. 25", a report issued by Canadian Operational Research Group (CAORG), May 24, 1945, i.

explore the barren lands for potential sites for future exercises. Beyond these practical features, Lemming also marked a decided shift in focus for military research. The final report listed the exercise's first goal:

1. (a) To obtain information of a **non-tactical** [writer's emphasis] nature by which to extend Canadian Army winter doctrine from sub-Arctic conditions. . . .²¹

Lemming ground force was led by Lieutenant Colonel Patrick D. Baird (then Major), a noted Arctic explorer who had spent six years there before war, three with the British Canadian Arctic Expedition, 1936-39.²² During the war, Baird had served as a Troop commander in a special commando unit. Baird was an acquaintance of Wilson's before the exercise. As in the two preceding operations, there was an external observer component but in the case of Lemming, there was only one observer from the United States and none from Britain.²³ Additional scientific expertise was provided on the trek by two observers loaned from the Departments of Munitions and Supply and Mines and Resources.

While on their mission, the men of Lemming conducted research on various aspects of the Arctic environment, from describing topography and sea ice, to experimenting on the effects of wind-chill. Temperatures encountered were less extreme than in the previous exercises and stayed between minus 25°F and plus 35°F.²⁴ The final report explained the

²¹ Ibid., 1.

²² Dr. J.T. Wilson, O.B.E., "Exercise Musk-Ox, 1946", The Polar Record, Vol.5, Nos. 33,34, (December 1947): 15.

²³ Ibid., 17.

²⁴ D His DND, 746.083 Cold Weather Trials and Exercises," Exercise Lemming: CAORG Report No. 25", a report issued by Canadian Operational Research Group (CAORG), May 24, 1945, 12.

scientific information that was obtained on the exercise in terms of its possible military applications.²⁵ The emphasis on military aspects, however, was drastically reduced in comparison to both Eskimo and Polar Bear. Lemming rounded out CAORG's involvement in the north for that year. Wilson forged ahead with the planning and implementation of an additional non-tactical exercise for the winter of the following year, Exercise Musk Ox.

Musk Ox was the culmination of the three earlier exercises in 1945-46. Following Eskimo and Polar Bear, the design of the two succeeding exercises steered away from tactical research and began to look at broader aspects of military involvement in the Arctic. As early as Polar Bear, however, when the war was drawing to a close in Europe, there were clear indications that Wilson believed the Canadian Army could play a greater role in the future of the Arctic beyond simply testing men and materiel there. In an article for the Canadian Geographic Journal in February 1946, Wilson explained why he thought Musk Ox was needed: "Whether or not it is completely fulfilled, it will direct the attention of Canadians to the North they neglect, to the possibilities of opening it, and to the part the services can play in its exploration."²⁶ This statement is nearly identical to the mission statement of the AINA. Polar Bear, Lemming and Musk Ox were designed by Wilson. Together with a few like-minded friends, Wilson had set out as director of CAORG to test the potential of the Arctic and to direct national attention towards Canada's last unexplored frontier.

²⁵ Ibid., 24-5.

²⁶ Wilson, Canadian Geographical Journal, Vol. XXXII, No. 2.,(February 1946): 99.

The Americans too were interested in the Canadian North and Musk Ox.²⁷ They sent six observers to participate on the journey and published their own report following the manoeuvre. As observers, the team from the United States was not included in the preliminary stages of developing the exercise. The American report was shared with the Canadian military when it was completed and has some striking contrasts to the Canadian Army report.

Three key alumni of Musk Ox, Jock Wilson, Pat Baird and Graham Rowley, published articles in some magazines and journals after the war. Various members of the exercise were determined to publish a book about their exploits but none, unfortunately, has been able to complete the task. Musk Ox appears only as a passing reference in Shelagh Grant's Sovereignty or Security?: Government Policy in the Canadian North, 1936-1950, the author wrongly stating that Exercise Musk Ox was the first in a series of exercises designed to test materiel and men in Arctic conditions.²⁸ Musk Ox receives some attention in the doctoral thesis written by Kenneth Charles Eyre, "Custos Borealis: The Military in the Canadian North."²⁹ Eyre reviews the four northern exercises and argues that they were an ". . . abstract approach to defence capability. . . .", and in part a quest for expertise in defending the North from a potential aggressor.³⁰ Eyre wonders why "Canada did not

²⁷ D His DND, 112.3M1009 (D84), US Observers Report on EX "Musk-Ox" 1945/46, 5.

²⁸ Grant, 216.

²⁹ D His DND, 81/758, Kenneth Charles Eyre, "Custos Borealis: The Military in the Canadian North", Ph.D. Thesis, The University of London, King's College, Department of War Studies, 1981, 159-161.

³⁰ Ibid., 161.

develop the sovereign implications of the exercise. . . ."31 However, the exercise itself, and indeed its motives , are not discussed in detail.

This thesis has two main goals. It seeks, first of all, to provide a detailed account, the first such account, of the exercise based on a wide canvas of primary sources. Secondly, it compares Musk Ox's aims with its achievements, and asks whether opportunities were grasped or let slip away. In researching the thesis, I relied primarily on the Department of National Defence Directorate of History and Heritage records. The Department of National Defence holdings at the National Archives were used to augment the Directorate's documents. I was able to conduct several interviews with key members of the expedition here in Ottawa and also by telephone. I reviewed the National Film Board Musk Ox documentary and some of the unedited film material that was housed at the National Archives. Mr. Graham Rowley, Mr. Gordon Watson and Dr. Patrick Nasmyth, participants in the exercise, provided me with some of their personal records, both visual and written. I also had access to the diaries of several members of the Musk Ox team.

Chapter One begins with an account of the planning and organization of Exercise Musk Ox. Chapter Two recounts the preliminary training and practice exercises that took place in Shilo and Churchill, Manitoba. The 81 days of the Moving Force trek across Canadian barren lands are then explored in Chapter Three. Chapter Four examines the reports published after the exercise and considers the expedition in its historical context.

Though few Canadians venture far from the 49th parallel, the Arctic is a strong

³¹ Ibid., 159.

symbol of Canada's national identity. Canada's claim to much of the Arctic, however, still remains largely implicit. So much of the north lies unexplored and undeveloped. The few Arctic pioneers who were at the heart of Exercise Musk Ox, believed that the Arctic frontier held vast untapped potential. For them, Musk Ox presented an opportunity to learn from the Arctic. They believed that the nation would someday benefit from Musk Ox and other expeditions like it. But Musk Ox failed to leave a lasting mark on Canadian policy makers. The commander of the Baker Lake Force, Graham Rowley, lamented fifty years later that both the public and the government had lost a unique opportunity in ignoring the lessons Musk Ox had to teach them.³² He remembers Musk Ox as an exercise in lost opportunities.

³² Interview with Graham Rowley in Ottawa, August 19, 1996.

Chapter One: Origins and Preparation

During Lemming, the ground work for Musk Ox was laid. Lemming was the first exercise that took place almost entirely in climatic extremes of the Arctic. The mission came at a time when the war was winding down. Wilson's plan was to capitalize on some of the techniques and equipment that it had developed over the course of the war and, as previously stated, use them to demonstrate to the Canadian public, the untapped potential of the Arctic. At the time that Wilson first began organizing Exercise Lemming, Baird was preparing to leave with the moving force of Polar Bear.³³ The new director of CAORG requested that Baird be released from his duties in Polar Bear to begin assisting him in Lemming.

Baird was given permission to leave Polar Bear at the end of January and immediately made preparations to visit Exercise Eskimo already in progress. Baird travelled west to Churchill, linking up with Eskimo, where he gathered information that would be included in his plan for Lemming. Back in Ottawa, Baird set out the details of his proposal in a Ministerial Submission which was forwarded to the Minister of Defence on February 15, 1945. On the 19th of the same month, Ministerial approval was received and the Army's first non-tactical Arctic exercise officially commenced.

Lemming's first objective was to obtain non-tactical information.³⁴ Beyond this, Lemming's other goals were more pragmatic. First of all, Baird's team was to test three types of military vehicles to obtain data for the development of future over-snow vehicles. A

³³ D His DND, 746.083 Cold Weather Trials and Exercises," Exercise Lemming: CAORG Report No. 25", a report issued by Canadian Operational Research Group (CAORG), May 24, 1945, 43.

³⁴ Ibid. See page 1 of report for objective statement.

serviceable snow vehicle would be the cornerstone of continued Canadian northern exploration. Secondly, the men of the Moving Force would be venturing into uncharted barren grounds and analysing them for future expeditions, recording a variety of details that would benefit future treks. Finally, and perhaps most telling, the final mission statement in the Lemming report stated that it was the intention of the manoeuvre, ". . .To assist civil development and surveys in the Barren Grounds."³⁵ Lemming thus represented an attempt to expand the role of the Canadian Army beyond the strictly military.

Baird drew all the men and equipment for Lemming from Eskimo.³⁶ Since Lemming was much smaller than the two previous exercises, its success depended on only a handful of men. Baird carefully selected his team, eventually developing a close working relationship with them. This was important since the climate and the equipment that were used dictated that the men would be in close confines for the entire duration of the journey. Furthermore, Lemming's Moving Force carried only limited provisions and any difficulties that were encountered with the machines or with the environment had to be dealt with quickly in order to complete the mission safely.

The most important lessons that were learned in Lemming related to the use of gas vehicles in the Arctic. In the expedition's tests of the three mechanized vehicles, the M-7 Half-track was totally disqualified for use in the harsh frozen climate. Both the Weasel and the Snowmobile were acceptable, although were not completely satisfactory for Arctic

³⁵ Ibid.

³⁶ Ibid., 16.

travel, with the rugged Canadian Snowmobile emerging from the exercise with a slight edge over the more fragile Weasel. Baird concluded that travel over the Arctic Barren Grounds and coastal sea ice was not a difficult task given proper over-snow vehicles. Lemming proved that the ". . .inaccessibility of the Arctic is just another myth. . . ."37

Baird suggested a number of alterations should be made to the Snowmobile to make it more suitable for Arctic exploration. Snowmobiles were covered in light armour; after all, they had been developed for a potential combat role. Armour made the vehicle slow and heavy, as well as increasing fuel consumption. Baird suggested removing the armour to reduce all important ground pressure, the amount of force a vehicle exerts over a given area of snow surface. Baird also recommended a heated cab to accommodate more comfortable travel. Lemming's team concluded that fully tracked vehicles were the only feasible method of transportation on the barren grounds, especially in areas where there was drifting or loosely packed snow.³⁸ The Snowmobile was eventually selected to be modified for use in Musk Ox.

Musk Ox was first discussed following Lemming. On Monday April 2, 1945, Baird received word that Colonel Wilson was flying up to meet the Lemming expedition, at Eskimo Point on the western shores of Hudson Bay, along the return leg of the journey.³⁹ Baird and his men held up near their over-night campsite, but Wilson failed to arrive that evening. Baird decided to press on and continued for four more days with no sign of Wilson.

³⁷ Ibid., 1.

³⁸ Ibid., 3.

³⁹ Ibid., 56.

Finally, on Friday April 6, 1945, Wilson and his friend, Major Walter Wood, the American Military attaché in Ottawa, appeared with a dog team and stayed with the travellers until they reached a United States Army camp, 205 miles past Eskimo Point.⁴⁰

Lemming returned to Churchill, Manitoba on April 7, where it had begun its trek only 16 days earlier. There, the men and equipment of Lemming were loaded on to a train and headed south for Winnipeg. It was on that train, in the comfortable surroundings of the Canadian National Railroad's (CNR) line superintendent's private car, that the idea for Musk Ox was hatched. As Baird recalled:

Musk-Ox got its initial planning on a train. It was April 1945 at the end of a successful small military foray-exercise Lemming-. . .Our three train passengers were Col. Wilson, Walter Wood (the American military attaché in Ottawa) and myself -all of us scientists of a sort, fellow founders of the Arctic Institute of North America. . .⁴¹

The aspirations of Wilson, Baird, Wood, and the rest of the Arctic Institute for the development of the north were reflected in the design of Musk Ox. The three men reasoned that, if a ramshackle collection of vehicles had managed to traverse nearly 1000 kms in the Canadian Arctic in such a short time, the next logical step was to attempt an even longer journey across the entire Arctic using the best vehicle available.⁴² So came Musk Ox, a more ambitious version of Lemming. The defining features of Musk Ox would be its length and size. Musk Ox would penetrate so far into the heart of the barren lands that the planners would also have to incorporate the Air Force into their design because the moving force

⁴⁰ Ibid.

⁴¹ Baird, North, Vol. XXV, No. 5, (September/October 1978): 25.

⁴² Ibid.

would have to rely nearly entirely on air-dropped supplies. It was up to Wilson to sell authorities back in Ottawa on the ambitious idea.

Wilson's immediate superior was Brigadier S. F. Clarke, head of Research at National Defence. Clarke and Wilson agreed early in the war that it would eventually be important that the Canadian military be prepared to defend the north properly.⁴³ Both men also believed that the Canadian Army should learn how to operate in Arctic conditions so that they could meet any challenge in any country with a similar climate to that of our own. Clarke had furthermore, voiced concerns about the integrity of the extreme edges of the country, particularly Ellesmere Island.⁴⁴ He feared that the Americans might take over northern regions where Canadians did not maintain a presence. Wilson, in responding to Clarke's concerns, told him that there was no issue as to whether or not Canada owned the Island, but if the military were intending to assert sovereignty in the North, ". . .they should at least know where it is."⁴⁵ Clarke did not require much persuading, and approved Wilson's proposal to develop a preliminary plan for Exercise Musk Ox.

The preliminary planning stage of Musk Ox required nearly an entire year. In August and September of 1945, several preliminary planning meetings to discuss Musk Ox were held at the Directorate of Research, National Defence Headquarters, and in the Air Council

⁴³ Ibid.

⁴⁴ Interview with Graham Rowley in Ottawa, August 19, 1996.

⁴⁵ Ibid.

Chambers at the Lisgar Building, both located in Ottawa.⁴⁶ On August 31, 1945, at a small planning committee meeting chaired by Wilson and attended by Baird and Brigadier G. A. Mc Carter, the terms of reference were sketched out.⁴⁷ It was decided at that meeting to include the following items in the draft plan:

- (a) Having tried out vehicles on Exercise "Lemming" supply and mobility over a much longer route should now be tried.
- (b) Air supply and advanced landing field techniques must be stressed.
- (c) Information should be passed on to the interested civilian agencies since at present the army knows more about winter travel than these agencies.
- (d) To study country over which the route passes. . . .⁴⁸

The minutes of later meetings of the main committee and various sub-committees assigned to develop plans for the exercise made it clear that the central focus of Exercise Musk Ox was non-tactical research.

The second major meeting involved the Air Force, to which Baird and Wilson explained their vision of air support. Other sub-committees were struck to develop research guidelines for the exploration of various aspects of the Arctic.⁴⁹ By late September, a ministerial submission had been prepared by Wilson and the Musk Ox planning committee for General Clarke's review. The Chief of the General Staff, Lieutenant-General Charles Foulkes, gave the Army's endorsement for the draft to the Minister. October 4, 1945, the

⁴⁶ NAC, RG 24, Reel C-8419, File 9012-564-1-1, Operational Research- Project Winter Exercise 1945-46, Minutes of Meetings, August-September, 1945.

⁴⁷ NAC, RG 24, Reel C-8419, File 9012-564-1-1, Operational Research- Project Winter Exercise 1945-46, Minutes of Meetings held at D Research, August 31, 1945

⁴⁸ Ibid.

⁴⁹ NAC, RG 24, Reel C-8419, File 9012-564-1-1, Operational Research- Project Winter Exercise 1945-46, Minutes of Second Meeting for Planning Exercise "Musk-Ox", September 14, 1945.

signed recommendation was delivered to Douglas C. Abbott, Minister of National Defence.⁵⁰

It began:

It is therefore proposed, with RCAF cooperating, to conduct, between approximately 14 February and 5 May, 1946, a non-tactical movement of over-snow vehicles from Churchill, Manitoba, to Edmonton, Alberta, via Victoria Island and Fort Norman, Northwest Territories, a total distance of over 3,000 miles. . . .⁵¹

On October 12, 1945, Exercise Musk Ox was approved by the Minister and the formidable task of assembling men and equipment began.

The Chain of Command was set out in the "Terms of Reference - Exercise Musk-Ox" naming the Deputy Chief of the General Staff, General Clarke, as the Director of the exercise. The Director of Research at CAORG, Wilson " . . . will act as Deputy Director, with full power of the Director."⁵² Thus, despite his title, Wilson was the real commander of the operation, overseeing all matters of policy relating to the Force and all liaison with the United States War Departments and RCAF. Headquarters.⁵³

The Army organization and formation orders were cut on October 19, 1945 and sent out to regional commands across the country.⁵⁴ These orders requested district commanders to commence immediately the process of selecting and providing volunteer personnel based

⁵⁰ D His DND, 746.033 (D1), COLDWEATHER TRIALS, Papers on Exercise "Muskox", Ministerial Submission, October 4, 1945.

⁵¹ Ibid.

⁵² D His DND, 746.033 (D1) , COLDWEATHER TRIALS, Papers on Exercise "Muskox", Terms of Reference-Exercise- "Musk-Ox", October 9, 1945.

⁵³ Ibid.

⁵⁴ D His DND, 171.009 (D7) EX "MUSK OX" Organization and Formation, Exercise "Musk-Ox" Force, Request for selection and provision of personnel for exercise force, October 19, 1945.

on the exercise requirement specifications included with the orders.⁵⁵ Wilson had selected a full slate of officers to head the exercise by October 31, 1945.⁵⁶ The Department of Public Relations for the Army issued their press release on November 8:

The operation is primarily an Army scheme with the RCAF providing air support. The RCAF expects to obtain much valuable information on air navigation in polar regions, on the dropping of supplies from the air and on winter operations generally in the Arctic weather zone. . . .

In addition, certain technical research projects in Arctic air and ground warfare will be studied, but apart from its military aspect the expedition is expected to obtain information that will be of immense value to other government departments and civilian research workers. For these reasons the departments concerned have been invited to include their representatives. The Arctic Institute of North America is cooperating in this exercise. . . .⁵⁷

Finally the order came down in the first week of November for all personnel concerned to make their way to an advance training centre at Shilo, Manitoba by November 15, 1945.⁵⁸

The operational plans outlined an exercise separated into three parts: Moving Force; Advance Meteorological Base; and Base Force. Estimated personnel requirements for the Army operation were 161 men: the moving force- 30 men; the meteorological base- 3 men and the base force-128 men.⁵⁹ However, the forecasted personnel requirements for the

⁵⁵ D His DND, 169.009 (D154) TRG COMBINED EXERCISES "Musk-Ox" -Oct 45/Jan 47,, Appendix "B", Personnel Selection, October 1945.

⁵⁶ NAC, RG 24, Reel C-8419, File 9012-564-14, Operational Research- Project Winter Exercise 1945-46, Personnel and Home War Establishment, October 31, 1945.

⁵⁷ NAC, RG 24, Reel C-8419, File 9012.564-13 No. 1, Department of National Defence Press Release (Army) Public Relations, Press Release, November 8, 1945.

⁵⁸ D His DND, 171.009 (D7) EX "MUSK OX" org and fmn of -d/9 Oct 45, by D Org. , Organization and Formation, Exercise "Musk-Ox" Force, Request for selection and provision of personnel for exercise force, October 19, 1945.

⁵⁹ Ibid.

operation were underestimated and later were revised upwards by practical demands.

The Base Commander, Lieutenant Colonel J. Donald Cleghorn, was responsible for maintenance of the Moving Force in the field and reported to Wilson. The Moving Force Commander, Patrick Baird, was crucial to the success of the operation and would accordingly be vested with critical responsibilities. Though some key officers on Musk Ox had previous experience in the Arctic, the rest of the men did not. Baird had to ensure that all those under his command were proficient in Arctic survival techniques and that they were familiar with the operation of all vehicles and equipment to be used by his Force.⁶⁰ All observers that accompanied Musk Ox would be subject to the orders of the Force Commander, ". . . insofar as discipline, accommodation, movement and rations are concerned."⁶¹

The ground portion of Musk Ox was divided into two separate main manoeuvres. The first portion of the exercise, the Baker Lake Force, was sent in advance of the Moving Force to establish a base of operations at Baker Lake in the Northwest Territories. Under the command of Lieutenant Colonel Graham Rowley, 11 men in two snowmobiles and two large bulldozers were to set out across the Churchill River for Baker Lake two weeks in advance of the main force.⁶² Rowley was a former colleague of Baird's from the British Canadian Arctic Expedition. His party's initial task was to break trail for the Musk Ox

⁶⁰ D His DND, 746.033 (D1), COLDWEATHER TRIALS, Papers on Exercise" Muskox", Terms of Reference-Exercise- "Musk-Ox", October 9, 1945.

⁶¹ Ibid.

⁶² Lieut. Colonel G.W. Rowley, "Exercise Muskox", Geographical Journal, Vol. CIX No. 4-6., (October 1947):177.

Moving Force. Once they reached their destination, Baker Lake Force was immediately to commence construction of a 3500 foot run-way and establish a radio and meteorological station in support of the main force.⁶³ Baker Lake was used as a remote air base and fuel depot, providing the extra range that the Dakota aircraft needed to reach the expedition in the outer-most reaches of the Canadian hinterland.

CAORG had already shown that operations in harsh climates multiplied the amount of supplies needed for each individual several times over compared with operations in normal settings.⁶⁴ Consequently, a small moving force of men in the Arctic would require many more that number to support them. When factoring in the personnel requirements for the Air Supply Unit, Musk Ox's tiny Snowmobile train would require, at times, nearly 10 times its own number to support its movements.

It was Air Supply Unit No. 1 (ASU#1 or ASU) that shouldered the heavy burden of supply. The RCAF issued a separate set of operational orders for the exercise based on CAORG's requirements. Set up under the command of No. 9 Transport Group Headquarters, ASU would be tasked to " . . . Supply by air the requirements of the Mobile Army Unit (Exercise "Musk-Ox") which will be moving through the Northland during the winter months of !945/46. . . ."⁶⁵ RCAF Wing-Commander Jack Showler, from Winnipeg, was

⁶³ Ibid., 179.

⁶⁴ Interview with Graham Rowley in Rockcliffe, August 19, 1996.

⁶⁵ D His DND, 181.002 (D 304) NWAC File 204-13 Operation Order No. 205, Exercise "Musk-Ox", October 22, 1945.

appointed the Commanding Officer of the ASU.⁶⁶ Showler was an experienced bush pilot familiar with much of the terrain that was encountered by Musk Ox. The RCAF contingent of the operation would be larger than that originally proposed by the Army but eventually their forces were equal in size. The number of RCAF personnel fluctuated somewhat during the exercise but generally, #1 ASU would require 225 men for flight operations.⁶⁷

#1 ASU was formed from an existing supply unit based in Rockcliffe, Ontario, and therefore it was not necessary to canvas the entire country to find suitable personnel. The force would utilize six C-47 Dakota twin engine aircraft and three C-64 Norseman single engine aircraft.⁶⁸ The practical considerations for the ASU were similar to the ground force in that the RCAF as well had never participated in such an extensive Arctic operation. The key to success in any operation is rehearsal, especially in circumstances where new techniques or equipment are to be employed. Musk Ox was full of new ideas.

