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Cash, William G., Major, U.S. Army

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U.S. Army Command and General Staff
College
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Fort Leavenworth, KS 66027

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The peculiarities of northern offensive operations during the winter season are the subject of this thesis. The purpose is to provide the reader with an understanding of the dynamic effects of environmental factors on the northern areas on offensive military operations and to point out the methods used to overcome or reduce the significance of these effects. The first chapter is devoted to an examination of the physical features of the earth that lies north of the Temperate Zone (50 degree isothermal line). Chapter II discusses the effect on the soldier. Chapter III discusses training requirements for an infantry division. Combat service support during the conduct of winter offensive operations is discussed in Chapter IV. The conclusion is reached that the considerations for the organization of a task force in the North are no different from the considerations in the Temperate Zone. The techniques used by a task force in the North to seize assigned objectives will be different from Temperate Zone operations, but the tactical principles for the conduct of the attack will remain the same.

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NORTHERN OFFENSIVE OPERATIONS

An abstract for a thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements of the degree

MASTER OF MILITARY ART AND SCIENCE

WILLIAM G. CASH, Major, U.S. Army

Fort Leavenworth, Kansas
1965

U. S. ARMY COMMAND AND GENERAL STAFF COLLEGE

Name of Candidate WILLIAM G. CASH, Major, U. S. Army

Title of Thesis NORTHERN OFFENSIVE OPERATIONS

Accepted for Publication by:

Gen. C C Haudy, Research and Thesis Monitor

Wallace N Sutting, Member, Graduate Faculty

_____, Member, Graduate Faculty

Date 24 May 1965

The opinions and conclusions expressed herein are those of the individual student author and do not necessarily represent the views of either the United States Army Command and General Staff College or any other governmental agency.

The peculiarities of northern offensive operations during the winter season are the subject of discussion of this thesis. The purpose of this paper is to provide the reader with an understanding of the dynamic effects of environmental factors of the northern areas on offensive military operations and to point out the methods used to overcome, or reduce the significance of these effects. A thorough understanding of how and to what extent the environment affects operations is a prerequisite for the effective and efficient employment of military forces in a northern region.

The first chapter is devoted to an examination of the physical factors of that part of the earth's surface that lies north of the Temperate Zone, or in more technical terms, the area north of the 50° isothermal line. Mountainous areas which lie within this line are omitted in that these areas require special considerations which are worthy of separate study. The topography, winter climate, vegetation, and cultural features of Canada, Alaska, Finland, and Eurasia are the principal areas of interest and research since the terrain in these land areas offers the best possibilities for the conduct of warfare.

Chapter II is a discussion of those aspects of a cold environment which may affect the will of the soldier to fight or his capability to perform his job in an efficient manner. The first aspect considered is the physiological

effects of the northern environment on personnel. This subject area includes the difficulty of the human body to acclimatize to the hostile climate of Arctic areas and the requirement for protective clothing and equipment to safeguard against the hazards of cold injury. Although this protective clothing proves most effective in protecting the body, the hampering action of these bulky garments serves to reduce individual efficiency. The efficiency of the individual is further reduced as the windchill factor increases. The remaining portion of this chapter is devoted to an analysis of the mechanical aspects of frostbite and the psychological effects of cold weather environment. The psychological effects of the cold environment on personnel are less defined than are the physiological effects and consequently are more controversial.

The minimum training requirements for an infantry division to successfully conduct operations in an arctic environment is the subject of Chapter III. A master training program is submitted for consideration. This program includes the indoctrination training that should be conducted at the division's home station, as well as the training requirements that must be completed after the division arrives at an arctic training site. Included in the discussion are individual, unit, and specialist training requirements. It is emphasized that the program outlined is the minimum training required, with additional training, when possible, being desired.

Combat service support during the conduct of winter offensive operations in a northern environment is discussed in Chapter IV. The problems of logistical support are complicated by the difficulty of cross-country movement, widely separated and poor communications facilities, and the increase in logistical loads due to the special equipment needed by the infantry division in northern areas. Wheeled vehicles have been determined to be valueless for cross-country operations. Tracked vehicles should be substituted for wheeled vehicles that are expected to operate in the forward combat areas. Frequent task force operations will require the fragmentation of the support command.

The tactical considerations for operations in northern areas during winter months is the last subject for discussion. The winter season, with its frozen lakes, streams, and muskeg swamps, presents the best period for the conduct of offensive operations. These frozen waterways often provide excellent avenues of approach and routes of communication due to their flat and smooth surfaces. The numerous lakes which dot the landscape of northern areas constitute ready-made landing areas for cargo aircraft and heliborne operations. One of the greatest limiting factors for infantry operations in the northern area is the difficulty of cross-country movement and the slowness of troop reaction time in accomplishing assigned tasks. Factors causing this delayed reaction time are discussed along with the importance of accurate and current meteorological data in decision making.

The few communications facilities that do exist in the northern areas assume greater tactical significance than would be the case in a temperate zone environment. These rail and road facilities will often be designated as objectives for the infantry division