The Canadian military had, therefore, described the operation as essentially scientific. Tests and experiments were planned to test and record many features of the Arctic previously unrecorded. In the "Outline Plan" distributed to commanders of the three sections (Advance, Moving and Base Forces) of the ground portion of the exercise, the scope of the research was set down.⁶⁹ ASU also had considerable research responsibilities. Musk Ox's

⁶⁶ NAC, RG, Reel C-8419, File 9012.564-13 No. 1, "Musk-Ox" Air Boss", The Standard, Montreal, January 12, 1946.

⁶⁷ D His DND, 181.003 (D 1452), "No 1 Air Supply Unit RCAF Final Report on Exercise Musk Ox", 1946.

⁶⁸ Ibid.

⁶⁹ D His DND, 314.009 (D254), "Exercise Musk-Ox" Dec-45-Mar 46, Outline Plan, Appendix: Exercise "Musk-Ox"- Research Report Forms, December 1945.

key personnel were recruited and assigned various duties under 24 heads of research. Each officer was issued a "Research Report Form" that he was responsible for completing during the exercise.⁷⁰ The heads of research were titled:

1. Meteorology (ground); 2. Meteorology (air); 3. Navigation (ground); 4. Navigation (air); 5. Magnetic (ground); 6. Magnetic (air); 7. Signals (ground); 8. Signals (air); 9. Air Supply (ground record); 10. Air Supply (air record); 11. Vehicles; 12. Aircraft Maintenance; 13 Landing Fields; 14. Air Operations; 15. Housing; 16.Clothing; 17. Medical (health, morale, food, cooking, water supply and washing) 18. Snow and Ice Data; 19. Photos (ground); 20. Photos (air); 21. Ground Topography (terrain, geology and sketch maps); 22. Auroral Observations; 23. Fauna and Flora; 24. Small Arms and Pyrotechnics.⁷¹

The recordings made under these various titles would form the backbone of the final report.

The Outline Plan set down the itinerary and route destination for the Moving force.

The Moving Force was scheduled to leave from Churchill, Manitoba on February 14, 1946 and arrive in Edmonton, Alberta by May 5, 1946.⁷² Along the way, the Force was to pass through; Eskimo Point, Baker Lake, Perry River, Cambridge Bay, Coppermine, Port Radium, Norman Wells, Fort Simpson, Fort Nelson and finally arrive at Edmonton. Wilson had spent several months arranging logistics for the exercise with both civilian agencies and other government branches. Several government organizations and private companies would cooperate with the exercise, ranging from mining companies to the Royal Canadian Mounted Police (RCMP).

⁷⁰ Ibid.

⁷¹ Ibid.

⁷² D His DND, 314.009 (D254), "Exercise Musk-Ox" Dec-45-Mar 46, Outline Plan, December 1945, 2.

Even though Wilson took great pains to ensure that the proposed exercise would be viewed entirely as a Canadian operation, the American Army and the British Army were invited to observe the expedition. On December 18, 1945, an invitation from Canadian General H.F.G. Letson to supply observers to accompany Musk Ox was accepted by the senior member of the American Army on the Joint Permanent Board on Defence, Major General Guy V. Henry.⁷³ The American Military Attaché in Ottawa, Walter Wood, was with Wilson when the idea for Musk Ox was hatched. Wood was a member of the Arctic Institute and a close friend of Wilson's. Wilson had discussed possible American involvement with Wood several months before a formal invitation was extended. The American Army enthusiastically provided six observers to accompany the expedition and report on their findings.

The Americans assigned to the operation were: Col. Norman B. Edwards, Commander of the American contingent, Lt. Col. Frank G. Forrest, Lt. Col. Edward G. Butler, Major Albert H. Jackman, Major Walter P. Maiersperger, and a civilian from Office of the Quarter Master General, William House.⁷⁴ The American soldiers were guided by different interests throughout Musk Ox and the directive issued by the American War Department on December 21, 1945, to the six observers was of a wholly different nature than that issued by Clarke and Wilson for the Canadians:

⁷³ NAC, RG-24, E-1-B, Vol. 3556, File 945-10-1, Letter from General H.F.C. Letson, Senior Canadian Army Member, Permanent Joint Board of Defence, to Major General Guy V. Henry, Senior American Army Member, Permanent Joint Board on Defence.

⁷⁴ Ibid.

4. General Instructions:

a. With the development of new weapons and improved aircraft the prospect of operations, offensive and defensive, through the Arctic regions assumes increasing importance. One aspect of particular interest is the feasibility of hostile attacks through the Arctic against industrial centres in the United States, either by long-range aircraft and guided missiles from bases in Asia or Northern Europe or from advanced bases established in Northern Canada or the Arctic. In addition to making observations pertaining to the doctrine of living in the Arctic and the functioning of material,[etc.]. . . It is desired that the following items of strategic interest be reported upon by the observers. . . .⁷⁵

Meanwhile, Musk Ox had already become a contentious issue between the Canadian Army and the American press. Time magazine published an article on Musk Ox on November 26, 1945, which was accompanied by a picture of bombers and missiles heading south over the north pole headed by the caption, " OPERATION MUSK OX, Problem: Attack from the North."⁷⁶ Following that article, others in a similar vein started to appear in the Canadian newspapers and magazines raising concerns that Musk Ox was, in fact, a secret tactical operation looking at security concerns in the north. For example, the Ottawa Citizen claimed that ". . .if Japan ever recovers from her defeat and succeeds in making an ally of the Soviet Union, she will some day attempt to invade the United States across Canada. . . ."⁷⁷

Wilson did not want his expedition becoming a venue for international sabre rattling. Commander Patrick Baird immediately issued a statement on the 28th condemning the

⁷⁵ D His DND, 112.3M1009 (D84) U.S. Observers Report on Ex "Musk-Ox", 1945/46, Canadian Winter Exercise Musk Ox, "Annex A" DIRECTIVES, 12.

⁷⁶ NAC, RG Reel C-8419, File 9012.564-13 No. 1, " OPERATION MUSK OX, Problem: Attack from the North", Time, November 26, 1945.

⁷⁷ NAC, RG Reel C-8419, File 9012.564-13 No. 1, "Operation Muskox", The Ottawa Citizen, November 27, 1945.

speculative press assertions.⁷⁸ He emphasized the scientific aspects of Musk Ox and refuted any suggestions concerning a hidden or secret military agenda:

The aim of the exercise, despite recent malicious misrepresentations in a widely circulated magazine, are perfectly simple and straightforward. There is nothing secret or backstage about them. Canada's policy after contributing her share to winning the war, is now devoted to maintaining the peace. She does not desire to stir up any anxiety among peoples. . . .
In addition, one of the main purposes is to pass on to civilian agencies the army's specialized knowledge developed under stress of war, to aid in peaceful development of our north country⁷⁹

Media and public attention from this point on began to escalate for reasons that remain unclear. Musk Ox was more widely reported than any of its predecessors. Plans were set early on in the preparatory stages to include a Department of Public Relations (DPR) cameraman to accompany the Moving Force and officially record the event both for the military and the National Film Board. Staff Sergeant Roger Racine had previously escorted Baird on Lemming and was chosen to accompany Musk Ox as the official cameraman recording both still and action shots.⁸⁰ In addition, Staff Sergeant Fred Way was to also accompany the exercise as an official writer.⁸¹ The DPR officer would be stationed at Churchill to funnel information from the Moving Force and to liaise with visiting media representatives. Wilson and DPR made arrangements for press to visit the Base Force at

⁷⁸ NAC, RG Reel C-8419, File 9012.564-13 No. 1, "Charges Aim Of Musk-Ox Falsified", Winnipeg Free Press, November 28, 1945.

⁷⁹ Ibid.

⁸⁰ NAC, RG 24, Reel C-8419, File 9012-564-1-1, Operational Research- Project Winter Exercise 1945-46, Minutes of Meeting for Planning Exercise "Musk-Ox", December 5, 1945.

⁸¹ Ibid.

Churchill and to link up periodically with the Moving Force as it progressed on its journey.⁸² Throughout Musk Ox, contention continued between the Canadian Army and the press, particularly the American press, about the true nature of the exercise.

In addition to the American contingent, there was one British Army Observer in the exercise. Lieutenant Colonel Andrew Croft was a close friend of Patrick Baird's and would ride with him in the first Snowmobile throughout Musk Ox. Croft had served with Baird as a fellow Troop commander in 14 Commando during the war.⁸³ Croft was an Arctic explorer, having been on several pre-war expeditions, including one in which he crossed Greenland's ice-cap in 1934 using a three-man dog team.⁸⁴ Although a British representative, he was considered by both Wilson and Baird to be a key to the success of the operation. Croft later prepared a report for the British Army Scientific Council centring primarily on scientific aspects of the journey.⁸⁵ With all the personnel and equipment slots now filled, Musk Ox moved into the advance phase in Shilo, Manitoba in late fall of 1945.

⁸² Ibid.

⁸³ Baird, North, Vol. XXV, No. 5, (September/October 1978): 27.

⁸⁴ Ibid.

⁸⁵ Personal Papers of Dr. Patrick Nasmyth, Lieut-Col. NAC Croft, "Report by the British Army Observer on Exercise Musk-Ox, Military-Operational Research Report No. 35.", 1946.

Chapter Two: Shilo and Beyond

In early November, the volunteers from all over Canada came to Shilo to prepare for advanced training scheduled to take place in Churchill after Christmas, 1945. At Shilo the men were assigned their respective tasks in either the Base Force or the Moving Force and were issued their Arctic kit.⁸⁶ The men were started on a physical fitness regime which consisted of route marches and other typical military training. The Musk Ox crews received basic training in survival techniques in the Arctic and learned the operation and maintenance of the Snowmobiles.

Patrick Baird, Graham Rowley, Andrew Croft and the Signals Officer for the Moving Force, Captain R. Frank Riddell, were the only men on the expedition who had substantial previous experience in the Arctic.⁸⁷ Riddell had spent considerable time in the Mackenzie Delta with the Corps of Engineers.⁸⁸ Riddell and the Musk Ox Base-Signals Officer, Major Earl Hersey, had been part of the posse that hunted down the Mad Trapper, Albert Johnson, in the Yukon in 1932.⁸⁹ Wilson would rely on these leaders, especially Baird, Croft and Rowley, to transform soldier recruits into cold weather specialists.

While training advanced in Shilo, reporters continued to probe team members about the nature of the mission. Though Baird and his men responded by explaining the non-

⁸⁶ D His DND, 95-52, John Lauder, Base Force, "Tracks North", unfinished manuscript, 11.

⁸⁷ Personal Papers of Dr. Patrick Nasmyth, Lieut-Col. NAC Croft, "Report by the British Army Observer on Exercise Musk-Ox, Military-Operational Research Report No. 35.", 1946, 10.

⁸⁸ Baird, North, Vol. XXV, No. 5, (September/October 1978): 27.

⁸⁹ D His DND, 95-52, John Lauder, Base Force, "Tracks North", unfinished manuscript, 20.

tactical aspects of Musk Ox, there were still those in the media that persisted in reporting that Musk Ox was a secret mission to test defences against Arctic invasion. On December 14, 1945, in the House of Commons, the Minister of National Defence, wary of continued press speculation, took care to explain that the exercise as one of scientific discovery:

The benefits derived from it may well be of greater civilian value than military value, although it is hoped that they will be both. . . . There is nothing secret about this expedition; it is a very small one. . . .⁹⁰

The following day, Colonel Wilson gave a radio talk to Canadians about Musk Ox on the Canadian Broadcasting Corporation (CBC).⁹¹ Wilson stressed the northern development theme and the civilian application of military technology developed for cold weather during the war.⁹² Wilson pointed out that civilian government departments had been invited to participate and that an open invitation had been extended to the press to visit the expedition along its path. This information was provided to help calm suspicions regarding secret agendas and clandestine military experiments.⁹³ The CBC address emphasized that the exercise was Canadian and that the United States was participating as an observer only.

Despite the Canadian Army's attempts to reassure the press, as preparations continued towards the February launch, many reporters were still convinced that there was a hidden agenda behind Musk Ox. Two days after Wilson's speech, on December 17, an

⁹⁰ NAC, House of Common Debates, December 14, 1945, 3552-3553.

⁹¹ NAC, RG 24, Reel C-8419, File 9012.564-13 No. 1, Radio speech, "The Canadian Broadcasting Corporation -Talk on Canadian Army and RCAF Exercise "Musk-Ox" Sunday 15, December 1945 at 1845 hrs by Col. J.T. Wilson, Director of Operational Research ", December 15, 1945.

⁹² Ibid.

⁹³ Ibid.

Associated Press (AP) article "US And Canada Work Out Plans For Joint Defence" appeared in the Ottawa Evening Citizen.⁹⁴ Despite Wilson's recent speech to the contrary, the article began: "Mindful of atomic age possibilities, the United States and Canada are beginning to work out joint plans to defend North America against any attack from Asia or Europe across the North Polar region Allied diplomatic officials have reported."⁹⁵ The AP article received wide distribution and angered the leaders of the exercise.⁹⁶ Wilson and the Canadian Army's assertions that the exercise was not a joint undertaking; was not tactical; and was not clandestine in any way; continued to be ignored by the press.

The majority of American coverage picked up on the theme of the AP article. The Canadian Army Intelligence section in Washington reported that, "The Associated Press story covering the spectacular projected "Exercise Musk-Ox" was greeted by enthusiastic coverage in the US press."⁹⁷ Articles on Exercise Musk Ox appeared in the Christian Science Monitor, Washington Post, New York Herald Tribune, Chicago Sun, Baltimore Sun, Louisville Courier-Journal, Kansas City Star, the Cincinnati Enquirer and the Denver Post.⁹⁸ Not all the coverage was misleading. An article written by an Ottawa correspondent for the Chicago Daily News, titled "Expedition to Explore Arctic" expanded on the considerable

⁹⁴ NAC, RG 24, Reel C-8419, File 9012.564-13 No. 1, John M. Hightower, "U.S. And Canada Work Out Plans For Joint Defence", The Ottawa Evening Citizen, December 17, 1945.

⁹⁵ Ibid.

⁹⁶ See reference to Baird response, NAC, RG Reel C-8419, File 9012.564-13 No. 1, "Charges Aim Of Musk-Ox Falsified", Winnipeg Free Press, November 28, 1945..

⁹⁷ NAC, RG 24, Reel C-8419, File 9012.564-13 No. 1, Press Analysis Section CIS Canadian Embassy Washington D.C. Memorandum, "Exercise Musk-Ox", December 29, 1945

⁹⁸ Ibid.

role of the Snowmobile and air supply in Musk Ox.⁹⁹ Most of the American media attention, however, centred on the possible strategic ramifications of the experiment and was characterized by claims such as Musk Ox was necessary to "emphasize the radical change in grand strategy brought about by the simultaneous development of long distance aviation and the advent of the atomic bomb."¹⁰⁰ The amount of press attention devoted to the potential Soviet threat foreshadowed the coming of the Cold War. The USSR was the unnamed villain in this media campaign, the press was somewhat premature in its predictions. The Russians did not yet possess any intercontinental delivery system for an atomic bomb, and would not until the end of the decade.

Meanwhile, in the cold of northern Manitoba, training was moving into full swing for the mission and few of the men taking part in the exercise would have time to reflect on the political controversy as they turned their attention to learning about Arctic survival. Following a brief leave at Christmas, advanced training began in the cold sub-Arctic conditions of Churchill, Manitoba. On December 29, the men of the Moving Force assembled and boarded a special train in Winnipeg for the two day trip to Churchill.¹⁰¹ For many of the soldiers, it was their first taste of extreme cold, "We arrived in Churchill at 17:00 hrs[December 31, 1945]. It is extremely cold here and the word dismal is an

⁹⁹ NAC, RG 24, Reel C-8419, File 9012.564-13 No. 1, David M. Nichol, "Expedition to Explore Arctic", Chicago Daily News, December 17, 1945.

¹⁰⁰ NAC, RG 24, Reel C-8419, File 9012.564-13 No. 1, Press Analysis Section CIS Canadian Embassy Washington D.C. Memorandum, "Exercise Musk-Ox", December 29, 1945

¹⁰¹ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Pte. Regimbal A.C., Base Force, 1945: entry for December 29.

understatement for this place."¹⁰² The base at Churchill was one of the former American air bases during the war and had recently been purchased by the Canadian government.¹⁰³ The facility had been all but closed after the war and had to be revitalized by the Base Force of Musk Ox. Cleghorn's men had actually arrived at Churchill several weeks in advance of the Moving Force on December 14, to begin the task of refurbishing the base.¹⁰⁴ In addition to the difficult duties of base commander, Cleghorn had to prepare for a continuous stream of visiting press correspondents and foreign dignitaries.

Wilson had invited many foreign government representatives to Churchill to observe the cold weather operations. At least part of Colonel Wilson's motive was to allay international fear about the true nature of the Canadian exercise. The military attaches arrived in Churchill on January 27, 1946.¹⁰⁵ Attaches from France, Belgium, Chile, Norway, Peru and assorted American personnel were among the first diplomatic visitors, as was Lieutenant Colonel Peter J. Domashev from the Embassy of the USSR.¹⁰⁶ Wilson hoped that as a Soviet observer, he would put an end to the rumours surrounding the supposed "secret" agenda of the exercise, and indeed an article had appeared in the Ottawa Citizen on January 15 had suggested that a "Red Army Man" should be invited to view a portion of the exercise

¹⁰² Ibid., entry for December 31, 1945.

¹⁰³ Wilson , The Polar Record, Vol. 5, Nos. 33,34,(December 1947): 18.

¹⁰⁴ NAC, RG 24 C3, Vol. 13884, War Diary of Exercise "Musk-Ox":December 1-31, 1945.

¹⁰⁵ NAC, RG 24 C3, Vol. 13884, War Diary of Exercise "Musk-Ox":January 1-31, 1946.

¹⁰⁶ Ibid.

to quash some of the speculation caused by American military officials.¹⁰⁷ The article, incidently, went on to state that General H.H. Arnold of the United States Air Force had suggested that the next war could involve long range rocket driven devices carried over the pole to the heartland of the United States and Canada.¹⁰⁸

The many ramshackle tar-paper-covered buildings which had formerly protected American personnel from the cold sub-Arctic climate were everywhere on the base.¹⁰⁹ Among these shelters, the army and air force personnel cemented together as a team and first experienced the severe challenges that would be presented by the exercise they were about to undertake. The Moving and Base Force's stay at Churchill through January was a busy one. Various cold weather tests were carried out by the men on military equipment. Specific committees were established to review and test certain materiel.¹¹⁰ The men were drilled on the finer points of Arctic survivals skills. Igloo building was one of the recurring lessons stressed by Baird, Croft and Rowley.¹¹¹ Almost everyone had an opportunity to try their hand at building an igloo, an essential skill should one ever find themselves in search of emergency shelter while awaiting rescue. Unlike tents, which provide almost no protection from the bitter cold unless heated, igloos provide adequate insulation from the outside

¹⁰⁷ NAC, RG 24, Reel C-8419, File 9012.564-13 No. 1, "Invite a Red Army Man", The Ottawa Citizen, January 15, 1946.

¹⁰⁸ Ibid.

¹⁰⁹ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Pte. Stevens, Air Supply Section, 1946: entry for January 7. .

¹¹⁰ Ibid.

¹¹¹ Gordon Watson, Diary of Gordon D. Watson, Scientific Observer of Exercise Musk-Ox, personal copy of Mr. Watson, 1946: entries for January 2-6.

environment. Igloos, furthermore, are rigid, enabling them to withstand the incredible Arctic blizzards that frequently blow across the barrens.

During their time at the Churchill base, the men of Musk Ox developed three practice exercises to test the equipment and techniques they would employ on the open barren grounds. Officers who were responsible for the completion of the Research Report Forms needed time to practice or develop experiments that would suit the Outline Plan. The men of the Moving Force would quickly learn during the sorties that the cornerstone of Arctic exploration is adaptability. Even before the test runs, some of the men became educated as to the degree of flexibility that would be required of them in the coming months. Gordon Watson, a civilian observer volunteer from the Canadian Armament Research and Development Establishment (CARDE) was presented with one such challenge early on in his arrival to Churchill.

A substantial section of the initial leg of the exercise had yet to be explored and plotted, and in fact, grid lines were all that filled the space on the eastern portion of many of the Moving Force's navigation maps.¹¹² Captain Back's 1833-34 survey of the Back River was the only reasonably accurate mapping that had been completed in the eastern Arctic.¹¹³ On January 6, 1946, Colonel Baird paid a visit to Watson to inform him that an RCAF astro navigator had been evacuated to Winnipeg with appendicitis. Colonel Baird then put it to Watson that, since he was a scientist, albeit an armament specialist, perhaps he would be

¹¹² Ibid.

¹¹³ Ibid.

interested in learning astro navigation.¹¹⁴

Watson agreed to the challenge, and took a 3 day crash course in astro navigation. Using heavenly bodies as navigation fixes was one of the only sure ways to navigate in the extreme north where compasses are difficult to use and the land is virtually featureless. Baird had considerable experience finding his way across the barrens, and had mastered traditional methods of navigation. Together with dead reckoning, Watson and Jack Innes, the Magnetic Observer, would take sun and astro shots using the bubble sextant and help guide the Moving Force through much of the unchartered eastern Arctic.

On January 5, the Moving Force were divided into crews and finally assigned Snowmobiles.¹¹⁵ The modifications to the Snowmobiles had only just been completed by the Ottawa Car and Aircraft Company, and their arrival in Churchill, on January 1, was the first opportunity that the expedition actually had to view the Musk Ox version of the vehicle.¹¹⁶ Fifteen vehicles had been rebuilt to the Snowmobile configuration.¹¹⁷ After being loaded with supplies, the Snowmobiles could carry only 3 or 4 men . Only twelve vehicles were originally assigned for the actual exercise which included one of the previously mentioned American manufactured M-29 Weasels. The remaining three vehicles were slated to form part of the Baker Lake roster.

¹¹⁴ Ibid.

¹¹⁵ Gordon Watson, Diary of Gordon D. Watson, Scientific Observer of Exercise Musk-Ox, personal copy of Mr. Watson, 1946: entry for January 5.

¹¹⁶ NAC, RG 24, Reel C-8419, File 9012.564-13 No. 1, "Snowmobiles for Arctic Exercises Designed and Made in Ottawa", The Ottawa Evening Journal, December 13, 1945.

¹¹⁷ Wilson, The Polar Record , Vol. 5, Nos. 33,34, (December 1947): 19.

The lightly armoured Penguins were engineered to offer a low silhouette, so that in battle they would be less obvious on the horizon line to the enemy. This meant that there was only room to accommodate two men. This feature was of no consequence to the Musk Oxer's. The vehicles had their top armour removed and a platform mounted on to their chassis so that a light-weight aluminum and plywood cabin could be attached.¹¹⁸ It had two 36" wide tracks that could support its weight on the snow even though it weighed in at nearly 4.5 tons.¹¹⁹ Powered by the well proven General Motors, 110 hp 12 cylinder, Cadillac engine, the Snowmobiles had plenty of power to pull but were not well suited to gas conservation.¹²⁰ Unfortunately, though the vehicles had undergone substantial refitting, they arrived in Churchill in deplorable mechanical condition and their crews would struggle throughout the journey to overcome or adapt to, many related problems.

"Practical experience was gained [while in Churchill] by many small exercises of varying duration, which proved invaluable."¹²¹ After several weeks of survival training and lessons in the use of special Arctic equipment, the Moving Force set out in their first full scale training exercise "Operation Kelsey".¹²² Right from the start, the exercise encountered problems. Leaving from Churchill, Kelsey had set out on a course of 100° which would take

¹¹⁸ D His DND, 95-52, John Lauder, Base Force, "Tracks North", unfinished manuscript, 13.

¹¹⁹ Wilson, The Polar Record, Vol. 5, Nos. 33,34, (December 1947): 19.

¹²⁰ D His DND, 746.033(D2) Winter Ex "Musk Ox" 1946, "Canadian Army Winter Exercise Musk Ox: 1946, " prepared under the direction of the Chief of General Staff, 1947, Appendix "G", 152.

¹²¹ D His DND, 112.3M1009 (D84) US Observers Report on Ex "Musk-Ox", 1945/46, 3.

¹²² Gordon Watson, Diary of Gordon D. Watson, Scientific Observer of Exercise Musk-Ox, personal copy of Mr. Watson, 1946: entry for January 21.

the party directly to the coast of Hudson Bay.¹²³ The crews left at 9:30 AM January 22, but by noon had traversed only about nine miles due to extremely rough terrain. Some of the Snowmobiles immediately began to succumb to mechanical failures. By the second day, two of the machines had experienced serious mechanical failures and one of the Snowmobiles had to be abandoned.¹²⁴ American M-29 tracked supply trailers were being tested by two Snowmobiles but the crews found that they were "over-designed" and often became mired in the snow causing an undue strain on the Cadillac engines.¹²⁵ Baird and Captain Vaughn Stewart had difficulty navigating with compasses that were mounted on the vehicles' dashes on the first morning.¹²⁶ Consequently, the two navigators led the expedition on a crooked trail for a while. Later, the men improvised with hand held compasses that were not affected by the vehicle vibration and the operation's course straightened out. The men also experienced a brief taste of the harsh Arctic winds which made erecting tents extremely difficult and time consuming. Navigation in the blinding blizzards was all but impossible and made communication with base unreliable. These two complications were worrisome to the commanders of the test exercise who knew full well that they could easily become hopelessly lost in such conditions.

Temperatures over the three days remained relatively cold. On the first and third

¹²³ Ibid.

¹²⁴ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for January 22.

¹²⁵ Ibid.

¹²⁶ Gordon Watson, Diary of Gordon D. Watson, Scientific Observer of Exercise Musk-Ox, personal copy of Mr. Watson, 1946: entry for January 22.

days, air drops had been scheduled. It would be the first time that the entire Moving Force had to be located and supplied by the ASU. Despite a strong and constant cross wind of 20 mph, the first air drop went well and the ASU delivered their cargo of fuel on target to the awaiting Snowmobiles.¹²⁷ However, getting the fuel out of the barrels presented another problem to the men of Kelsey. With only a single hand pump, fuelling all of the machines took up a considerable amount of time.¹²⁸ Another attempt to locate the expedition by air was made on January 23, but because of severely reduced visibility and problems with communications, the air crews were unable to spot the machines on the barrens.¹²⁹ As the trial expedition limped back to Churchill, Musk Ox must have appeared to be a monumental undertaking.

Two more exercises of reduced scale were carried out over the last weeks in January and into the first weeks of February. On January 30, Captain Stewart led a four day trek with fewer vehicles primarily to test the radios after adjustments had been made following their dismal performance in Exercise Kelsey. The operation was dubbed "Ice Worm." While the exercise was away, Commander Cleghorn's force experienced its only fatalities of the entire mission. The American construction of the base shelters had been completed using tar-paper wall covering and the wooden floor boards of the buildings were soaked with fuel oil in the areas around the heating stoves where the previous residents had been less than careful about

¹²⁷ Gordon Watson, *Diary of Gordon D. Watson, Scientific Observer of Exercise Musk-Ox*, personal copy of Mr. Watson, 1946: entry for January 21,23.

¹²⁸ *Ibid.*

¹²⁹ D His DND, 95-52, John Lauder, Base Force, "Tracks North", unfinished manuscript, 25.

spillage. These factors eventually led to fire on the morning of February 3.¹³⁰

The fire started in the Officer's Mess and quickly became a raging wall of flames. The men could do little at first to contain the blaze. There were no hoses available and the bitter cold of the evening made the situation worse. The fire had galloped out of control and temporarily threatened much of the base. Finally, a bulldozer was mobilized to knock down the walls connecting the other buildings.¹³¹ When the fire burned down, the soldiers would discover that there had been two men trapped in the mess. Their bodies had almost completely been consumed by the inferno.¹³² The event cast a sombre mood over the camp and Wilson immediately established a Court of Inquiry to examine the cause of the fire. Cleghorn organized frequent drills afterwards to keep the men on their toes.

Following on the heels of Ice Worm, seven Snowmobiles and one Weasel, again under the command of Baird, set out on the last exercise before the main launch. Exercise "Hearne" again encountered difficulty and Baird lost a Snowmobile as it broke through shell ice and had to be abandoned.¹³³ Hearne was the final test run for the Musk Ox contingent before the anticipated departure of the expedition on February 14, 1946.

Though perhaps ground operations were not running as smoothly as had been hoped for, Air Operations were meeting with some trouble of their own. The ASU had been

¹³⁰ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for February 3.

¹³¹ Ibid.

¹³² NAC, RG 24, Reel C-8419, File 9012.564-13 No. 1, "Two Soldiers Die When Fire Destroys 'Muskox' Barracks", The Ottawa Journal, February 4, 1946.

¹³³ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for February 5.

initially assembled at Base Uplands in Ottawa and established their first remote main base at Gimli, Manitoba in December, 1945.¹³⁴ The unit was comprised of six Dakota C-47 aircraft and three C-64 Norseman.¹³⁵ Main Base shifted to Churchill on January 6, 1946. Maintenance would continue to be carried out from Gimli until February 14 when maintenance responsibilities were then shifted to Yellowknife. At that time the main unit was split up into two sections, two Dakotas and one Norseman were stationed at the airfield in Yellowknife and the rest of the aircraft remained at the Churchill base. ASU also planned to establish three other staging posts, one at Baker Lake and the others at Cambridge Bay and Port Radium.¹³⁶

Three weeks of training were carried out in Gimli during December, 1945 by the ASU. The air supply personnel were selected from Army personnel and were taught air supply techniques. Training consisted of packing parachutes and learning how to work on air supply drop crews.¹³⁷ The Dakotas landed on wheels and could only land safely on cleared runways. The Dakotas generally, therefore, had to parachute supplies to the convoys and were the most efficient method of carrying large amounts of cargo available at the time. Few of other the men that were connected with the ASU had any sort of previous air supply training either. When the main base at Gimli moved to Churchill on January 6, 1946, an

¹³⁴ D His DND, 181.002 (D304), NWAC File 204-13, "Op. Musk Misc. reports corres. 22 Oct. 45 to 22 Mar. 47, re. plan and progress & results of Musk-Ox," Signals Report, May 27, 1946.

¹³⁵ Ibid.

¹³⁶ D His DND, 181.003 (D1452), "No.1 Air Supply Unit RCAF Musk Ox Final Report", 1946, 1.

¹³⁷ D His DND, 114.301009(D31) Ex "Musk Ox", Interim Report, Reports on Air Supply Exercise "Musk-Ox", 1946, 1.

intensive six week training program began for the ASU¹³⁸ The training allowed the air crews their first opportunity to deliver cargo to the full Moving Force, complete with Snowmobiles, and also exposed them to some of the hazards of Arctic flight.

The Moving Force carefully plotted locations for air drops and the ASU relied on them to maintain an accurate course.¹³⁹ For the air crews, the astro compass and drift recorder were the most accurate method of navigation in the Arctic and the aircraft could track their course accurately and use the sun or the moon to determine ground speed depending on the azimuth.¹⁴⁰ Once the Dakotas were in range of 25-30 miles from the Snowmobiles, they would home on a signal broadcast from the Moving Force.¹⁴¹ Still, when preparing a direct drop, the air crews needed to have a visual fix on the force to ensure the load would be delivered on target. Weather at times made this difficult.

On Operation Kelsey, the air crews, as mentioned before, were unable to spot the Moving Force from the air easily when there was blowing snow. One of the Norseman while taking off to meet Kelsey, suffered a tear in its fuselage when it turned into a snow drift. Repairs had to be improvised by the maintenance crews until proper replacement parts arrived from the south.¹⁴² Churchill possessed only one aircraft hangar, which was almost

¹³⁸ Ibid.

¹³⁹ D His DND, 181.003 (D1452), "No.1 Air Supply Unit RCAF Musk Ox Final Report", 1946, 37.

¹⁴⁰ Ibid.

¹⁴¹ Ibid.

¹⁴² D His DND, 181.002 (D304), NWAC File 204-13, "Op. Musk Misc. reports corres. 22 Oct. 45 to 22 Mar. 47, re. plan and progress & results of Musk-Ox, No. 1 ASU Muskox-Weekly report: January 1-29 inclusive, 1946.

impossible to heat. The hangar was heated by a portable "Herman Nelson Heater", and there were only a few of these units that were serviceable with no spares available to the ground crews.¹⁴³ In Arctic conditions, the aircraft generally had to be preheated before takeoff and the single hangar meant only one of the Dakotas could be heated at a time resulting in delays in turn around. Though there were some complications in Arctic operations, the ASU was performing well in their main function of resupplying the Moving Force.

The Dakota crews became adept at parachuting cargo. During the training stages at Churchill, ASU maintained a very low rate of loss of supplies due to damage or inaccurate releases.¹⁴⁴ The Norseman bush planes were fitted with skis and could land on relatively short lake airstrips that did not necessarily have to be cleared. They were used to recover many of the dropped parachutes that were abandoned by the Moving Force once they had recovered their supplies from the parachute's harness. The rugged single engine planes proved themselves on the many confined makeshift runways where they met the Moving Force. Norsemans provided the Moving Force with a dependable method for evacuating men or materiel that was in need of repair or replacement. The Moving Force, Base Force and the ASU, were at last prepared for their scheduled February 14 departure. Musk Ox, however, really began with the Graham Rowley's advance party's departure for Baker Lake on January 24.

¹⁴³ Ibid.

¹⁴⁴ Ibid.

Chapter Three: Musk Ox Begins

Some 490 miles from Churchill lay Baker Lake. Early in the design stages of the exercise, it became clear that, in order for the RCAF to safely supply the Moving Force, it would be necessary to establish a meteorological site at Baker Lake in the North West Territories.¹⁴⁵ In addition to this function, the Baker Lake scientific station provided a control for magnetic observations taken by the Moving Force. It was anticipated that it would be necessary to establish the station one week in advance of the Moving Force's arrival at Baker Lake, which would also to serve as a landing strip and supply depot. The distance from Churchill to Perry River return was over 1500 miles and, in order to allow the ASU to operate economically and, safely, an airstrip would have to be prepared along the route. Baker Lake would be the first of three such staging posts employed by the ASU; the other two were later established at Cambridge Bay and Port Radium.¹⁴⁶

The Musk Ox team planned to leave as early as possible in January, but the late arrival of some heavy duty winches for the tractors postponed their departure until late January.¹⁴⁷ Rowley's team would consist of two parts, two snowmobiles with seven men and two D-6 Caterpillar Tractors (bulldozers) with four men. Of the four men on the tractors, two were civilian operators and the other two were Army operators. Rowley put a civilian in

¹⁴⁵ D His DND, 112.3E1 (D19), CAORG MEMORANDUM #36, "BAKER LAKE FORCE REPORT", 1946.

¹⁴⁶ D His DND, 181.003 (D 1452)," No 1 Air Supply Unit RCAF Final Report on Exercise Musk Ox", 1946, 1.

¹⁴⁷Rowley, Geographical Journal, Vol. CIX No. 4-6., (October 1947):177.

charge of the tractor train, Eric Carlson.¹⁴⁸ Carlson was selected because he had served as a mate on a ship that sailed the coastline north of Churchill. He was familiar with the land line on the route and could assist the party in navigating.¹⁴⁹ The Colonel would travel with the Snowmobiles.

The first tractor left on January 20, but due to more mechanical problems, the second was unable to leave Churchill until the 23.¹⁵⁰ On January 24, the Snowmobile party left the base camp.¹⁵¹ The Snowmobiles were much faster than the D-6's and scouted ahead of the tractors for the best route. Baker Lake Force's course would take them directly from Churchill to Eskimo Point then from Eskimo Point to the east end of Baker Lake then across the lake, heading west along the north shore until arriving at the Hudson Bay Post.¹⁵²

One tractor towed a caboose which served as living quarters for the four tractor operators and also provided a readily available heated space for pre-heating oil for the tractors, for drying clothes and thawing anti-freeze.¹⁵³ There was a constant danger of the bulldozers going through the ice and the crews could not travel in a closed cab for fear of being trapped in the frigid waters.¹⁵⁴ Travelling in an exposed cab where temperatures

¹⁴⁸ NAC, RG 24 Vol. 13884, War Diary of Exercise "Musk-Ox":January 1-31, 1946.

¹⁴⁹ Ibid.

¹⁵⁰ D His DND, 112.3E1 (D19), CAORG MEMORANDUM #36, "BAKER LAKE FORCE REPORT", 1946, 3.

¹⁵¹ Ibid.

¹⁵² Ibid.

¹⁵³ Rowley, Geographical Journal, Vol. CIX, No. 4-6., (October 1947): 177.

¹⁵⁴ Ibid.

regularly dipped below minus 40° F and winds blow snow like sand against the face, was a test of spirit for the operators.

The tractors travelled at a monotonous pace and it was expected to take one month to reach their destination. The tractors left first from Churchill but because of their slow speed, the snowmobiles would eventually overtake them and serve as route guides to Baker Lake. In addition to the caboose, the tractors would tow three large cargo sledges and a spare empty one.¹⁵⁵ Caterpillar D-6's have a heavy towing capacity so there would be no need for the Baker Lake force to be supplied by air although one cache of diesel fuel was provided for the force at Eskimo Point by air. Apart from this, the mission was self supported.¹⁵⁶ Norseman aircraft dropped mail to the force from time to time and also relayed messages back to Churchill. The Snowmobiles would each carry their own tracked sled, the kind that was rejected by the Moving Force during their pre-exercise manoeuvres.

Almost immediately after leaving, the Baker Lake Force began to experience some set backs. According to the log:

6. On Jan 28 the tractor train started at first light and we let them get 2 1/2 hours ahead before following in their tracks. Owing to bad going, poor visibility, and a broken sledge the tractor train made slow progress and we caught it up just south of Caribou River which we crossed behind it. On the north bank of the river were an empty cabin and church we visited. Meanwhile the wind had increased and visibility was reduced to a few yards. Just after leaving the church the two snowmobiles became separated and, after waiting an hour and leaving a message on the tractor tracks, returned to the church where the snowmobile had been last seen. As it was drifting too badly to pick out its tracks, camp was made and the tent pitched inside the

¹⁵⁵ D His DND, 112.3E1 (D19), CAORG MEMORANDUM #36, "BAKER LAKE FORCE REPORT", 1946, 4.

¹⁵⁶ Ibid.

church.13 miles were covered during the day. Contact was made with Churchill by wireless at night. . . .¹⁵⁷

On a few occasions during the first days travelling along the route, the snowmobiles became separated and lost and problems with the wireless radio set further complicated the situation.¹⁵⁸ At times, rough ice slowed progress and drifting snow made it difficult for the tractors to follow the tracks of the Snowmobiles. By February 2nd, however, the Snowmobile party was in sight of Eskimo Point where there was an RCMP detachment, a Hudson Bay Post and a small village. On the next day, the tractor train caught up with the Snowmobiles at Eskimo Point. On February 3, at Eskimo Point, the main spring on one of the tractors was found to be broken and nearly the entire weight of the vehicle was resting on a single bolt.¹⁵⁹ Such a failure was virtually unheard of and potentially could have resulted in catastrophic mechanical failure. The bolt lasted till the crews made Baker Lake. When Rowley informed the mechanics back at Churchill that one of the tractors needed a new main spring, they thought the message was incorrect and did not respond to the request initially. The entire exercise was finding that equipment that had preformed well in cold weather or even subarctic conditions did not always perform satisfactorily in Arctic conditions.

Before leaving Eskimo Point, Rowley made arrangements to secure an Inuit guide, Nigiak, to travel with the snowmobile party for approximately half the remaining distance

¹⁵⁷ Ibid.

¹⁵⁸ Ibid.

¹⁵⁹ Ibid. 6.

to Baker Lake.¹⁶⁰ The force would be leaving the waterways for most of way beyond Eskimo Point and Rowley thought it best that he employ a guide that was familiar with the country. Nigiak's village was on the Ferguson River along the route to Baker Lake. After reaching the village, the crews met with the locals and a missionary, Father Cortemanche. Rowley made arrangements for a second older Inuit guide, Nauja, to escort the team the remaining way to Baker Lake.¹⁶¹ His expertise as a guide was invaluable.

Nauja chose the best possible route to avoid unnecessary jarring of the vehicles. Rugged terrain, however, was still taking a toll particularly on the heavy machinery.¹⁶² As the Force continued inland, the bulldozers often had to winch themselves over the rocky outcrops which predominate the eastern Arctic, slowing progress to a mere few metres per hour at times.¹⁶³ Constant jarring caused strain on many parts of the tractor and trailers that they were towing and the crews were constantly improvising repairs on the go to keep the machines functioning, "Broke two front bolsters, repaired same with splints made out of 2" by 4" material and soft wire..."¹⁶⁴ The weather was also still presenting problems.

Sometimes, the combination of strong winds and extreme cold made travel quite impossible. Just eight days removed from their stopover at Eskimo Point, the force would encounter the most severe weather of the entire journey forcing, them to hold over from

¹⁶⁰ Ibid.

¹⁶¹ Ibid. 7.

¹⁶² Personal papers of Graham Rowley, Eric Carlson's Tractor Train Log, January-February, 1946.

¹⁶³ Ibid.

¹⁶⁴ Ibid.

February 11 to February 13:

The only available thermometers were mercury and were frozen, but we found later that the temperature at Baker Lake at this time went down to -56 Fahrenheit and with us it was probably the same. This unusual combination of wind and cold caused the severest conditions I have ever experienced. . .¹⁶⁵

Mechanical failures brought on by the cold required constant vigilance from the crews of both the Snowmobiles and the tractors as they continued on their way to Baker Lake.¹⁶⁶ The tractors' diesel fuel flowed very poorly in the extreme cold and fuel lines became clogged and the diesel engines would lose power and sputter.¹⁶⁷ One of the Snowmobiles was abandoned on the 22nd day of the trek because of an ignition problem. All the essential items that were in the stalled Snowmobile were transferred over to the other operational machine and Rowley forged ahead.¹⁶⁸ Finally, 25 days after departing from Churchill, the Snowmobile party reached Baker Lake on February 17 with the tractor train arriving the following day.¹⁶⁹

The first order after arriving at Baker Lake was to clear an airstrip on the ice. Vibration at low temperature had caused the hydraulic system on one of the D-6s' to fail and

¹⁶⁵ Rowley, The Geographical Journal, Vol. CIX Nos. 4-6, (October 1947): 178.

¹⁶⁶ D His DND, 112.3E1 (D19), CAORG MEMORANDUM #36, "BAKER LAKE FORCE REPORT", 1946, 6.

¹⁶⁷ Personal papers of Graham Rowley, Eric Carlson's Tractor Train Log, January-February, 1946.

¹⁶⁸ D His DND, 112.3E1 (D19), CAORG MEMORANDUM #36, "BAKER LAKE FORCE REPORT", 1946, 8.

¹⁶⁹ Rowley, The Geographical Journal, Vol. CIX, Nos. 4-6, (October 1947): 179.

only one of the tractors would be able to clear snow.¹⁷⁰ The lone bulldozer worked throughout the day on February 19 and continued through the night and most of the next day preparing the landing field. In the interim, Rowley decided that a Dakota would have to parachute in some much needed supplies on the evening of the 19th. On hearing this news, the locals became quite agitated. Apparently, a Dakota aircraft that had parachuted in some supplies in advance of the force's arrival at Baker Lake, had narrowly missed an igloo with a fuel barrel.¹⁷¹ Rowley quickly arranged to have a drop zone marked out a safe distance from the settlement and which could be illuminated with burning markers in the evening.

Baker Lake received its first visit from one of the large Dakotas on the afternoon of February 20.¹⁷² By this time the airstrip was 3,500 feet long by 100 feet wide and although the surface was glare ice, the cleats on the tracks of the bulldozer roughened the surface enough so that it provided an excellent surface on which to land.¹⁷³ The Dakota made a perfect landing in front of the anxious Baker Lake Force. Eventually, the strip would be lengthened to 4,000 ft by 200 ft which would provide ample room for landing as well as a safety buffer.

The Hudson Bay Company had placed the warehouse at their Baker Lake post at the

¹⁷⁰ D His DND, 112.3E1 (D19), CAORG MEMORANDUM #36, "BAKER LAKE FORCE REPORT", 1946, 13.

¹⁷¹ Ibid.

¹⁷² Ibid., 14.

¹⁷³ D His DND, 112.3E1 (D19), CAORG MEMORANDUM #36, "BAKER LAKE FORCE REPORT", 1946, 13 also Rowley, The Geographical Journal, Vol. CIX, Nos. 4-6, (October 1947):179.

disposal of the military. Unfortunately, no one had informed the post manager of this fact.¹⁷⁴ While the bulldozer was busy clearing the runway, the other men hastily prepared the warehouse for its new role as a meteorological and communications centre. On February 22, the magnetic observer was flown in by Dakota to take up residence at the new station.¹⁷⁵ The observer, as previously mentioned, had to establish a temporary magnetic observatory to control magnetic observations that were to be taken by the Moving Force on their journey. With the completion of Baker Lake facility, the first stage of Musk Ox had been completed.

Back at Churchill training was almost complete and the Moving Force was preparing to leave. Baird was still taking every opportunity to promote the civilian and development themes among the visiting press. Colonel Baird even raised the possibility of the Snowmobile's potential use as a type of Arctic tour bus for tourists who would be "... glad to pay \$1000.00 a crack" to travel in the frozen north in comfort.¹⁷⁶ At the end of January, Baird led a small convoy of Snowmobiles carrying the visiting foreign military attaches and some members of the press out to the great stone fortress, Fort Prince of Wales, on Hudson Bay.¹⁷⁷ During an informal ceremony, Baird had one of the fort's old 24 pounder cannons fired in a ceremonial salute to the visiting dignitaries.¹⁷⁸ Musk Ox was set to begin.

¹⁷⁴ D His DND, 112.3E1 (D19), CAORG MEMORANDUM #36, "BAKER LAKE FORCE REPORT", 1946, 13.

¹⁷⁵ *Ibid.*, 14.

¹⁷⁶ NAC, RG 24, Reel C-8419, File 9012.564-13 No. 1, "Polar Tourist Trips For \$1,000 Foreseen", The Ottawa Evening Citizen, January 25, 1946.

¹⁷⁷ NAC, RG 24, Reel C-8419, File 9012.564-13 No. 1, "Guard at Canadian Fort First Time Since 1783", The Ottawa Evening Citizen, January 30, 1946.

¹⁷⁸ *Ibid.*

On February 15, 1946, 11 Snowmobiles and one Weasel travelling in three divisions of four vehicles set out for Baker Lake following the tracks of Rowley's advance party.¹⁷⁹ The Force would encounter the same severe cold front as Rowley. Average temperature for the month of February was a mere minus 24.9°F which was 8° colder than average, a significant variation.¹⁸⁰ With only three men having previous Arctic experience, the extreme cold was very uncomfortable for most of the men.¹⁸¹ Scarcely one day out of Churchill and with mechanical failure already becoming a factor, the entire Moving Force was forced to hold up in a blizzard that reduced visibility to a few feet.¹⁸²

Throughout the two days that the blizzard conditions persisted, the men could do little to get comfortable. Tents offered little refuge from the gale force winds and seemed to take on a life of their own as they flapped with the storm.¹⁸³ Stoves were used to heat each of the tents but they were virtually useless as the wind blew snow down the stove pipes with such force as to make it almost impossible to generate heat:

Some of the tents were caught worse than we were, as the wind changed, was blowing straight in the doors. I threw up a small wall by shovelling- instead of cutting blocks and laying a fancy wall as others were doing. The only answer is an igloo. If the wind keeps up I'll probably go out and building(sic)

¹⁷⁹ Personal Papers of Dr. Patrick Nasmyth, Lieut-Col. N.A.C. Croft, Report by the British Army Observer on Exercise Musk-Ox, Military-Operational Research Report No. 35., 1946, 10.

¹⁸⁰ Ibid.

¹⁸¹ Ibid.

¹⁸² D His DND, 112.3M1009 (D84) U.S. Observers Report on Ex "Musk-Ox", 1945/46,4.

¹⁸³ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for February 16.

one this afternoon. . . .¹⁸⁴

Igloos, however, were not always a realistic alternative. Snow blocks have to be cut from the snow and can not simply be shaped from loose snow. There has to be relatively deep hard-packed snow available in order to build igloos and the bare ice surface of James Bay did not always provides the proper material for the task.

The first mechanical casualty of the exercise occurred on February 17, as the M-29 Weasel had to limp back to base with its front sprockets badly bent.¹⁸⁵ The run to Eskimo Point took the force out onto the James Bay ice for the entire journey and it was rough sea ice that eventually wore down the fragile M-29. The Snowmobiles were also slowed by the rough terrain and forced to reduce their speed to a low range gear. The reduced gear necessitated running the machine at nearly full throttle and the "hammering" even at the slow speed, was all that the men inside the confined quarters of the modified snowmobiles could endure.¹⁸⁶ Even when the terrain opened up, the Snowmobiles could not be run in high gear for long or the engines would overheat. This design flaw plagued the force all along the journey.

For all of the problems that the Moving Force was encountering, they still had not yet traversed 50 miles in all. There were still over 3000 miles to go and, Gordon Sangster, the vehicle expert commented, "The romance of Musk-Ox has had the edge taken off a little

¹⁸⁴ Ibid.

¹⁸⁵ Ibid.

¹⁸⁶ Personal Papers of Dr. Patrick Nasmyth, Lieut-Col. NAC Croft, Report by the British Army Observer on Exercise Musk-Ox, Military-Operational Research Report No. 35., 1946, 10.

bit!".¹⁸⁷

An article about the experimental aspects of the exercise appeared in the February 18, 1946 Newsweek.¹⁸⁸ The article was one of the rare pieces that centred on the expedition's role in the potential future development of the north, "Miners believe it will advance by twenty years their knowledge of the Canadian Arctic, the touchstone for development of natural resources."¹⁸⁹ The article went on to describe the Penguin as a versatile transport that would some day make all of the north accessible to the public. Regarding the apparently secret tactical nature of the exercise, the piece quoted Minister Abbott, "It just isn't so. . . If there was no Russia, or no land mass on the other side of the Pole, we would still have every reason to hold this exercise."¹⁹⁰ The article exaggerated the civilian contributions of the exercise but it was almost exactly what Wilson had attempted to emphasize in his earlier press releases and radio address. Despite this opportunity, CAORG failed to capitalize on the publicity and the column went virtually unnoticed.

The Force had barely started again when another blizzard blew in and forced another halt on February 18 and 19.¹⁹¹ By this time, Musk Ox had made it to Hubbard's Point (or Nunulla), a former Hudson Bay Post along the coast of Hudson Bay , where a cache of fuel

¹⁸⁷ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for February 16.

¹⁸⁸ NAC, RG 24, Reel C-8419, File 9012.564-13 No. 1, "Canada Tests Its Icebound Barrens With Column of Mechanized Troops", Newsweek, February 18, 1946.

¹⁸⁹ Ibid.

¹⁹⁰ Ibid.

¹⁹¹ D His DND, 112.3M1009 (D84), US Observers Report on EX "Musk-Ox" 1945/46, 5.

and supplies had been left by the ASU. Other than direct parachute drops, cache provided the other most common method for delivering supplies. Caches were laid ahead of the Moving Force. The usual procedure for preparing a cache would involve landing a Norseman at the proposed site to establish drop markers in the form of a "T" laid out in the snow.¹⁹² Supply stores were never set out in the featureless barren ground and were most often deposited near some landmark that could easily be identified by the Moving Force. A recovery crew aboard the Norseman would reclaim any parachutes after the drops were made where possible.

There were 4 small buildings at the Hubbard's Point, only 3 of which were habitable. Not all of the men could be accommodated in the buildings at once, and so some men elected to sleep in their vehicles while the others set up camp in the buildings or pitched their tents outside near the shacks.

The final leg before Eskimo Point was 96 miles and Baird decided to attempt the distance in one single movement even though their progress to this point had been continuously hampered by rough ice and extreme weather. The team took a chance and moved out in the early hours of February 20, when there was a lull in the weather. The 2nd and 3rd Divisions got started at shortly after midnight while 1st division had to delay departure until 0100 hours because of an ignition problem.¹⁹³ The force pulled into Eskimo Point that evening having been delayed for three of the six days it had taken to reach their

¹⁹² D His DND, 181.003 (D 1452), "No 1 Air Supply Unit RCAF Final Report on Exercise Musk Ox", 1946, 37.

¹⁹³ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for February 20.

destination and after having covered only 206 miles.¹⁹⁴ Despite the several set backs that the force encountered, the Snowmobiles and the sleds had managed to avoid any severe mechanical failures.

While at Eskimo Point, the force was well cared for by the local inhabitants. Some of the men were lodged in the mission and others were put up in the RCMP detachment. After the gruelling week spent on the trail, the men were grateful to sleep warm indoors. The team's Medical Officer, Captain Robert Croome, made rounds when Musk Ox arrived in a community. Croome also performed a regular medical tour of the force on layovers to record any ailments and report on any noteworthy effects of the exercise on the men. The doctor tended to the needs of any that were ailing as best he could but sometimes had to have simple cases evacuated.¹⁹⁵

The first two casualties of the exercise were treated at Eskimo Point and were airlifted out to Churchill by Norseman to recuperate.¹⁹⁶ Both were suffering only minor ailments, one with a wrenched knee and the other a nasal haemorrhage, but still neither could be properly cared for on the move.¹⁹⁷ It was ASU policy to keep a Norseman within "hopping" distance of the Moving Force at all times for just such occasions.¹⁹⁸ Were it not

¹⁹⁴ D His DND, 746.033 (D2) Winter Ex "Musk Ox" 1946, "Canadian Army Winter Exercise Musk Ox: 1946", prepared under the direction of the Chief of General Staff, 1947, 37-38.

¹⁹⁵ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for February 21.

¹⁹⁶ Ibid.

¹⁹⁷ Ibid.

¹⁹⁸ D His DND, 114.301009(D31) Ex" Muskox", [Interim Report] Reports on Air Supply Exercise "Musk -Ox", 1946, preamble.

for air support and radio communication, any minor wound could suddenly become catastrophic in the harsh environment.

During stopovers, some of the men took the opportunity to meet and trade with local crafts-people. Often the men would exchange their Army outer-wear for native caribou skins which proved to be superior to anything the Army had in their inventory because of their lightness, flexibility and great warmth.¹⁹⁹ Almost the entire military compliment had no previous experience with Inuit or Cree cultures and the encounters that they shared were generally learning experiences for both cultures. The Moving Force personnel, however, soon realized that the northern natives were well adapted to surviving on the land and took every occasion to learn from their ways. Much of the clothing that had been supplied by the Army was not equal to its indigenous counterpart.

The three divisions of the Moving Force left Eskimo Point on the 21st now headed inland over the same route that been travelled by Rowley and his advance party.²⁰⁰ Musk Ox was able to follow Rowley's tracks for long periods which was a surprise to the Moving Force considering the high winds and blizzards that had recently blown through the area. Wherever possible, Musk Ox tried to remain on the river ice and frozen lakes but the areas between the waterways were boulder strewn and consequently difficult to navigate.²⁰¹ Breakages that had riddled Rowley's vehicles were now becoming a problem for the main

¹⁹⁹ D His DND, 746.033(D2) Winter Ex "Musk Ox" 1946, "Canadian Army Winter Exercise Musk Ox: 1946", prepared under the direction of the Chief of General Staff, 1947, 89.

²⁰⁰ *Ibid.*, 39.

²⁰¹ Personal Papers of Dr. Patrick Nasmyth, Lieut-Col. N.A.C. Croft, Report by the British Army Observer on Exercise Musk-Ox, Military-Operational Research Report No. 35, 1946, 11.

force. Fuel stoppages and leaking fuel lines became a recurring malady early in the journey. When the path was clear, the Snowmobiles could maintain 20 mph for some distance before having to reduce their speed for fear of overheating the engines.²⁰² Weather also continued to be a determining factor. The entire force was halted due to blizzards on February 24, 26 for the better part of the 27th and again, all day on the 28th.²⁰³ On the 28th, the Force very nearly avoided tragedy.

Seven days out from Eskimo Point, on Lake Kaminuriak, the party was halted by perhaps the worst blizzard that had been experienced thus far. Some time during the evening, the wind, which had been facing the Snowmobiles when they stopped, had shifted to a tailwind.²⁰⁴ The Moving Force had decided to remain in the cabs of their vehicles instead of pitching their tents or making igloos. It was almost a fatal decision. The winds whipped snow into any crevice that was exposed on the vehicles, covering the engines under their hoods with several inches and inside the cabs with little mountains of snow.²⁰⁵ Every 12 hours or so, it was the practice to start the engine to warm them up for a while before letting them lie dormant again. On this occasion, with the wind blowing from behind, deadly carbon monoxide fumes were pushed directly into the cab from the rear of the vehicle:

After much persuasion we had the bus purring again on all eight by 1330

²⁰² D His DND, 746.033(D2) Winter Ex "Musk Ox" 1946, "Canadian Army Winter Exercise Musk Ox: 1946", prepared under the direction of the Chief of General Staff, 1947, 39.

²⁰³ D His DND, 112.3M1009 (D84), US Observers Report on EX "Musk-Ox" 1945/46, 5.

²⁰⁴ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for February 28.

²⁰⁵ Ibid.

hours. I looked up from the instrument panel to see Vic stagger towards us through the snow. His face was blue and he was floundering out of control so I yelled to Walter to reach out and drag him in. He was shaking from head to foot and twitching like a man with palsy. . . .²⁰⁶

Nearly a third of the force was temporarily incapacitated by the fumes and 50% were affected to lesser degrees.²⁰⁷ Many of the men, by the very nature of the illness, were not aware they were succumbing to a deadly slumber. Carbon Monoxide was a constant problem during the entire exercise, "It is the opinion of the Medical Officer that low grade carbon-monoxide poisoning was universal during the exercise until the weather became warm enough for personnel to ride outside."²⁰⁸ Whenever the train was halted again, the drivers made sure that they were turned into the prevailing winds.

From Lake Kamuriak, there were still 85 miles until the party reached Baker Lake. Baird's First Division made the run non-stop in 23.5 hours, arriving on March 1 at approximately 1800 hours.²⁰⁹ The other two divisions were delayed by fuel shortages and had to wait for an air drop and Two Division was further delayed by a broken steering yoke, another problem that would reoccur through out Musk Ox.²¹⁰ One of the D-6's was sent with

²⁰⁶ Ibid.

²⁰⁷ Personal Papers of Dr. Patrick Nasmyth, Lieut-Col. NAC Croft, Report by the British Army Observer on Exercise Musk-Ox, Military-Operational Research Report No. 35., 1946, 11.

²⁰⁸ D His DND, 114.301009 (D31) "Ex Musk Ox", Medical Report-Exercise Musk-Ox, 1946, 11.

²⁰⁹ Personal Papers of Dr. Patrick Nasmyth, Lieut-Col. NAC Croft, Report by the British Army Observer on Exercise Musk-Ox, Military-Operational Research Report No. 35., 1946, 11.

²¹⁰ Ibid.

a trailer of fuel to meet the other Snowmobiles.²¹¹ The Two and Three Divisions would require 35 hours to travel the last stretch to Baker Lake. Baker Lake was a planned stop-over point where the crews could conduct required maintenance and receive any spare parts that were required before moving on.

The Snowmobiles had been consuming a far greater amount of petrol than had been anticipated. This was partly because of the fact that the engines were being driven almost continuously at high RPM in low gear. ASU's limited flight resources were taxed to the limit meeting the Moving Force's appetite for fuel. There was now a fear that the RCAF could not maintain an effective fuel supply for the entire Moving Force beyond Baker Lake. The next leg was to Perry River 372 miles away, making this section of the journey the furthest flight for the ASU.²¹²

Wilson arranged a meeting at Baker Lake with Baird, Showler and senior RCAF officers, including Air-Commodore L.E. Wray, to discuss the logistical requirements of the exercise and to develop a plan to deal with the increased fuel demand for the rest of the expedition. The Baker lake meeting was not unique. Along the way, Wilson and Wray along with other senior officers, often visited Musk Ox by air. Showler began the meeting by stating that he was not satisfied with the level of cooperation he was receiving from the

²¹¹ D His DND, 112.3E1 (D19), CAORG MEMORANDUM #36, "BAKER LAKE FORCE REPORT", 1946, 15.

²¹² D His DND, 746.033(D2) Winter Ex "Musk Ox" 1946, "Canadian Army Winter Exercise Musk Ox: 1946", prepared under the direction of the Chief of General Staff, 1947, 39.

Moving Force.²¹³ The heavy fuel consumption meant that the ASU had to drastically increase its number of supply flights. He complained that the Army had apparently no appreciation of the time factors involved in the turn-around for delivering air supplies and placed unrealistic demands on the ASU.²¹⁴ In order to reduce some of the strain on the air contingent, it was decided that the force would be reduced to two divisions of 5 vehicles each.²¹⁵ This would alleviate pressure on fuel rations. After the American Weasel had broken down, Baird originally planned to pick up a replacement vehicle from Rowley's parade but with the fuel consumption now a factor, the Commanders also agreed not to replace the crippled M-29.²¹⁶ Two vehicles from the Moving Force had experienced severe mechanical failures and instead of changing engines, one of them was replaced with a Snowmobile from the Baker Lake Force.

Musk Ox was delayed by weather again at Baker Lake and the ASU that was grounded back at Churchill. Moving Force was awaiting the delivery of some critical replacement parts for the Snowmobiles. Meanwhile, the men took the four days to rest and enjoy the few creature comforts that were afforded them at the settlement. Some of the men were given accommodation by two Roman Catholic missionaries and a Anglican minister.²¹⁷

²¹³ D His DND (D34) NWAC File 204-13 "Op. Musk Misc. reports corres. 22 Oct. 45 to 22 Mar.47 re: plans, progress & results of Musk-Ox", Weekly Report [ASU] February 28th to March 6th.

²¹⁴ Ibid.

²¹⁵ Personal Papers of Dr. Patrick Nasmyth, Lieut-Col. N.A.C. Croft, Report by the British Army Observer on Exercise Musk-Ox, Military-Operational Research Report No. 35., 1946, 12.

²¹⁶ Ibid.

²¹⁷ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for March 2.

Other shelter was provided by the Hudson Bay Factor and the RCMP corporal stationed there.²¹⁸ The warm buildings were a welcome break from the frigid weather that had dogged the men since Churchill. On March 6, after receiving their supplies, the Moving Force left for Perry River and uncharted territory.²¹⁹ They were also no longer able to follow the trail of Rowley's force.²²⁰

The next section of the trek was the longest uncharted portion of the journey. The first day out of camp, Baird made a slight miscalculation in his course and temporarily diverted the Moving Force off course for about 30 miles.²²¹ The second day, the Divisions moved into uncharted territory, only grid lines appeared on the air navigation charts that they used to navigate.²²² On March 8, three Dakotas delivered 24, 45 gallon barrels to the Moving Force. As the force moved further out, the topography became increasingly rugged and elevated. Considerable time had to be spent hunting for traversable gullies through the rocky hills.²²³

Travel over jagged rocks was resulting in damage to the Snowmobiles but to this

²¹⁸ Ibid.

²¹⁹ Personal Papers of Dr. Patrick Nasmyth, Lieut-Col. N.A.C. Croft, Report by the British Army Observer on Exercise Musk-Ox, Military-Operational Research Report No. 35., 1946, 12.

²²⁰ Ibid.

²²¹ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for March 2.

²²² Personal Papers of Gordon Watson, Diary of Gordon D. Watson, Scientific Observer of Exercise Musk-Ox, 1946: entry for March 7.

²²³ Personal Papers of Dr. Patrick Nasmyth, Lieut-Col. N.A.C. Croft, Report by the British Army Observer on Exercise Musk-Ox, Military-Operational Research Report No. 35., 1946, 12.

point, they were minor. Two of the sledges that were being towed, however, became unserviceable and had to be abandoned. Until Baker Lake, each Snowmobile had been pulling two sleds, a Canadian design and an American unit behind it.²²⁴ Two additional Canadian trailers were added at Baker Lake. One of each type had failed.

On March 11, the Moving Force attempted to have a Dakota drop in an American sled by parachute, but this proved to be a disaster. Both of the chutes that were attached to the sled failed to open properly and the trailer disintegrated when it hit the ground.²²⁵ The Moving Force continued on, searching for the Perry River Post located at the mouth of the river on the Arctic ocean approximately 140 miles to the south-east of Cambridge Bay. Maps were of no use to the Moving Force at this point and navigating was becoming increasingly difficult. By March 13, the Force had not reached the Perry River Post and Colonel Baird had set out to reconnoitre the area in front of the party to get a fix on their position. The Force had been following a river which they had assumed to be the Perry.²²⁶

While Baird was searching, a RCAF Norseman landed beside his column. The pilot, Squadron Leader J.C. Coombs, was Jack Showler's second in command and reputed to be the most experienced bush pilot in the north. He had just come from the Perry River Post.²²⁷

²²⁴ D His DND, 746.033(D2) Winter Ex "Musk Ox" 1946, "Canadian Army Winter Exercise Musk Ox: 1946", prepared under the direction of the Chief of General Staff, 1947, 66.

²²⁵ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for March 11.

²²⁶ Personal Papers of Gordon Watson, Diary of Gordon D. Watson, Scientific Observer of Exercise Musk-Ox, 1945-46: entry for March 8.

²²⁷ Personal Papers of Dr. Patrick Nasmyth, Lieut-Col. N.A.C. Croft, Report by the British Army Observer on Exercise Musk-Ox, Military-Operational Research Report No. 35., 1946, 12.

He told Baird that, in fact, the river that they had been travelling on was the Pitok and not the Perry and that, if the columns followed it to the mouth at the Queen Maud Gulf and then turned westward along the coast, they would find the Perry River Post. On March 13, the force arrived at Perry guided the last few miles by a local Inuit. The Force was now 8 days behind schedule.

The stay at Perry was a brief but eventful one. The Perry River Post was very small and did not have an airstrip. After arriving there, Captain Croome discovered that a young boy was apparently suffering from acute appendicitis.²²⁸ Croome was concerned that the child might perish if he did not operate. There was also a risk that, unless a plane could evacuate the boy soon after the operation, he might also die. After confirming that a Norseman would be able to pick up the patient, Croome prepared for emergency surgery in one of the buildings at the post.²²⁹ ASU confirmed that there was no way to get a Norseman there and back in under 48 hours and that the flying was particularly hazardous on that section at the best of times.²³⁰ After opening the child's abdomen, it was discovered that the boy's situation was more grave than previously thought and that there was little that Captain Croome could do. It was decided to close the patient and wait for the evacuation.²³¹ A Norseman flew in the next day and airlifted both the Doctor and the little boy out to

²²⁸ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for March 13.

²²⁹ Ibid.

²³⁰ D His DND (D34) NWAC File 204-13 "Op. Musk Misc. reports corres. 22 Oct. 45 to 22 Mar. 47 re: plans, progress & results of Musk-Ox", Weekly Report[ASU] March 7th to March 13th.

²³¹ Ibid.

hospital at Akalavik where he recovered. The Captain would later be flown back to Musk Ox on the trail.

The flight to Perry River was gruelling for the pilots of the Dakotas. The Round trip from Churchill was a distance of some 1400 miles. On March 14, four Dakotas dropped in 8.5 tons of supplies to Musk Ox in under one hour.²³² Together with the regular supply of fuel and mail, the Dakotas also dropped 6 sets of Canadian type sled runners to replace the ones that had been damaged on the way to Perry River. Cambridge Bay was 138 miles away across sea ice.

Cambridge Bay was a sprint compared to what the exercise had faced up to this point. Out on the sea ice, the surface was smooth and the Snowmobiles could use their high range gear for extended periods reducing fuel consumption and without excessive overheating of the engines. The two divisions made 63 miles on March 14, the first day out of Perry, and the next day travelled the remaining 75 miles to Cambridge Bay in less than 9 hours.²³³ Cambridge Bay was another planned stop over point.

Driving into Cambridge Bay, the Divisions were met by a greeting party from the community consisting of the Hudson Bay factor and his wife, the RCMP and several native community members.²³⁴ Cambridge Bay is where the RCMP ship "St. Roche" had wintered. The St. Roche was renowned for its two harrying voyages through the North-west Passage.

²³² Wilson, The Polar Record, Vol. 5, Nos. 33,34 ,(January-July 1947): 22.

²³³ Personal Papers of Dr. Patrick Nasmyth, Lieut-Col. NAC Croft, Report by the British Army Observer on Exercise Musk-Ox, Military-Operational Research Report No. 35., 1946, 12.

²³⁴ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for March 15.

Although it was certainly not an impressive vessel to look at, it was a welcome sight to the men, especially Frank Riddell, the signals officer. Henry Larsen was the ship's skipper and an old trapping partner of Riddell.²³⁵ The stay in Cambridge allowed the two to reminisce and renew their old friendship. Riddell and his Snowmobile crew were invited to stay on board the St. Roche for the duration of their stay in Cambridge Bay.

Once again, the local inhabitants extended a warm greeting to the exercise and billeted the men in their homes and work places. On March 16, Col. Baird announced that a small party of 15 men in three snowmobiles would make a dash due north for Denmark Bay.²³⁶ The crews travelled without air support and crammed an additional crew member into the cab of each vehicle. Round trip was 239 miles across a narrow section of Victoria Island. The North Magnetic Pole was only 100 miles east of Victoria Island and the sortie to Denmark Bay would allow the magnetician an excellent opportunity to take observations and recordings.²³⁷ Readings were taken by Morris Innes, a representative of the Dominion Observatory, one of the three civilian observers accompanying the Moving Force.²³⁸

The rest of the machines were scheduled for inspection and maintenance while the Denmark Bay party was away. One of the engines had to be replaced completely and there

²³⁵ Ibid.

²³⁶ Ibid.

²³⁷ Ibid.

²³⁸ D His DND, 746.033(D2) Winter Ex "Musk Ox" 1946, "Canadian Army Winter Exercise Musk Ox: 1946", prepared under the direction of the Chief of General Staff, 1947, 129.

were a host of other minor problems that needed attention as well.²³⁹ A large patch of wind blown ice enabled the RCAF to establish a staging base. Cambridge Bay received their first visit from two Dakotas while Musk Ox was halted at Cambridge Bay. This was a first for the RCAF, which had never landed a twin engine plane that far north. A rare period of spare time allowed several members of the force to try their hand at dog sledding.

As Baird's team neared the magnetic pole, compass readings would become less reliable than in other sections of the trip. The party would rely on dead reckoning, a sun-compass card, and watching the drifts from the prevailing winds.²⁴⁰ Two sextants were used to obtain relative positions on the move and astro fixes when the party halted and the magnetician was able to supply very accurate astro fixes by theodolite when there was time enough to stop.²⁴¹ Baird planned to allow four days for the round trip to Denmark Bay, which would allow almost 24 hours for Innes to perform his observations. The terrain was relatively smooth on route and the small force was able to use its high gears for long stretches of the route. On March 19, the team reached its destination and Innes set out his instruments to take magnetic readings and astro fixes.²⁴²

Denmark Bay marked another milestone for Musk Ox. No European had ever made

²³⁹ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for March 17.

²⁴⁰ Personal Papers of Dr. Patrick Nasmyth, Lieut-Col. N.A.C. Croft, Report by the British Army Observer on Exercise Musk-Ox, Military-Operational Research Report No. 35, 1946, 14.

²⁴¹ Ibid.

²⁴² D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for March 19.

the trip along that route before.²⁴³ Previous expeditions had mapped the area from the coast and therefore could only accomplish rough approximations of where landmarks were in relation to their position. Baird's team however was able to take readings inland, the most accurate to that date.²⁴⁴ There was some conjecture on which side of the bay the Baird had arrived but there was absolutely no way to determine their position from the map. It indicated that the party should have been in the middle of valley surrounded by hills but there was no such landmark anywhere in sight.²⁴⁵ Innes was able to determine that they were 200-250 miles to the west of the magnetic pole.²⁴⁶ The men took a brief period to bask in their achievement and many pictures were taken before they turned in for the night near the top of the world. The following day, March 20, the party set out for their return journey to Cambridge Bay. The column followed its original path the first day back. On the second day, Baird decided to travel a different route back to base through an Inuit village.²⁴⁷ After a brief diversion, with fuel running low and no village in sight, Baird again changed his course and returned to the original route. The Norseman was still back at Cambridge Bay and the team radioed their temporary base that they would need fuel deposited at a cache on the return

²⁴³ Ibid.

²⁴⁴ Ibid.

²⁴⁵ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for March 19.

²⁴⁶ Ibid.

²⁴⁷ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for March 22.

leg.²⁴⁸ According to the original schedule, Musk Ox should have been already one day's journey away from Cambridge Bay and on its way to Coppermine. Back at Cambridge Bay, some of the men listened to the news on CBC aboard the St. Roche and laughed as they heard the commentator explain that Musk Ox was now 90 miles out from Coppermine.²⁴⁹

On March 21, the Equinox, the entire expedition was reunited at Cambridge Bay. It was time for the men to pack up again and leave their comfortable surroundings. The reunion signalled the closing of Churchill as a main base for the RCAF and entire operation switched headquarters to Norman Wells.²⁵⁰ Cambridge Bay had served as a staging base for the RCAF since February 19.²⁵¹ The men were confident heading west on March 22 that the worst of the cold temperatures and rough winds were now behind them. Musk Ox now headed out on the ice of the Coronation Gulf for 322 miles along the north west coast of Canada and generally smooth travelling compared with the inland routes that the expedition had just traversed.

The sea ice allowed the Divisions to return to a quick pace, at least for a while. The sea ice, however, was rarely completely smooth and periodically there were long ridges where the ice had broken to relieve the pressure in the ice surface from drifting or current. These pressure ridges often presented formidable obstacles, extending for miles in a

²⁴⁸ Ibid.

²⁴⁹ Personal Papers of Gordon Watson, Diary of Gordon D. Watson, Scientific Observer of Exercise Musk-Ox, 1946: entry for March 18.

²⁵⁰ D His DND, 181.003 (D 1452), "No 1 Air Supply Unit RCAF Final Report on Exercise Musk Ox", 1946, 1.

²⁵¹ Ibid.

continuous line of jagged broken ice. Water sometimes escaped to the surface at the cracks and creates a slush hazard. For the Arctic trekker, water was one of the greatest of hazards. Damp clothing wicked away body heat at a much greater rate than air so dry clothing was essential for survival and comfort. Pressure ridges on the way to Coppermine were not impeding the progress of Musk Ox. Drifting snow, however, was problematic and forced the Snowmobiles to reduce gears and speed as the heavy machines bulled their way through the deep snow.²⁵² A farm bob sled had been brought in to experiment with in place of the American sled that had been abandoned at Perry River. The sled was proving unstable and caused the Second Division some delay when it continually overturned.²⁵³ Meanwhile, the First Division was pulling way out in front. A broken radiator hose and failed mainspring on Captain Croome's vehicle forced Second Division to halt out on the ice as the First Division was ready to head inland some 20 miles ahead.²⁵⁴ Baird turned around and headed back to the mechanically troubled stragglers and they set up camp on the sea ice of the Gulf still four days back of Coppermine.

Suspension failures in vehicles from both the First and Second Divisions forced the expedition to reduce speed again. The usual overheating problems were reoccurring and the sled runners were continuing to fail as the Force neared Coppermine.²⁵⁵ On February 27,

²⁵² Personal Papers of Dr. Patrick Nasmyth, Lieut-Col. N.A.C. Croft, Report by the British Army Observer on Exercise Musk-Ox, Military-Operational Research Report No. 35., 1946, 14.

²⁵³ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for March 23.

²⁵⁴ Ibid.

²⁵⁵ D His DND, 746.033(D2) Winter Ex "Musk Ox" 1946, "Canadian Army Winter Exercise Musk Ox: 1946," prepared under the direction of the Chief of General Staff, 1947, 41.

Baird steered the expedition down the Asiatic River and almost immediately realized that it had been an unwise decision. The river was too swift to freeze solid and the Snowmobiles were breaking through shell ice frequently.²⁵⁶ The party had to send out scouts on foot to reconnoitre a route off the ice. The snow proved too deep for easy travel even that way. Finally, the Divisions managed to get off the ice and find their way back to the sea and headed for Coppermine. Musk Ox had encountered its first shrubbery in nearly 1500 miles on their diversion down the Asiatic River and that provided some compensation to the men for the slow progress.²⁵⁷ Adding to the mechanical complications, the transmission on No. 2 Snowmobile had worn out and the vehicle had to be towed for the last 20 miles into Coppermine.²⁵⁸ At 2030 hours the Force came into view of the settlement at Coppermine:

...we finally saw habitation dead ahead and all sighed with relief as it meant warm buildings instead of camping on the ice. Also meant a breathing spell for few days. Believe me, these layovers are becoming increasingly necessary. The edge has come off the trip a bit and tempers are starting to flare at times. Everyone is tired and we are short of restful sleep on the trail.²⁵⁹

The engine on Snowmobile No. 10 had to be completely replaced at the stopover in Coppermine. This provided the planners with the first opportunity to experiment with United

²⁵⁶ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for March 23.

²⁵⁷ Ibid.

²⁵⁸ D His DND, 746.033(D2) Winter Ex "Musk Ox"1946, " Canadian Army Winter Exercise Musk Ox: 1946," prepared under the direction of the Chief of General Staff, 1947, 41.

²⁵⁹ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for March 27.

States C-G4A glider.²⁶⁰ Three un-powered American Hadrian Gliders were modified in Rockcliffe, Ontario for trials in Churchill during the month of March.²⁶¹ The gliders had their bellies reinforced and had cabin heaters plus insulation added to increase crew comfort.²⁶² Dakotas would be used to tow the gliders over the target where they were released and piloted down with supplies on board. After retrieving the contents of the glider, ground crews erected a tower from which a swooping Dakota could snatch an attached cable and carry the glider aloft again. The Moving Force could evacuate men or materiel in this way.

On board the glider that landed at Coppermine was the new engine that was used to replace the failing engine on No. 10 Snowmobile.²⁶³ Engine life became an increasing problem as the journey wore on. The gliders had a substantial payload limit and were able to carry supplies weighing up to 70% of the entire load that could be transported inside the Dakotas, some 3500 pounds.²⁶⁴ Unlike the parachute drops, the gliders could be landed exactly on target, saving valuable time gathering scattered supplies. The Moving Force was impressed by the glider operation and, had the glider been deployed earlier in the journey, it could have served as a useful tool on several occasions when repairs or evacuations were

²⁶⁰ Personal Papers of Dr. Patrick Nasmyth, Lieut-Col. N.A.C. Croft, Report by the British Army Observer on Exercise Musk-Ox, Military-Operational Research Report No. 35., 1946, 15.

²⁶¹ D His DND (D34) NWAC File 204-13 "Op. Musk Misc. reports corres. 22 Oct. 45 to 22 Mar.47 re: plans, progress & results of Musk-Ox", D.A.R. Bradshaw to AOC No. 9 Transport Group, March 1, 1946.

²⁶² Ibid.

²⁶³ D His DND, 746.033(D2) Winter Ex "Musk Ox" 1946," Canadian Army Winter Exercise Musk Ox: 1946," prepared under the direction of the Chief of General Staff, 1947, 27.

²⁶⁴ D His DND, 181.003 (D 1452)," No 1 Air Supply Unit RCAF Final Report on Exercise Musk Ox", 1946, 80.

needed.

Musk Ox's departure from Coppermine on March 31 was beset with serious mechanical failures. The geography was changing into rolling hills with deeper snow which placed a great strain on the Cadillac engines. Steep hills and poor traction necessitated that the trailers be removed from the Snowmobiles at the bottom of the hills and then winched to the top by cable.²⁶⁵ It was a laborious task, requiring much time. At one point, it took 12 hours to travel a mere 24 miles.²⁶⁶ Captain Stewart's No. 6 Snowmobile blew two engine valves shortly after departing Coppermine.²⁶⁷ It was a mechanical failure that resulted in the Moving Force's first serious casualty. As No. 6 limped along the engine radiator began to boil over, and the driver, Gunner Edward Mowat, received severe burns to his face when he attempted to remove the radiator cap.²⁶⁸ He had to be evacuated as soon as possible.

A Norseman was flown in to wait for the column at Dismal Lake so that Mowat could be airlifted back to hospital. As the party advanced towards the lake, Stewart's machine continued to delay their advance as it plodded along on only eight of twelve cylinders. Mowat had been transferred to the Medical Snowmobile, No. 10. During the last 18 miles to Dismal Lake, No. 10 broke formation and raced on ahead to meet the Norseman but when

²⁶⁵ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for March 31.

²⁶⁶ D His DND, 746.033(D2) Winter Ex "Musk Ox" 1946, "Canadian Army Winter Exercise Musk Ox: 1946," prepared under the direction of the Chief of General Staff, 1947, 41.

²⁶⁷ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for March 31.

²⁶⁸ Ibid.

they arrived, the Norseman was unable to restart its engine and had to overnight on the ice.²⁶⁹

It was now April 2 and spring's warmer weather was presenting a new set of challenges.

Baird had received word that the Petitot River lay open on the way to Fort Nelson. He decided to send the team's only naval officer, Lieutenant James P. Croal, ahead with No. 11's driver, Joseph Marazzo, to assess the problem and provide a solution.²⁷⁰ The two men together with an additional party of men would be landed at the River by glider to build a bridge or rafts to ford the river.²⁷¹ The Petitot was still several days off. Mowat, Marazzo and Croal, departed in the Norseman on April 3. The travelling out from Dismal Lake was still very rough and the terrain difficult to navigate. Colonel Croft's experience as a navigator was much appreciated and he often ran on foot in front of the Divisions keeping them on course and finding a negotiable route.²⁷² On April 4, the exercise had reached the tree line and Great Bear Lake.

The trip across Great Bear Lake to Port Radium proved to be hazardous. The surface ice was like sea ice and there were large banks of pressure ridges. The Medical Snowmobile became wedged in a pressure crack as it attempted to breach a gap soon after leaving the shore.²⁷³ The cab of the vehicle had immediately filled with frigid water and the crew was

²⁶⁹ Ibid.

²⁷⁰ Personal Papers of Dr. Patrick Nasmyth, Lieut-Col. N.A.C. Croft, Report by the British Army Observer on Exercise Musk-Ox, Military-Operational Research Report No. 35., 1946, 15.

²⁷¹ Ibid.

²⁷² D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for April 4.

²⁷³ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for April 4.

lucky to escape with their lives. Had the vehicle not become wedged and continued through the ice, there would have been no chance of escape. Port Radium was only 1.5 miles away at this point and a radio message was sent ahead to the Eldorado Mine located there to send a bulldozer out to assist in removing the trapped Snowmobile.²⁷⁴ By the time the tractor arrived with its driver, a mine employee named John Farmer, night had fallen and the accident site had to be illuminated by the headlights of the Snowmobiles and tractor. Major Gordon Sangster proposed to the driver that the tractor travel across the crack to other to assist in pulling with the Snowmobiles from one direction. As the tractor started across, it somersaulted pinning the driver in the water and under the entire weight of the heavy machine.²⁷⁵ Farmer was killed instantly.

The next day, April 5, a tripod was rigged to lift the tractor off the driver.²⁷⁶ Sometime during the evening, however, his body had gone completely through the ice to the bottom of the lake. Eventually the trapped Snowmobile was lifted out and the men retired to Port Radium where some creature comforts helped to reduce the air of gloom that once again had fallen on the exercise. The mine produced uranium and radium during the War which had been essential in the development of the Atomic Bomb. The mine recreation and housing quarters were well equipped. Ration weary men were treated to fresh vegetables and

²⁷⁴ Ibid.

²⁷⁵ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for April 4.

²⁷⁶ Ibid.

fruit for the first time since beginning Musk Ox.²⁷⁷ The mine manager provided every hospitality to military men many of whom were also able to take their first bath in over two months.

Port Radium had been the RCAF staging post since February 17.²⁷⁸ The Dakotas were able to land at the airstrip there and flew in an engine for No. 6 Snowmobile. In addition, maintenance was carried out on the tracks of several machines.²⁷⁹ Colonel Baird toured the accident site the next day and established a Military Court of Inquiry on April 6 to hear evidence and testimony concerning the unfortunate event.²⁸⁰ On April 8, the men were packed and ready to leave.

By this stage of the journey, the cold weather and blizzards that had slowed the mission along the first half of the journey ceased to be a factor. Fort Norman was 268 miles from Radium and the only impediment to progress was the varied terrain. Out on the ice of the lake, the Divisions encountered several large cracks on the first day that had to be bridged with timber carried by the First Division.²⁸¹ On the second day out from Radium a Norseman

²⁷⁷ Ibid.

²⁷⁸ D His DND, 181.003 (D 1452), "No 1 Air Supply Unit RCAF Final Report on Exercise Musk Ox", 1946, 1.

²⁷⁹ D His DND, 746.033(D2) Winter Ex "Musk Ox" 1946, " Canadian Army Winter Exercise Musk Ox: 1946," prepared under the direction of the Chief of General Staff, 1947, 47.

²⁸⁰ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for April 6.

²⁸¹ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for April 8.

landed with some additional timbers that were distributed to the Second Division.²⁸² A herd of some 400 caribou was spotted out on the ice the same day. Outside of Fort Norman, the crews discovered the first road they had seen since leaving the lake. It was a winter road used by Imperial Oil and the crews were grateful for the easy running for a while. Musk Ox rolled into Fort Norman in the evening of April 11.

On April 12 at Fort Norman, the Medical Crew of Musk Ox prepared for a mock evacuation by glider. A Dakota had landed a glider on the ice in the morning and the force medic, Sergeant Williams, had rigged a stretcher from tent poles and pack boards and loaded Captain Croome on the glider as a test patient.²⁸³ Caught up in the enthusiasm of the moment, too many men had piled on board with the Doctor.²⁸⁴ When the Dakota came in for an attempt it could not get the glider airborne and the cable broke off its moor in the tug aircraft.²⁸⁵ The glider skidded to a halt never having left the ground. Croome was eager for another attempt but Baird thought that was enough experimenting for that day.

The heavy snow and the slight warming trend that the expedition was experiencing as it headed into the sub-Arctic mandated a change in tactics for rest of the operation. There was only a limited number of spare engines available and if the attrition rate continued, the exercise was in jeopardy. All ten of the vehicles had undergone at least one engine change

²⁸² Ibid., entry for April 12.

²⁸³ Ibid.

²⁸⁴ Baird, North, Volume XXV, No. 5, (September/October 1978): 40.

²⁸⁵ Ibid.

by this point, two Snowmobiles were on their third engines.²⁸⁶ Baird decided that it would be prudent to leave the Canadian sleds behind at Fort Norman to reduce drag in the deep snow and save the engines.²⁸⁷ Musk Ox travelled from Norman on the CANOL Tractor Trail through the bush to Fort Simpson. The trail was built to service the CANOL oil project, but had not received any travel recently and the 369 miles on the trail would be difficult to negotiate. Baird decided to send a scout party out in front of the main columns to find a route through the snow and hills. Meanwhile, James Croal had also returned to the Force with his report on his reconnaissance mission on rafting and bridging the open water on the Petitot still several days away.

Showler had dispatched three tug aircraft and three gliders to Fort Nelson for the Petitot Operation under the command of Lt. Col. Butler of the United States Air Force.²⁸⁸ Two gliders were then dispatched to a lake 14 miles from the Petitot. One of the gliders contained all the personnel and the other glider contained the M-29.²⁸⁹ Unfortunately, the glider carrying the Weasel landed down wind at high speed and crashed on landing, resulting in a broken vertebrae for its American pilot.²⁹⁰ The Canadian co-pilot emerged unscathed as did the M-29. The undamaged glider was used successfully to evacuate the wounded pilot

²⁸⁶ D His DND (D34) NWAC File 204-13 "Op. Musk Misc. reports corres. 22 Oct. 45 to 22 Mar.47 re: plans, progress & results of Musk-Ox", Weekly Report[ASU] April 12th to April 18th.

²⁸⁷ D His DND, 114.3001009 (D31)"Ex Musk-Ox" A.G. Sangster (Vehicle Specialist), DVSA OBSERVER REPORT ON EXERCISE MUSK OX, 1945-46, 7.

²⁸⁸ D His DND (D34) NWAC File 204-13 "Op. Musk Misc. reports corres. 22 Oct. 45 to 22 Mar.47 re: plans, progress & results of Musk-Ox", Weekly Report[ASU] April 12th to April 18th

²⁸⁹ Ibid.

²⁹⁰ Ibid.

back to Fort Nelson.²⁹¹ Lt. Croal had all the equipment he needed to ford the river delivered to him by the gliders. Depositing the M-29 by air, saved valuable time and reduced the mechanical risk to the vehicle. The Hadrians were proving themselves to be invaluable in the rugged terrain of the Canadian sub-Arctic.

It was April 14 when the Force left for Simpson on the tractor trail. Baird and Lieutenant Patrick Nasmyth scouted on ahead in their vehicles. On the first day there were two engine failures in No. 6 and No. 11 as the deep snow taxed the engine transmissions to their limit.²⁹² The heavy bush country that the men now found themselves in created a new problem for maintenance and repairs. The Dakotas had fewer choice areas to drop supplies to the Moving Force and the narrow trail did not always allow for on-the-spot servicing. Stricken vehicles sometimes had to be towed to a suitable place to affect repairs.²⁹³ To avoid increasing hardships, it was decided to rest in the warm of the days and travel at night when temperatures would drop and the snow would firm up.²⁹⁴ News of the mechanical troubles Musk Ox was all that was being reported by the press at this point in the journey.²⁹⁵ Besides the mechanical and geographical problems that the Moving Force was dealing with, the men were beginning to tire of each other's company after travelling 2000 miles together in tight

²⁹¹ Ibid.

²⁹² D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for April 14.

²⁹³ Ibid.

²⁹⁴ D His DND, 746.033(D2) Winter Ex "Musk Ox" 19461946, " Canadian Army Winter Exercise Musk Ox: 1946," prepared under the direction of the Chief of General Staff, 1947, 41.

²⁹⁵ Various articles reprinted in The Polar Times, No. 22, June 1946.

confines.²⁹⁶ Musk Ox was still one month away from its final destination.

By April 20 and 65 days from Churchill, the Moving Force was on the final few miles to Fort Simpson. The progress had been slow for the trail-breaking party, Baird and Nasmyth, and they had been forced to cut many trees by axe and hand saw from the trail.²⁹⁷ The two men became increasingly fatigued as the trip wore on, and left more trees and obstacles for the two Divisions following to clear for themselves. As they closed on the final major obstacle before Fort Simpson, the Mackenzie River, springtime was now fully upon the Moving Force and the River surface did not look promising.

When the units arrived at the river, it was obvious that Baird had already gone on ahead across the ice from his tracks. Still, the crews could not be sure that the ice may not give way as they passed over. In wide intervals, the Snowmobiles and their crews descended the steep banks of the river and on to the ice.²⁹⁸ The river crossing to Fort Simpson was two miles and when each Snowmobile was ready, the drivers put the Snowmobiles in high gear and headed for the opposite shore at full speed:

The Snowmobiles don't float, but they will do a deep wade safely. I didn't notice the mileage but it must have been two miles across the way we drove. When we climbed the far bank I was able to breathe freely again, but I must admit my nerves were none to steady. I dropped a cigarette trying to light it but then maybe the chill was making me shiver a bit. . . .²⁹⁹

²⁹⁶ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for April 15.

²⁹⁷ *Ibid.*, entry for April 20.

²⁹⁸ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for April 20.

²⁹⁹ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for April 20.

The Moving Force continued straight through Fort Simpson to the Department of Transport airstrip 12 miles outside the town.³⁰⁰ Many townspeople turned out to greet the exercise and watched enthusiastically while Musk Ox pulled their sleds through the muddy streets. Out at the airstrip, the RCAF had landed a glider outfitted as a mobile mechanical shop in preparation for repairs to the Snowmobiles.³⁰¹ Two more replacement engines were landed by a Dakota and the Moving Force's quota of remaining engines was running out.³⁰² The most difficult leg of the journey still awaited Musk Ox, the seven day, 245 mile stretch from Fort Simpson to Fort Nelson.

The weather was rapidly turning mild and the Moving Force anticipated hitting more open water on the route to Fort Nelson. There were four major rivers; the Liard, Poplar, Petitot and Nelson, and two smaller rivers, the Muskeg and the Sahataneh, on the trail south. Musk Ox headed out on April 22, across the air strip, down a steep bank through some scrub brush and met their first water crossing, the Liard River.³⁰³ Temperatures went as high as plus 54°F in the afternoon hastening the onset of the spring thaw.³⁰⁴ It was only a short race across to the other side, but as the vehicles drove on to the ice water rushed onto the surface

³⁰⁰ D His DND, 746.033(D2) Winter Ex "Musk Ox" 19461946, "Canadian Army Winter Exercise Musk Ox: 1946," prepared under the direction of the Chief of General Staff, 1947, 43.

³⁰¹ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for April 20.

³⁰² Ibid.

³⁰³ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for April 22.

³⁰⁴ Canadian Press, "Muskox Bucks Spring Thaw", April 24, 1946, reprinted in Polar Times, No. 22, June 1946.

from the pressure they were creating and the Snowmobiles waded through several feet of water to reach the other side.³⁰⁵ The trail from Fort Simpson alternated with muskegs, swamps, mud and slush and deep snow, the soft under footing was again causing great strain on the transmissions and the engines. Low range was necessary much of the time which led to a familiar problem, overtaxing the transmissions and causing engine failure.³⁰⁶ Mechanical break-downs on the tractor trail were now occurring at regular intervals and the repairs to the machines had to be completed in the most difficult of situations. Between Fort Simpson and Fort Nelson, there was no place for the Dakotas to land. Even the Norsemen's were entirely restricted with the spring thaw eliminating ice landings on small lakes. The entire leg would have to be supplied by parachute drop over varied terrain. Fortunately for the exhausted crews, the 150 miles from the Liard to the Petitot River were free of fallen timber that had slowed progress before but was very rough and hilly.³⁰⁷

As the Moving Force approached Simpson, the advance RCAF base at Norman Wells was closed and the remain air operations would be flown from Yellowknife, Fort Nelson or Edmonton.³⁰⁸ 70 days out from Churchill and Musk Ox had become an exercise in endless mechanical repair. From the 24 to the 25 of April, both Divisions had already gone through

³⁰⁵ Ibid.

³⁰⁶ Ibid.

³⁰⁷ D His DND, 746.033(D2) Winter Ex "Musk Ox" 19461946, " Canadian Army Winter Exercise Musk Ox: 1946," prepared under the direction of the Chief of General Staff, 1947, 44.

³⁰⁸ D His DND, 114.301009(D31) Ex" Muskox", [Interim Report] Reports on Air Supply Exercise "Musk -Ox", 1946, preamble.

3 transmissions and all their machines were continuing to degrade.³⁰⁹ Transmission repairs were averaging 3-4 hours in good conditions and the Moving Force vehicles played a type of leap frog as they halted to repair and were passed by other Snowmobiles only to pass them later on the trail when they halted for repairs. Baird raced to beat the approaching spring thaw and he knew if force was slowed by too many more delays, even small streams might become impassable raging torrents. The convoys began to jettison unnecessary supplies to help lighten the loads on the struggling engines.³¹⁰ Even sleds were ditched as the Snowmobiles tried to put as many rivers as they could behind them.³¹¹

The Muskeg River required only a short fording but the water was deep and fast and littered with broken ice. Both Divisions made the crossing without incident.³¹² Meanwhile, Croal's men had prepared the crossing at the Petitot River. The party were now travelling in a American Weasel which had been reintroduced to the exercise because unlike the Snowmobile, the M-29 was amphibious of great advantage on the thawing rivers. The Weasel had been flown in by Glider to Nelson two weeks earlier. Croal's party had been christened the "tadpoles" by the Moving Force as they had been busy fording rivers and swamps constructing bridges and blowing beaver dams during the two weeks. Their work was much appreciated by Musk Ox and saved much crucial time.

³⁰⁹ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for April 25.

³¹⁰ Ibid.

³¹¹ D His DND, 746.033(D2) Winter Ex "Musk Ox" 19461946, " Canadian Army Winter Exercise Musk Ox: 1946," prepared under the direction of the Chief of General Staff, 1947, 46.

³¹² Ibid.

The Petitot's thawing and broken ice cover had been bridged with a corduroy mat of logs which was in turn, covered with a layer of snow.³¹³ The snow covered corduroy as well as reinforcing the ice, delayed melting, hopefully long enough to allow Musk Ox to cross. By April 26, the bridge was deteriorating rapidly. First Division had made it across while the bridge was intact but Two Division was slower than anticipated and the bridge was now missing nearly 40 feet from either end which had washed out in the swift current of the shallow shore lines.³¹⁴ Number Two crossed safely and the exercise was off to the next major river, the Nelson.

Tempers began to flare as the men were forced to perform in wet-cold conditions. The trail was littered with deep, water-filled holes and was difficult to follow all the way to the Nelson.³¹⁵ On April 27, the two Divisions reached the Nelson, now entirely open water, and camped there overnight. Croal crossed the river and determined that the river could not be forded by the Snowmobiles. An alternate solution would have to be devised. As they went to bed, the men pondered how they would make the crossing the next day.

Reveille was at 300 hours the next morning. Musk Ox ordered a bulldozer from Fort Nelson to meet them on the other side of the river.³¹⁶ A simple plan was devised by Croal. The team constructed a raft from material along the river as well as supplies that were

³¹³ Ibid.

³¹⁴ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for April 26.

³¹⁵ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for April 26.

³¹⁶ Ibid.

ordered from the RCAF.³¹⁷ From trees cut along the shoreline, the men built a raft frame. The ASU delivered 50 empty fuel drums to be placed in the frame and they were "free dropped" on the soft beach sand along the river.³¹⁸ The Weasel was used to carry a tow line across the river which was then attached to a steel cable on the bulldozer on the Fort Nelson side and pulled back and attached to the raft on the other side.³¹⁹ Another full morning and afternoon of work passed before the barrels had been delivered and the raft completed. The First Division started to cross at 1400 hours and the tractor pulled their last Snowmobile out at midnight.³²⁰ Second Division's crossing was delayed until the morning of the 29th when the crews could see again.

In the morning, Second Division crossed the river within approximately 1 hour.³²¹ One at a time, the ten Snowmobiles had been ferried across the river atop the barrel raft. Musk Ox was now 4 miles from the Alaskan Highway, but the trail between the river and the road was hilly and muddy, the stickiest mud the Force had yet endured. Because of the mud, another track trailer was abandoned to save a transmission. Finally, the convoys crested the last hill revealing a roadway with speeding automobiles, the ALCAN Highway. That evening as Baird passed through the town of Fort Nelson, his exercise was now days behind

³¹⁷ Baird, North, Volume XXV, No. 5, (September/October 1978): 42.

³¹⁸ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for April 28.

³¹⁹ *Ibid.*

³²⁰ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for April 29.

³²¹ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for April 29.

schedule.³²² There was a planned three day rest period for the crews before they headed into British Columbia but there was no way that now tightened schedule would permit that much time. The Fort Nelson Airfield was 6 more miles up the highway and the men could rest for only two nights before moving on to the last stage of the trip down to Fort St. John B.C. then on to Grand Prairie, Alberta. The crews celebrated that evening at the air base and were able to make their first telephone call since Christmas of 1945.³²³

The longest leg of the mission was the 396 miles on the gravel road of the Alaskan Highway. Although Musk Ox covered the distance in four days the trek almost proved to be the mission's undoing. Baird had anticipated that the crews could do 150 miles per day on the maintained road surface. He had not anticipated that the dust stirred from their travel would cripple their vehicles within short order. The air filters on the Snowmobiles had been removed at the beginning of the journey so that they could not become clogged with blowing snow in the Arctic. Though new ones had been requested before arriving in Fort Nelson, they did not arrive in time for installation.

Along the Highway, the ASU no longer supplied the Moving Force. May 1, the Moving Force left Fort Nelson with a "B Echelon" of wheeled army transport trucks following.³²⁴ The convoys raised dust storms as they travelled and the vehicles had to keep

³²² Canadian Press, April 30, 1946, reprinted in Polar Times, No. 22, June 1946.

³²³ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for April 29.

³²⁴ D His DND, 746.033(D2) Winter Ex "Musk Ox" 1946, "Canadian Army Winter Exercise Musk Ox: 1946", prepared under the direction of the Chief of General Staff, 1947, 47.

1/2 mile intervals just to be able to navigate.³²⁵ Sangster and the mechanics decided to adapt and install the spare truck air filters in the Snowmobiles so that the engines would not stall completely within a few miles of their departure.³²⁶ Every 50 miles it became necessary to halt to change the engine oil and every hour the make-shift air filters needed to be cleaned.³²⁷ On the first day, the engines on No.'s 10 and 11 were changed and over the next 24 hours, four more engines failed.³²⁸ On May 3, the expedition reached Dawson Creek where an official welcome had been organized by the Chamber of Commerce and the Mayor.³²⁹ Baird wanted to keep the limping convoy on the move in the final hours before Edmonton, and the men had only have a few hours to enjoy the town's hospitality. The real air filters arrived approximately 180 miles from Simpson but by this time it was too late and the damage to the engines was too severe for the filters to make any real difference.³³⁰ Grande Prairie, Alberta was only another 180 miles beyond Dawson Creek . With almost all the machines now continually breaking down, it was the last miles that the Snowmobiles travelled under their own power.

Reaching Grande Prairie on May 4, three Snowmobiles were completely out of

³²⁵ Ibid.

³²⁶ Ibid.

³²⁷ Ibid.

³²⁸ Ibid.

³²⁹ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for May 3.

³³⁰ Baird, North, Volume XXV, No.5, (September/October 1978): 43.

commission.³³¹ Two were towed by other Snowmobiles and No. 5 was on a tank carrier travelling in B Echelon.³³² Musk Ox was entering farming territory and news of the arrival of the now famous expedition had been eagerly awaited by the local residents. As the column slowed to a halt just outside the town, the crews were already busy signing autographs for the local civilians.³³³ Edmonton was still 360 miles distant but with three vehicles needing new engines and no stock of spare engines left to draw on, Baird decided to load the Snowmobiles onto flat cars at Grande Prairie for the remainder of the journey rather than to risk having to march into Edmonton on foot.³³⁴ There was an airfield outside the town where the vehicles could be repaired enough so that they could limp through a parade planned for their arrival in Edmonton.³³⁵ First though, in appreciation for the community's warm reception, Baird sent seven vehicles the four miles into Grande Prairie to parade through the streets of the little town.³³⁶ The explorers were received by nearly all the townspeople, who had turned out along the streets to catch a glimpse of Musk Ox. That night, the men returned to the airfield to clean up and again celebrate before loading the vehicles onto the train

³³¹ D His DND, 114.3001009 (D39)"Ex Musk-Ox" A.G. Sangster (Vehicle Specialist), DVSA OBSERVER REPORT ON EXERCISE MUSK OX, 1945-46, 12-13.

³³² D His DND, 746.033(D2) Winter Ex "Musk Ox" 1946, "Canadian Army Winter Exercise Musk Ox: 1946", prepared under the direction of the Chief of General Staff, 1947, 47.

³³³ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for May 4.

³³⁴ D His DND, 112.3M1009 (D84), US Observers Report on EX "Musk-Ox" 1945/46, 7.

³³⁵ D His DND, 179.009 (6) A.G. Sangster (Vehicle Specialist), Personal Diary, February-April 1945-46: entry for May 4.

³³⁶ D His DND, 72-804, "Exercise Musk-Ox", Personnel Selection Research Project: Concluding Report, Diary of Sgt. Williams E.T.W., Moving Force medical NCO, 1946: entry for May 4.

following day for the trip to Edmonton.

The next day, May 5, the special train already prepared, was waiting for Musk Ox at the train station with five flat cars, one coach and one caboose plus the engine.³³⁷ Patrick Nasmyth's vehicle was still piggybacked on the tank carrier when it arrived at the station and the two other Snowmobiles were still being towed. By 1600 hours, the Snowmobiles had been strapped down to the cars and the men boarded the coach and left for Edmonton. The expedition arrived on May 6 and dismounted at the Edmonton Train Station. The vehicles drove to the Prince of Wales Armoury where they assembled for the final portion of their odyssey, the parade through the streets of Edmonton:

Fairly good reception - no hell though. Got Back to Armouries and were addressed by the Lieutenant Governor of Alberta, and this was answered by Baird, and then came the long awaited (81 days) command "Musk Ox Moving Force, Dismiss!"³³⁸

Musk Ox had come to an end just one day behind schedule on May 6, 1946. After a congratulatory address by both Alberta's Lieutenant-Governor, J.C. Bowen and Baird, Baird gave his final order on the mission for the Musk Ox crews to stand down. Questions, however, surrounding the true motivation for the exercise still lingered. As a final footnote to the exercise, an AP correspondent asked Baird, "Did you learn if the Arctic area of Canada is defensible?" to which Baird responded, "That's a rather difficult question to answer, I think that we had better leave that one alone."³³⁹

³³⁷ Ibid., entry for May 5.

³³⁸ Ibid.

³³⁹ Special article, May 6, 1946, reprinted in Polar Times, No. 22, June 1946.

Chapter 4: Lost Opportunities

Musk Ox was designed with two sets of objectives. There was a set of military goals which was outlined in the final report and another set of informal aims which belonged to J. T. Wilson. The Canadian Army had set out to research specific aspects of operating a mechanized force in the Arctic and the Army and the RCAF were interested in studying cooperation between their two branches. Wilson's goals were less pragmatic. He hoped that, through Musk Ox, he could direct the attention of the Canadian public northward to show them the vast and untapped potential of the Arctic, and, furthermore, to demonstrate the role that the military could play in developing that potential.³⁴⁰ The success of Musk Ox therefore, should first of all be judged in terms of its reaching these two sets of objectives.

In the exercise proposal submitted to Minister of National Defence D.C. Abbott, on October 4, 1945, the military research goals were outlined:

3. This last exercise [Lemming] showed movement of military forces to be feasible in the Arctic barren lands which comprise 30% of Canada. It is considered, however, that more information is necessary. Canada has ideal conditions under which a small exercise can be conducted to study matters of movement and maintenance generally and

- (a) Army-Air Force cooperation.
- (b) Mobility of over-snow vehicles under a wide range of winter conditions beginning on the barren grounds and terminating in spring in the northwestern bush country.
- (c) Methods of air supply including the possibility of establishing temporary landing strips on the barren grounds.
- (d) Certain technical research projects in Arctic warfare.³⁴¹

³⁴⁰ Wilson, Canadian Geographical Journal, Vol. XXXII No. 2, (February 1946):99.

³⁴¹ D His DND, 746.033 (D1), COLD WEATHER TRIALS, Papers on Exercise "Musk-Ox", Submission to Minister D.C. Abbott from Lieutenant Charles Foulkes, Chief of the General Staff.

Following the exercise, the Department of National Defence published two complete sets of reports, one by the Canadian Army and one by the Royal Canadian Air Force. In addition to the final reports, a more comprehensive set of data was circulated internally by each branch in interim reports expounding on technical aspects of the air, ground and base operations. Based on a review of these reports, Musk Ox can be dissected along three lines for the purposes of analysis. First, there was the Army research pertaining to mobility and maintenance of a Moving Force in the Arctic and over-snow vehicle performance. Secondly, the success Army-Air Force cooperation (air supply methods) was a major consideration in Musk Ox. Finally, a third broad group, covering general scientific research results was covered in the final reports.

First and foremost , Musk Ox was an operation designed and performed for the benefit of the Canadian Army. Major Gordon Sangster, the mechanical and vehicle expert, recorded the most exhaustive data of all the various research heads. Traversing the entire length of the Canadian Arctic using over-snow vehicles had never been attempted before Musk Ox. A major finding for the Army was that mechanized travel in the most extreme conditions that the Canadian climate had to offer was possible and relatively easy given unlimited air supply.³⁴² The Snowmobile itself, according to Sangster's research report as well as other sources, had substantial design flaws.

Originally designed as a light armoured utility vehicle for tactical deployment in a proposed invasion of Norway, 300 of the Snowmobiles had been purchased by the military.

³⁴² D His DND, 112.3M1009 (D84), US Observers Report on EX "Musk-Ox" 1945/46.

Operation Plough was eventually determined to be impractical and the Snowmobile never saw action in Norway. The Penguin nevertheless was used extensively in other applications during the War. The vehicles modified in Ottawa for Exercise Musk Ox had all seen substantial use before being shipped to Churchill in January, 1946.³⁴³ Consequently, reduced engine life was the most critical mechanical problem encountered during the exercise. Sangster reported that engine life averaged between 1000 and 3000 miles depending on the condition that the individual engines arrived in at the start of Musk Ox.³⁴⁴ In total, the Moving Force mechanics replaced 15 engines during the 3130 mile trip from Churchill to Edmonton.³⁴⁵ By journey's end, there were no more spare engines available.

The experienced Arctic explorers, Baird, Rowley and Croft, had all learned that extended travel in the north required the ability to adapt to wide range of climate and topographical variables:

In general, each phase of this trip posed new problems and a new set of both weather conditions and mechanical failures. Snow conditions were found to be infinitely variable, depending on atmospherical and topographical considerations. The main feature common to all types of terrain encountered was the restriction of vehicle speed and increased fuel consumption. . . .³⁴⁶

There was no uniform topography in the Arctic where the Snowmobiles could operate in high gear at speed for extended periods of time. Low range operation increased fuel

³⁴³ D His DND, 114.3001009 (D31)"Ex Musk-Ox" A.G. Sangster (Vehicle Specialist), DVSA OBSERVER REPORT ON EXERCISE MUSK OX, 1945-46, Part II, 3.

³⁴⁴ Ibid.

³⁴⁵ Ibid.

³⁴⁶ D His DND, 746.033(D2) Winter Ex "Musk Ox" 1946, "Canadian Army Winter Exercise Musk Ox: 1946", prepared under the direction of the Chief of General Staff, 1947, 37.

consumption and engine wear and the entire journey was plagued by mechanical failures of every description.

Mechanical failures were the most common ailment on the exercise. Despite the many problems encountered and the considerable expertise in cold weather repair developed during Musk Ox, Sangster reported that the amount of usable data relating to the mechanical features of the Penguin was limited:

The main feature in connection with the mechanical aspect of the Snowmobiles used on the Exercise was the fact that they were part-worn vehicles to start with and a large percentage of their placement components were either part-worn or reworked to an unknown degree. While these conditions provided us with no true datum, certain conclusions can be drawn reasonably accurately, based on epidemic troubles under different conditions of terrain, weather and mileage. . . .³⁴⁷

Major Sangster's comments pointed to the need for major modifications to the engine, transmission, steering, tracks and suspension, vehicle stability, heating, and electrical power supply, all of which were part of his final recommendations.³⁴⁸ Sangster also suggested that the Snowmobile should be amphibious so that it could operate in open water. Without major design changes, the extended, unsupported use of the Snowmobile in the Arctic was impractical either for civilian development or military applications. According to the wording contained in the Musk Ox final report:

The present vehicle [Snowmobile] 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

³⁴⁷ Ibid., 47.

³⁴⁸ Ibid., 63.

before operations in all seasons will be possible. . . .³⁴⁹

This reserved endorsement of the Penguin was still an overstatement of its capabilities. Though the Snowmobile succeeded in crossing northern Canada, it did so unreliably. If unlimited access to costly air supply had not been available, it is likely that severe delays would have occurred and perhaps the cancellation of the Musk Ox.

The vehicle report also incorporated a critique of the sleds and trailers that were used during the expedition as well as a brief on the only other snow vehicle that was utilized, the American M-29 Weasel. Minor design modifications were suggested for both the American and Canadian sleds that were utilized for nearly the entire trek up until the Alaskan Highway. The M-29 tracked trailer, however, was not recommended for Arctic operation.³⁵⁰ A failure in the idler sprocket of the Weasel on the initial leg of Musk Ox to Baker Lake, precluded a proper assessment of its performance but the vehicle was judged by the Army to be insufficiently rugged for heavy use in the high Arctic.³⁵¹

Baird also commented that the exercise proved the inaccessibility of the Arctic to be just a myth. Though that was technically true, it was an exaggeration of the facts. A pragmatic review of Baird, Rowley, Croft and Sangster's research reports, as well as accounts from other sources, paints a very different picture. Based on this information, Musk Ox showed that extended overland travel by vehicle in the Arctic was impractical.

³⁴⁹ Ibid.

³⁵⁰ D His DND, 746.033(D2) Winter Ex "Musk Ox" 1946," Canadian Army Winter Exercise Musk Ox: 1946", prepared under the direction of the Chief of General Staff, 1947, 63.

³⁵¹ Ibid.

Current technology in ground mobility meant that long overland journeys in the Arctic were only feasible with constant air supply. Maintenance of a ground force over the entire Arctic was indeed possible, but required huge resources in terms of support personnel and equipment even for a small party. Mechanics had to struggle with poor working conditions in extreme cold and with no shelter. Major modification to the existing Snowmobiles was necessary to make them suitable for long missions. The development of a reliable new vehicle was an expensive and extensive proposition. Contrasted against the strong performance of aircraft, the need for such modifications or development programs was questionable.

The RCAF played a central role in the success of the expedition. During the 3,100 mile run across the Canadian Arctic, the entire supply requirements of the Moving Force were met by the ASU. There were essentially 10 vehicles in the expedition and approximately 45 men in the Moving Force for most of the time. This comparatively small band had 344, 831 pounds of supplies delivered to them by air.³⁵² Of that total, 199, 609 pounds of supplies were dropped by plane and the remainder, delivered directly to the exercise by landing either the Norseman, Dakota or Hadrian aircraft.³⁵³ During the 72 days of travel before reaching the ALCAN Highway where the Moving Force acquired the B Echelon of supply trucks, the ASU averaged over two tons of air deliveries per day, some

³⁵² D His DND, 114.301009(D31) Ex "Muskox", [Interim Report] ,Reports on Air Supply Exercise "Musk-Ox",1946, preamble.

³⁵³ Ibid.

4, 789 pounds.³⁵⁴ Despite parachute drops over varied terrain, sometimes in less than ideal wether conditions, the percentage of supply losses incurred was only a minimal 3.9%.³⁵⁵ The Air Force believed this number to be higher than it could have been due to the failed attempts to resupply the American supply sleds.³⁵⁶

The remote areas that ASU and Moving Force operated over did not present any disproportionate hardships for them during their mission. Both the Army and the Air Force agreed that the key to overcoming the challenges of air supply in the far north was the effective liaison between the Moving Force, the Base Force and the ASU. Lieutenant Colonel Baird's force travelled with an Air Force Liaison Officer (AFLO), H.P. Kent, who together with Baird, helped determine the appropriate areas to deposit supplies and prepare landing strips for the Norseman aircraft.³⁵⁷ Liaison between the Moving Force Commander, the Base Force Commander, the Air Force Commander and the air supply detachment was carried out by Major E. W. Cutbill of the Canadian Army.³⁵⁸ Cutbill's responsibilities were crucial to the success of the operation.

The Moving Force radioed their requirements to the Base Commander, Donald Cleghorn, who in turn relayed an order to his men to retrieve and provide the supplies to the

³⁵⁴ D His DND, 181.003 (D 1452), "No 1 Air Supply Unit RCAF Final Report on Exercise Musk Ox", 1946, ii.

³⁵⁵ Ibid.

³⁵⁶ D His DND, 114.301009(D31) Ex "Muskox", [Interim Report], Reports on Air Supply Exercise "Musk-Ox", 1946, preamble.

³⁵⁷ D His DND, 112.3M1009 (D84), US Observers Report on EX "Musk-Ox" 1945/46, 32.

³⁵⁸ D His DND, 114.301009(D31) Ex "Muskox", [Air Liaison Officer's Interim Report], Reports on Air Supply Exercise "Musk-Ox", 1946, preamble.

air supply detachment. Each piece of cargo had a priority assigned to it based on how urgently it was needed by the Ground Force.³⁵⁹ At this point, Cutbill arranged for aircraft requirements with the ASU and scheduled departure times. The major prepared the composition of loads and notified Baird and Cleghorn of the estimated time for the arrival of the supplies on the expedition's route. The system was complex but worked well aside from one minor complaint from Kent. Baird and Cutbill on numerous occasions arranged for the delivery of supplies without previously notifying the AFLO. Kent complained that he often became aware that the supplies were arriving only when he saw the parachutes opening overhead.³⁶⁰ Other than this communication problem, "Cooperation between the two services was always excellent and never was there inter-service friction of any sort whatsoever. All the way down the line from Senior Officers to Airmen and Soldiers, the two services acted as a single service."³⁶¹ Cutbill's preliminary report on Air Supply evaluated the feasibility of future operations in the Canadian Arctic:

The main lesson learned was that it is perfectly feasible to supply a force in the Arctic by means of air supply. The number and type of aircraft used will be dependent on the size of the force and its anticipated requirements.³⁶²

The RCAF conducted several experiments of its own with new technology in the Arctic. Creation of runways for the Dakotas and the Norseman aircraft in the barren lands

³⁵⁹ Ibid., Part VII.

³⁶⁰ D His DND, 181.003 (D 1452), "No 1 Air Supply Unit RCAF Final Report on Exercise Musk Ox", 1946, 44.

³⁶¹ Ibid.

³⁶² D His DND, 114.301009(D31) Ex "Muskox", [Air Liaison Officer's Interim Report], Reports on Air Supply Exercise "Musk-Ox", 1946, Part IX.

required a practical method for marking their outline.³⁶³ Typically, in winter conditions, the RCAF relied on local evergreen trees. Where available, boughs were cut and laid out to line the runway but above the tree line that option was not available. The exercise tested two chemical markers, flouroscein and safranine. Neither proved to be completely satisfactory but allowed the air crews to identify the runway and land safely.³⁶⁴ Showler recommended that, for future operations, more research had to be done in this area to ensure safety. Runways, unless marked, were virtually invisible in the white and featureless landscape.

The ASU tested three types of aircraft during their supply runs, the Dakotas, the Norseman and the Hadrian Glider. All three aircraft proved themselves in their respective applications. The Dakotas C-47 had been used extensively during the war and were a proven work horse that had been flown in many varied air supply missions throughout the world. Cold did not limit their effectiveness but did require longer advance preparations for engine warm up and restricted out of door maintenance. The greatest distance covered in a non-stop flight by the twin engine cargo plane was 1400 miles.³⁶⁵ Extra capacity fuel tanks increased the range of the plane somewhat but also decreased the load capacity because of their weight. The average return range for the C-47 operating north of Churchill was about 1050 miles averaging 150 mile per hour ground speed.³⁶⁶

³⁶³ D His DND, 181.003 (D 1452)," No. 1 Air Supply Unit RCAF Final Report on Exercise Musk Ox 1946", 76.

³⁶⁴ Ibid.

³⁶⁵ D His DND, 114.301009(D31) Ex "Muskox", [Air Supply Unit #1 Interim Report] , Reports on Air Supply Exercise "Musk-Ox",1946.

³⁶⁶ D His DND, 181.003 (D 1452), "No 1 Air Supply Unit RCAF Final Report on Exercise Musk Ox", 1946, 19.

Dakotas were deployed in several tasks during Musk Ox. The primary responsibility for the Dakotas was to keep the Moving Force supplied at all times. The Moving Force was resupplied both by direct air drop and by advance drops of cargo caches along their path. Caches allowed the Dakotas commanders to determine, in advance, what weather they flew in and assured delivery of supplies to the ground force. The Moving Force never failed to locate a cache. Caches therefore, proved to be the most effective means for the Dakotas to supply the convoy, particularly in the rapidly changing adverse weather conditions that dominate the Arctic latitudes and that frequently caused scheduled flight operations to be suspended.³⁶⁷

Experimentation with the Dakotas revolved around the effective deployment of dropped cargo both by parachute and free drop. Normally, the Dakotas had to employ a five man Army drop crew to push cargo out the open door at the rear of the plane along a conveyor platform. The manual conveyors used by the five man crews were the primary delivery system and functioned satisfactorily. In addition to these conveyors, one Dakota was equipped with a power conveyor which automatically dropped cargo out of the plane.³⁶⁸ The RCAF was pleased with the operation of this American device because it allowed a reduction in the number of crew to be carried and subsequently allowed for corresponding increase in the cargo capacity. Manual drops required longer periods over the target zone and were

³⁶⁷ D His DND, 746.033(D2) Winter Ex "Musk Ox" 1946, "Canadian Army Winter Exercise Musk Ox: 1946", prepared under the direction of the Chief of General Staff, 1947, 27. [Advance cargo drops tend only to be practical in non-tactical situations where no enemy exists that may be also intent on intercepting provisions for their own use.]

³⁶⁸ D His DND, 181.003 (D 1452), "No 1 Air Supply Unit RCAF Final Report on Exercise Musk Ox", 1946, 19.

generally less accurate than the automatic drops as well.

Another prototype feature tested by the ASU were skis on the Dakotas. Deep snow landing capability was considered essential for an air unit supporting a ground force in the north. If there had been a need to evacuate a large portion of the Moving Force while they were far away from any landing strip, the Dakota was the only transport large enough for a rescue attempt. In tests, one Dakota was outfitted with a set of skis. Range or speed was not dramatically affected by retrofitting the skis and the aircraft flew well, demonstrating that it was flexible enough for a potential remote rescue mission.³⁶⁹

Finally, the Army experimented by constructing several airstrips for the C-47's directly on the ploughed frozen lake and ocean surfaces. The ice strips worked as well as permanent ones and easily accommodated the Dakotas. Constructing airstrips in the Arctic, therefore, was technologically possible as well as practical. The Dakotas proved that the advance of a ground force over the Arctic Barrens could be effectively supported from the air.

The Norseman bush plane was the mule of the air operations section of Musk Ox. Without the Norseman and its ability to land on remote small lakes, the mission could not have succeeded using only the C-47's. A Norseman was made available for evacuating casualties at all stages of the mission. Norseman crews based their operations on the progress of the Moving Force and were temporarily positioned at Baker Lake, Perry River, Cambridge

³⁶⁹ Ibid.

Bay, Coppermine, Port Radium Norman Wells, Fort Simpson and finally, Fort Nelson.³⁷⁰

Norsemen were used to evacuate three casualties during Musk Ox.³⁷¹ Aside from their mercy missions, the single engine planes flew all manner of supplies to the Moving Force, ranging from fuel to mail. One of the central roles of the Norseman was to deliver cargo that was too heavy to drop to the ground force. The 15 replacement engines were first flown by C-47, to any base that was close to Moving Force and that had an air strip large enough to accept it. The engines were then transferred to a Norseman and flown directly to the Moving Force out on the route.³⁷² This method proved effective and was essential to the mission's success. Norseman crews also prepared the sites for advance cache drops from the Dakotas when necessary, marking target areas and awaiting the drop teams arrival. The crews then secured and arranged supplies on the ice after they were dropped. Their duties in this respect were to retrieve parachutes for reuse and to prevent caches from being dragged by the wind where they could not be found by the expedition.

The Army and Air Force also experimented with supply gliders. Hadrian C-G4A Gliders were effectively deployed for the first time in the Arctic during Musk Ox. They were used as cargo transports for the Moving Force and one glider was outfitted as a workshop for engine repair. After witnessing the gliders perform, some Moving Force members expressed disappointment that they were not made available earlier in the mission where they may have been useful in many situations when major Snowmobile repairs were required and no

³⁷⁰ Ibid., 77.

³⁷¹ Ibid.

³⁷² Ibid.

proper shelter was available to work in.³⁷³ Later in the mission at Fort Nelson, a glider equipped as a workshop provided cover to maintenance crews in an area where none was otherwise available. The Air Force, however, was less pleased with the performance of the glider.

Showler commented that the ASU found that they could not reliably recover gliders from any area that could not land a wheeled Dakota.³⁷⁴ This severely limited their use on the mission. They recommended developing and fitting the Hadrian with skis for operations in snow covered terrain. ASU #1, nevertheless, still relied on the glider to fill the gap in carrying capacity between the Dakotas and the Norseman. James Croal's advance team with their amphibious American M-29 Weasel deployment by Hadrian Glider on the southern portion of the route was crucial to the ultimate success of Musk Ox.

Musk Ox demonstrated conclusively that, with existing technology, long range aircraft could supply and maintain a small ground force over the entire expanse of the Canadian Arctic. Army and Air Force cooperation facilitated the movement of the Snowmobiles virtually over the entire Arctic. All methods of air supply that were tested, ranging from parachute drops to remote landings with bush planes, were successful. Dakotas performed well in adverse conditions and provided excellent air support for the supply hungry Moving Force. The Norseman could land virtually anywhere on frozen or snow-covered surfaces and was also capable of carrying a relatively heavy payload. Musk Ox also

³⁷³ Personal Papers of Dr. Patrick Nasmyth, Lieut-Col. N.A.C. Croft, Report by the British Army Observer on Exercise Musk-Ox, Military-Operational Research Report No. 35., 1946, 15.

³⁷⁴ Ibid.

proved that extensive airstrips could be built on any suitable frozen surface in the Arctic, which provided a potential to operate and land large cargo aircraft almost anywhere that bulldozers could get to. Aside from the vehicle and air supply, other research reports were completed during the course of the exercise covering a wide range of topics set out during the initial stage of planning the mission.³⁷⁵

Ground topography was recorded as Musk Ox travelled along its route. The interim report on Ground Topography was prepared by Baird and two of the American military observers, Colonel Edwards and Major Jackman.³⁷⁶ Considering that the Ground Force was limited in what they could actually observe to a very narrow strip of terrain along the route of Musk Ox, the RCAF report on topography was used to augment the Moving Force report.³⁷⁷ In addition, Moving Force personnel did make inquiries along the way to the local inhabitants that they encountered in order to, ". . . obtain local place names and to supplement the meagre information available on some of the maps."³⁷⁸ The topography report took note of characteristics which would facilitate the construction of future bases, weather

³⁷⁵ The heads of research are set out previously in the text: 1. Meteorology (ground); 2. Meteorology (air); 3. Navigation (ground); 4. Navigation (air); 5. Magnetic (ground); 6. Magnetic (air); 7. Signals (ground); 8. Signals (air); 9. Air Supply (ground record); 10. Air Supply (air record); 11. Vehicles; 12. Aircraft Maintenance; 13 Landing Fields; 14. Air Operations; 15. Housing; 16. Clothing; 17. Medical (health, morale, food, cooking, water supply and washing) 18. Snow and Ice Data; 19. Photos (ground); 20. Photos (air); 21. Ground Topography (terrain, geology and sketch maps); 22. Auroral Observations; 23. Fauna and Flora; 24. Small Arms and Pyrotechnics

³⁷⁶ D His DND, 114.3001009(D31), "Muskox", Exercise "Musk-Ox" Syndicate Report Ground Topography, 1946.

³⁷⁷ Ibid., 1.

³⁷⁸ Ibid.

stations, potential harbours, airstrips etc.³⁷⁹ In previously un-visited regions, such as the North Eastern Arctic around the Back River, the information that was obtained by the ground force was useful but still very limited.

At the beginning of the Exercise, Gordon Watson, the CARDE observer accompanying Musk Ox, was assigned the task of measuring ice thickness en route.³⁸⁰ The proposed method for obtaining this information was for the Force to carry "Beehive" explosive charges and use them to blast holes in the ice and then to insert a measuring device in the open holes to determine ice thickness.³⁸¹ These devices created slope sided holes filled with debris which did not allow for accurate readings. Watson obtained a chisel to make more direct holes and an ice spoon at Baker Lake to scoop out the chipped ice as a more efficient alternative.³⁸² The tests were taken only when there was time enough to stop, usually during the scheduled halts at settlements and outposts along the way. Consequently, there was not enough data recorded to have a suitable representative sample.

Snow experiments were also dependent on the amount of time the expedition could spare during stopovers and therefore was also quite limited. Still, Gordon McKay, the Meteorological Observer on the exercise, attempted to record as much as possible about various aspects of the types of snow encountered by the Moving Force. These measurements

³⁷⁹ Ibid.

³⁸⁰ D His DND, 114.3001009(D31), "Muskox", Preliminary Report on Ice- Exercise "Musk-Ox" Moving Force, 1946.

³⁸¹ Ibid.

³⁸² Interview with Gordon Watson in Ottawa, January 17, 1997.

included readings of how deeply the Snowmobiles penetrated the snow surface.³⁸³ In soft snow, the vehicle sunk to a depth of 6 to 10 inches and on the wind blown lakes or ocean snow, the vehicles did not penetrate the surface at all.³⁸⁴ Reports beyond the rudimentary were impossible because of lack of proper equipment and time constraints. Much of the information that was recorded could have been obtained without travelling to the far north.

The Musk Ox Crews spent most of their time with in the confines of their vehicles and slept indoors during the expedition. For these reasons, the exercise was not considered to be an adequate test of clothing in Arctic conditions. Much of the clothing tested by the Moving Force was experimental. "Vapour Barrier Clothing", a concept that has been incorporated in Arctic expeditions, was tested on one person during the exercise.³⁸⁵ Vapour barrier clothing works by providing an impermeable barrier next to the insulating layer of clothing and blocks heat-robbing moisture from soaking into the insulation. Musk Ox demonstrated that this principle held considerable promise for development of future cold weather clothing. Though varied in construction, all of the military issue was adequate but required some redevelopment to be completely satisfactory for motorized operations in the Barren Lands.³⁸⁶

On the evenings that the crews spent in their tents, they were heated by Yukon

³⁸³ D His DND, 114.3001009(D31), "Muskox", Preliminary Snow Report Exercise Musk-Ox, 1946.

³⁸⁴ Ibid.

³⁸⁵ Ibid., 89.

³⁸⁶ D His DND, 746.033(D2) Winter Ex "Musk Ox" 1946, "Canadian Army Winter Exercise Musk Ox: 1946", prepared under the direction of the Chief of General Staff, 1947, 87.

Stoves which are a gas and wood burning unit.³⁸⁷ The men slept in Canadian Double Wall tents which had cotton outer shells and nylon inner shells. Sometimes when the tents were erected in extreme cold, dangerous amounts of hoar frost collected on the inner walls of the tent over night and when the tents were heated again in the morning for cooking, condensation would drip down and wet sleeping bags.³⁸⁸ Musk Ox was never far from a settlement and so they were always able to dry clothes and sleeping bags sufficiently, but, without proper facilities, the situation could have become critical when outside temperatures became cold enough to freeze thermometers. Wet insulation conducts cold efficiently and hypothermia can result unless the equipment is dried. For this reason the final report recommends that every soldier working in the Arctic should be familiar with constructing snow shelters.³⁸⁹ Igloos provide effective shelter from outside temperatures without the need for an intense heat source inside. There were some experiments that provided more technologically significant data.

Musk Ox relied on several methods of Ground Navigation to determine their location and heading. Map reading was a difficult task for most of the journey. From Nunnulla to Coppermine, accurate maps were not available and, on a substantial portion of the rest of the journey, where reasonably accurate maps were available, map reading was made difficult because of the snow cover and the inability to discern individual landmarks on the Arctic

³⁸⁷ Ibid., 85.

³⁸⁸ Ibid., 83.

³⁸⁹ Ibid.

terrain.³⁹⁰ Although Baird and Croft's experience travelling throughout the north was a great benefit and minimized the difficulties in navigation, the Force Commander commented that, until the air photographic cover of the north had been undertaken and completed, and suitable contour maps were created, map reading would continue to be unreliable.³⁹¹

The Force also experimented with several other methods of navigation in conjunction with map reading including: Dead Reckoning, Sun Compass Card, Astro Compass, Magnetic Compass, Bubble Sextants, Theodolite and an experimental Low Frequency Loran Receiver.³⁹² All these methods of fixing position yielded results with approximately a five mile error except for the theodolite. The theodolite was more precise but could only be operated by the magnetic observer. It required time to set up and, therefore, was relied on less than other more convenient instruments.³⁹³ Musk Ox did advance understanding of a new development in navigation using radio waves. A unique set of experiments with Low Frequency Loran Navigation were carried out by Patrick Nasmyth, the Radar Officer on Musk Ox.

Long Range Aid to Navigation (Loran) was not a new technology in 1946. Musk Ox, however, was testing a new version of the system which utilized low frequency radio waves. Loran navigation had previously been confined to use over water and had a limited range of some 600 miles. Musk Ox provided the first opportunity for the American Army to obtain

³⁹⁰ D His DND, 114.3001009(D31), "Muskox", Report on Navigation Ground, 1946, 1.

³⁹¹ Ibid.

³⁹² Ibid.

³⁹³ Ibid.1-2.

field data. The Americans provided the equipment and built the transmitter bases for the trials on Musk Ox and hoped to test the new long range capability of the low frequency system, estimated to be over 1000 miles on land.

The Moving Force carried one Loran receiver unit, which was operated by the Radar Officer.³⁹⁴ The unit received signals broadcast from several base stations established along the route and was used to determine relative position by fixing on at least two of the broadcast signals.³⁹⁵ The base stations established by the American Army Air Force were at Dawson Creek, British Columbia; Gimli, Manitoba; and Hamlin [the master station], Saskatchewan.³⁹⁶

The American military made it clear from the beginning of Musk Ox that this technology was secret and still in the experimental stage and could not to be totally relied on.³⁹⁷ Moving Force was only able to operate its receiver during halts, and there was a problem experienced with one of the base station signals, resulting in a higher than acceptable error when calculating position.³⁹⁸ Overall, however, the system was promising. Nasmyth still concluded that ,with further development, "It is felt that LF Loran would

³⁹⁴ D His DND, 114.3001009(D31), "Muskox", " Report on L F Loran Operation as Observed by "Musk-Ox Moving Force", 1946.

³⁹⁵ Ibid.

³⁹⁶ Ibid.

³⁹⁷ D His DND, 181.003 (D 1452), "No 1 Air Supply Unit RCAF Final Report on Exercise Musk Ox" 1946, 70.

³⁹⁸ D His DND, 746.033(D2) Winter Ex "Musk Ox" 1946, "Canadian Army Winter Exercise Musk Ox: 1946", prepared under the direction of the Chief of General Staff, 1947, 162.

provide a very accurate and convenient means of navigation in the North."³⁹⁹ Eventually, the Americans would ask the Canadian government to allow them to extend trials of their system beyond the close of the Exercise.⁴⁰⁰

Musk Ox also uncovered shortcomings in Canada's Arctic communication system and in the country's ability to read and forecast weather in the Arctic. There was clearly a need to establish a comprehensive system of meteorological stations and increase the number of communication centres in the Arctic to support continued exploration of the Canadian Arctic. There were 30 weather stations reporting to the Moving Force and the ASU during the exercise. Both the Moving Force and the RCAF found that the weather reporting capability during the exercise was not adequate and recommended that additional bases be maintained in the future. After Musk Ox, the RCAF requested that Baker Lake facilities remain open and other civil government agencies requested that the base be expanded and that a new permanent Scientific Station be established by the Department of Mines and Resources.⁴⁰¹ Dominion Meteorological Services established a permanent observing station

³⁹⁹ Ibid., 163., D His DND, 181.003 (D 1452), "No 1 Air Supply Unit RCAF Final Report on Exercise Musk Ox", 1946, 70-72. The ASU was also impressed with the operation of Loran, "Loran was a definite assistance to No. 1 ASU during exercise Musk-Ox. It was a disappointment that the system was still in the experimental stage which limited its use to check against authorized navigational procedure. . . ." No. 1 ASU had more reliable results using Loran and it assisted their travel, particularly in the area to east and north of Churchill where the magnetic field generated by the pole made compass navigation erratic. All the RCAF crews were eager to see the eventual development of the technology and looked forward to the eventual construction of permanent broadcast bases and reliable 24 hour operation.

⁴⁰⁰ D His DND, 82/196, Journal of PJBD (8 Vols), d/26 Aug 40 to 5 Oct 50, Vol. 5., Major General Guy V. Henry, Senior U.S.Army Member, Memorandum for the Secretary, Canadian Section, PJBD, April 23, 1946.

⁴⁰¹ NAC, RG 24, Reel C-8419, File 9012-564-9, Col. J.T. Wilson request to DND, March 9, 1946.

there in the summer of 1946.⁴⁰²

The requirements set out in the terms of reference were more or less met by Exercise Musk Ox. Army-Air cooperation facilitated the travel of 10 over-snow vehicles over the entire width of the Canadian Arctic. With air support, a small contingent of men could travel using tracked vehicles most anywhere in the north.

Musk Ox demonstrated that extended exploration of the Arctic in an over snow vehicle was possible, but only for those individuals or organizations who could afford to spin a web of air supply over the intended range of the expedition. The state of vehicle technology at the time the exercise was executed, did not allow reliable exploration without continuous air re-supply. If Musk Ox demonstrated that any method of Arctic exploration was practical, it would be through its efficient use of aircraft. By 1946, aircraft were capable of moving large amounts of equipment and personnel anywhere in the Barren Lands rapidly and efficiently, a fact clearly demonstrated by #1 ASU⁴⁰³. Compared with the ability of aircraft to land anywhere in the north and to travel long distances quickly and reliably with a heavy payload, Musk Ox did not show that there was any clear advantages to operating ground vehicles over large expanses of northern territory. Though the Snowmobile may have completed the journey, it was not a reliable long range Arctic transport. The success of the air operations suggested the next step in Arctic exploration and development by means of aircraft. Despite this fact, aircraft did not appear in Wilson's vision of the future of Arctic

⁴⁰² Ibid.

⁴⁰³ D His DND, 181.003 (D 1452), "No 1 Air Supply Unit RCAF Final Report on Exercise Musk Ox", 1946.

development.

Most other experiments that were undertaken intermittently during Musk Ox produced no significant advancement in understanding the Arctic " Scientific observations were confined to the route of the Exercise and are very sketchy due to the limited time during halts."⁴⁰⁴ There were a few notable exceptions relating to Loran and meteorology/communications, but for the most part, as a scientific endeavour, Musk Ox does not qualify as ground breaking. Though CAORG chose to pursue a non-tactical scientific research tack in the Arctic, the rationale for that is questionable.

Musk Ox represents the last of four northern exercises executed in the last months of the Second World War and the first few months after the conflict. If Wilson intended Musk Ox to promote the future civilian development of the north and demonstrate how technology developed by the military during the War could help realize that goal, the exercise was only a qualified success. Wilson himself wrote after the mission:

The opportunity that the end of the war presented to the Canadian Services was seized and adequately used. More could have been done, but the successful accomplishment of Exercise Musk-ox as it had been planned was a credit to the few Arctic leaders and their inexperienced followers. The repetition of such a long motor journey is not expected or desired. If the knowledge now available is used, and the Canadian people's consciousness of their north is aroused, the settlement of more permanent stations and the execution of extensive studies around them are the next requirements. . . .⁴⁰⁵

Stimulating public interest in the Arctic was not the key to its development. Economic reality would determine how and when the north would be explored:

⁴⁰⁴ Ibid., 8.

⁴⁰⁵ Wilson, The Polar Record, Vol. 5, No.s 33,34, (December 1947):18.

The rapid economic development which the USSR has attained in north-eastern Siberia (north of the 56th parallel and east of Lake Baikal) where population is reported to have increased from, during the period 1929 to 1944, from 40,000 to 250,000, illustrates what can be achieved in northern Canada. . . .⁴⁰⁶

This statement (also quoted earlier in this paper) from the Eskimo final report captures Wilson and the Arctic Institute's dreams for the north, but neglects the many basic differences that separated Canada and the Soviet Union, the most important of which were population and demand for resources. Canada's small population, was for the most part, huddled along the border with the United States and could never generate enough pressure on resources to stimulate the type of resource exploration and development that had taken place in the Soviet Union's Arctic. The Arctic explorer, Vilhjamur Stefansson, who consulted for the American government, wrote in 1939:

Canada is less interested in her Arctic domain than most people suppose. The Dominion has only some 11,000,000 with which to people a territory the size of the United States, and most of these live in the country's southern fringe separated from the Arctic by a broad intermediate belt that has not been colonized. Canada has no immediate need for her Arctic region, and thus far, shown little interest in settling even this intermediate belt.⁴⁰⁷

Aside from industry, there was another factor which had already influenced Arctic development and the military interest in the north during the Second World War: the threat of military attack. While Wilson endeavoured to promote peaceful exploration in the north, other forces were at work looking towards increased military involvement in the Arctic.

At the end of the war, the Canadian Government had taken the United States to task

⁴⁰⁶ D His DND, 746.013 (D2) Ex "Eskimo" - 1944-45, "Exercise Eskimo: Dry Cold", a report issued by General Staff, Department of National Defence, September 1, 1945, xix.

⁴⁰⁷ Vilhjamur Stefansson, "The American Far North", Foreign Affairs, No. 17, (April 1939):521.

over their military development in the north and their potential long term designs on the area for military as well as resource and commercial exploitation.⁴⁰⁸ If the Canadian Government was fearful that the United States would try to expand its control in the north after the war, then it was reasonable for the Army to capitalize on opportunity Musk Ox provided to promote Canadian sovereignty in the Arctic.⁴⁰⁹ Though it appears that the Canadian government was apprehensive that Musk Ox not be interpreted in a threatening manner by the international community, this did not explain why Canada's position in the north was not more clearly marked out and clarified.⁴¹⁰ The considerable publicity that accompanied Musk Ox was never properly exploited by the Canadian Government. This becomes especially significant in view of the American Army report on Exercise Musk Ox, which clearly demonstrated that the United States military still had considerable interest in developing the Canadian Arctic for tactical and strategic reasons.

Inter-continental ballistic missile development was still a decade away, but the advent of rocket technology in Germany during the Second World War ushered in the era of long range warfare. Potential enemy missile sites were a priority among the many questions that were outlined by Washington's War Department for investigation by the American observers on Musk Ox:

"General" [issues to be investigated by American Observers]

1. In what areas would it be feasible for an enemy to install and supply

⁴⁰⁸ D His DND, 81/758, Kenneth Charles Eyre, *Custos Borealis*, "The Military in the Canadian North", PhD. The University of London, 1981, 160.

⁴⁰⁹ NAC, King Papers, MG 26 J4, vol.. 305, file 3146, C211424, King Diary, March 29, 1943.

⁴¹⁰ NAC, House of Common Debates, December 14, 1945, 3552-3553..

installations from which important areas of the U.S. and Canada could be attacked by long range missiles?

2. In what areas and localities would it be feasible for an enemy to establish surveillance and reconnaissance posts in order to launch counteraction against any offensive air or long range missile action taken by the U.S. or Canada over these regions against any country within reach?

3. What suitable or feasible locations for Canada and/or U.S. would you recommend for the installation of radar stations and interceptor posts to permit wide surveillance and reconnaissance or to launch counteractions against any enemy air or long range missiles approaching from the Arctic?

4. What location would you recommend for the establishment of weather stations necessary for adequate coverage for air operations in or across these regions?

5. For the establishment of bases for action against enemy ground installations. . . .⁴¹¹

The United States observers, it must be noted, were not aggressive about fulfilling their mandate, and their behaviour does not appear to have provoked any suspicions in the Canadian team.⁴¹² The American observers were, indeed, aware that they should maintain and promote cooperative relations with the Canadians at all times while on the mission.⁴¹³ During the exercise, Wilson and his men continually reiterated that Musk Ox was not a joint exercise but a Canadian Army operation with some foreign observers accompanying it.⁴¹⁴ Canadian attempts to persuade the American press of this fact, however, were not completely successful and even after the mission Wilson was still trying to drive this point

⁴¹¹ D His DND, 112.3M1009 (D84), US Observers Report on EX "Musk-Ox" 1945/46, 13.

⁴¹² Various interviews with Dr. Patrick Nasmyth, Graham Rowley and Gordon Watson during 1996-97.

⁴¹⁴ See earlier in text, Wilson's radio address and Baird's reply in Winnipeg Free Press to Time article, NAC, RG 24, Reel C-8419, File 9012.564-13 No. 1, Radio speech, "The Canadian Broadcasting Corporation -Talk on Canadian Army and RCAF Exercise "Musk-Ox" Sunday 15, December 1945 at 1845 hrs by Col. J.T. Wilson, Director of Operational Research ", December 15, 1945: NAC, RG Reel C-8419, File 9012.564-13 No. 1, " Charges Aim Of Musk-Ox Falsified", Winnipeg Free Press, November 28, 1945.

home:

The Americans lent some equipment not available in Canada. . . .However, in no sense was the exercise a joint Canadian-American venture, although that view has been sometimes published . . .⁴¹⁵

The American observers did not agree with this assessment of the significance of their country's contribution to Musk Ox. In fact, the United States observers indicated that they thought the Canadians were somewhat over-zealous in matters of national pride and sovereignty. The paternalistic tone of the American final report and their discussion of "United States-Canadian Relationships" is unmistakable:

At times during the exercise, it became advisable for United States observers to suggest the use of certain types of United States equipment nonexistent in the Canadian Army, the lack of which would have seriously limited the operation of the exercise. . . . While these contributions were appreciated by the Canadians as necessary and not available in any other way, it was found that great tact was needed in suggesting their use in order to avoid suggesting their own plans and equipment were inadequate. Often, these suggestions, however tactfully made, were turned down at first but accepted later after actual experience proved them right. . . .⁴¹⁶

Issues of sovereignty were a sensitive area for the Canadians. In order to avoid unwanted friction between the two countries, American observers recommended that, in future, any observers participating with Canadians on an operation should take additional care so as not to make Canada feel like a junior partner in any defence relationship in the Arctic:

However, Canada does not want the United States to regard her northland as an unrestricted testing ground for the United States Armed Forces instead of a land over which she exercises complete sovereignty. . . .⁴¹⁷

⁴¹⁵ Wilson, The Polar Record, Vol. 5, Nos. 33,34 (December 1947):17.

⁴¹⁶ D His DND, 112.3M1009 (D84), US Observers Report on EX "Musk-Ox" 1945/46, 7.

⁴¹⁷ Ibid., 8.

American military authorities thought Canada the premier location to conduct cold weather trials.⁴¹⁸ The United States final report suggested selecting Churchill, Manitoba as a permanent site for cold weather testing of clothing, weapons, equipment and vehicles.⁴¹⁹ Churchill was subject to some of the most extreme temperatures on the continent, more extreme than anywhere in Alaska. In addition, it was easily supplied by existing rail lines. The American report recommends the establishment of "radar stations and interceptor posts to permit wide surveillance and reconnaissance or to launch counteractions against enemy or long range missiles approaching from the Arctic. . . ." ⁴²⁰ Among other areas that were suggested as possible air bases for the American Air Force were those that had been constructed by the United States Army Engineers during the war.

As part of its objective, the United States used the exercise as an opportunity to examine future strategic planning and assess potential threats. As far as the United States was concerned, Musk Ox was not purely a "non-tactical" exercise. Perhaps the Canadians should have been more alive to the concerns that had animated their government at the end of the war, when it asserted sovereignty in the north in a vigorous way.

⁴¹⁸ Ibid.

⁴¹⁹ Ibid.

⁴²⁰ Ibid.

Conclusion

Dr. Patrick Nasmyth, the Radar Officer on Musk Ox, when asked how he viewed the exercise in its historical context answered, " In my opinion, it was a turning point, it marked the end of Arctic exploration and the beginning of Arctic development."⁴²¹ During an interview with Graham Rowley, the Commander of the Baker Lake Force on Musk Ox, he emphasized the importance of the exercise in pioneering the exploration of the north by vehicle.⁴²² His wife Diana, his long time writing collaborator, commented that Musk Ox was the ". . . 'opener up' of the north but was never really recognized in that way; more attention was paid to the construction of the DEW line for example...."⁴²³ Dr. J. Tuzo Wilson hoped that with the Musk Ox mission Canadians would pay more attention to an area they had traditionally neglected and promote development and exploration in the north.

There can be no question that Musk Ox was a great test of men and equipment. In human terms, Musk Ox was an unqualified success. For three months, 45 men risked their lives to accomplish the first traverse of the Canadian Arctic by vehicle. The personal accounts and the diaries of the men attest to the dangers with which explorers were faced. By the mid-20th century, parts of the country still remained unexplored, and Musk Ox undoubtedly but temporarily focused the curiosity of the Canadian public northward. Neither Wilson nor his colleagues, however, could ever succeed in promoting large scale development and exploration of the barren lands purely through the use of science or

⁴²¹ Interview by telephone with Dr. Patrick Nasmyth, October 10, 1997.

⁴²² Interview with Graham and Diana Rowley in Ottawa, August 19, 1996.

⁴²³ Ibid.

publicity. Economics and demand for resources, more than any other factor, would determine the future of the Arctic.

The Army's terms of reference for Musk Ox established three broad objectives relating to maintenance/mobility, Army-Air Force cooperation- Air Supply, and general scientific investigation.⁴²⁴ The exercise was the first to completely cross the Canadian Arctic by vehicle and proved that air supply was an effective method of supporting extended ground travel in the far north. Army-Air Force co-operation was exemplary. Low Frequency Loran experiments yielded promising results and both the Moving Force and the ASU demonstrated the need for increased weather forecasting ability. Ground vehicle performance, however, raised many questions about the viability of future exploration using the Snowmobile.

The Snowmobile, based on several accounts from the mission, was not a reliable means of transportation in the north. Without air support, the vehicles could not have succeeded in crossing the Canadian Arctic. Ground exploration, therefore, continued to be an expensive proposition for the foreseeable future after Musk Ox, impractical for almost all with the exception of the Armed Forces and its unlimited resources. Modern long range aircraft on the other hand, could easily travel the entire expanse of the Canadian north. Air travel was fast, efficient and reliable compared with the available alternatives. A major lesson missed by Wilson, the military and the Canadian government, was that the future development and exploration of the Arctic probably hinged on flight and not ground travel.

⁴²⁴ D His DND, 746.033(D2) Winter Ex "Musk Ox" 1946, "Canadian Army Winter Exercise Musk Ox: 1946", prepared under the direction of the Chief of General Staff, 1947, 3.

Beyond the air and ground force aspects of the expedition, the scientific component of the exercise did not yield many significant findings. Much of the data that was collected under the many heads of research was limited by the amount of spare time the men had on the journey. Frequent mechanical failures on all of the vehicles required hard work by all personnel to keep the team on schedule. Most of the rest of the time, the men of Musk Ox were travelling in their Snowmobiles or sleeping. The Moving Force was able to observe only a narrow band of the Canadian Arctic along the carefully prepared route that they followed. The final report admitted that the amount of useful scientific information gathered during the exercise was small.⁴²⁵ Exercise Musk Ox may have met the requirements in its terms of reference but only in a restricted sense.

While the Canadian soldiers were fulfilling their non-military mandate, the United States military observers on the operation were busy with their own agenda. During the war, a military threat had brought the Americans into Canada's north where they quickly established a broad infrastructure to defend against an enemy that would never come.⁴²⁶ By the end of the war, Canadians had therefore, learned that, when the United States perceived a northern threat, it was willing to respond to that threat on Canadian soil. The American Army's final report on Musk Ox clearly indicates that they were again planning for the necessity of action in the Canadian north and were already forecasting the future Soviet

⁴²⁵ D His DND, 746.033(D2) Winter Ex "Musk Ox" 1946, "Canadian Army Winter Exercise Musk Ox: 1946", prepared under the direction of the Chief of General Staff, 1947, 8.

⁴²⁶ See C.P. Stacey, Arms, Men and Governments: The War Policies of Canada 1939-1945, (Ottawa, Queen's Printer, 1970), 381-82 for a description of the nature of American development of infrastructure in the north.

missile threat. The United States military was interested in the north but its Canadian counterpart was not thinking in these broad strategic terms.

What is more, the opportunity thrown up by Musk Ox to drive home claims to the Arctic was missed. As a result of the exercise, on 14 August, 1946 the United States Army requested permission to establish meteorological stations in the Arctic.⁴²⁷ A brief prepared by the Canadian military for the Chiefs of Staff Committee, brought out the threat posed by US activity in the north:

The United States Government have recently requested Canadian approval for an Arctic Weather Station programme which they have put forward. This and other US proposals in connection with defence may involve the question of Canada's claim to sovereignty over territories lying within the "Canadian sector" of the Arctic. . . .

In view of the weakness of Canadian claims to this region, this principle should be applied consistently even to a power with which Canada may share relationships of a most friendly and enduring nature, such as the United States. In any concessions which may be made the greatest care should be taken to fully safeguard Canadian sovereignty, as otherwise another great power may be presented with sufficient and justifiable grounds for pressing similar demands. . . . If the United States requirements are to be effectively met on the basis of cooperative undertakings this should be done in the form of joint defence measures. The nature of certain of the proposals already made, (and those anticipated) precludes the possibility of maintaining the fiction that they are purely "scientific" or "research" programmes. . . .⁴²⁸

For the next fifty years after Musk Ox, northern Canada was the front line between the Soviet Union and the United States. Churchill had just uttered the words "Iron Curtain", and the Americans were looking north with growing concern for a new enemy. Canada's

⁴²⁷ D His DND, 193.009 (D.53), Vol. 58, Sept 46, Memorandum provided to Chiefs of Staff of Committee regarding the US Meteorological Installations in Canada and Labrador, August 1946.

⁴²⁸ Ibid.

military and its government had a duty to begin looking at the role the Arctic would play in the second half of the century. Despite widespread media coverage throughout North America, the exercise was never exploited by the Canadian government. The non-tactical and peaceful goals of Musk Ox were admirable, and its human and mechanical achievements great, but Wilson and the Canadian Army and indeed, the Canadian government, should have been more imaginative in seeing Musk Ox as something more than a limited exercise in science and promotion.

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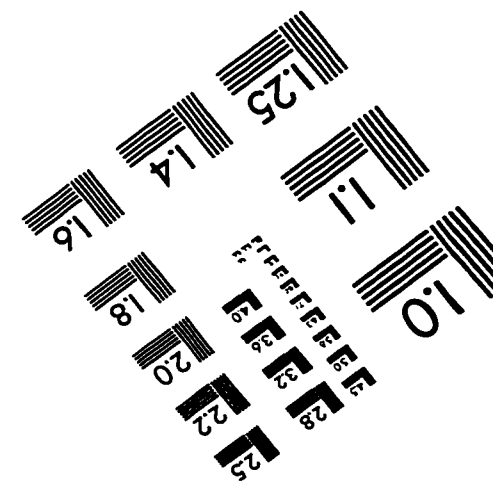
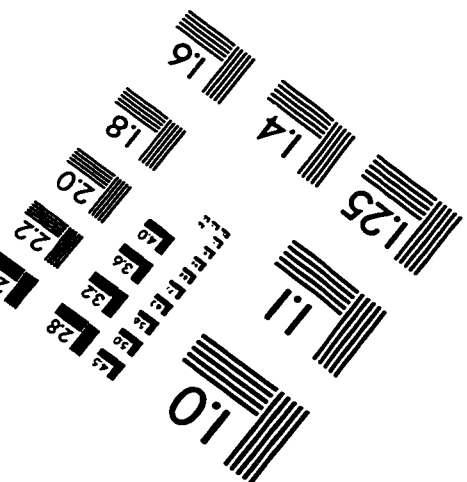
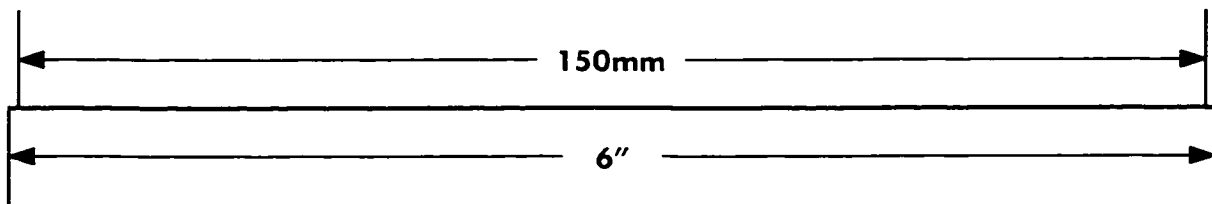
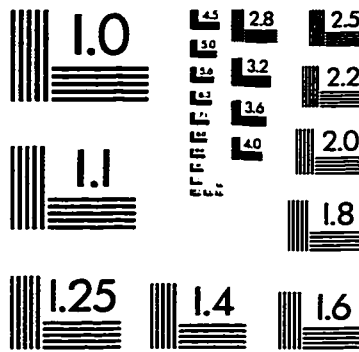
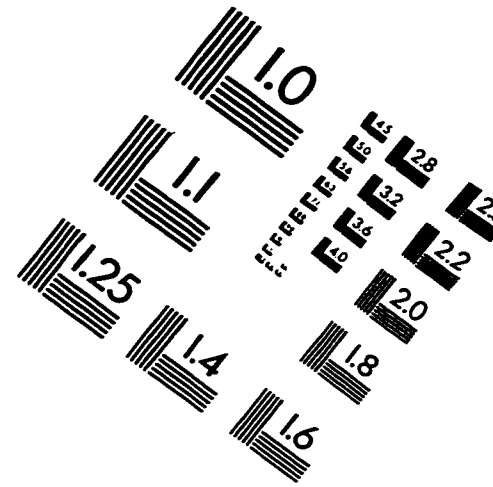
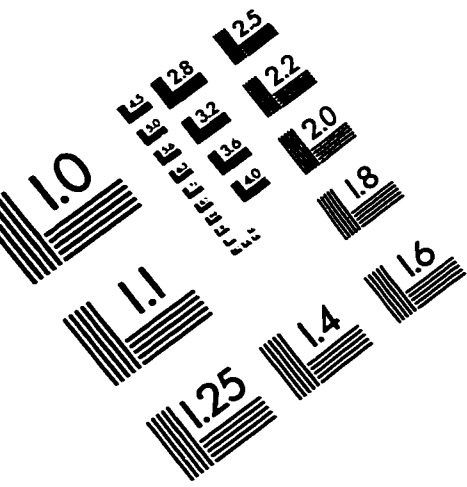
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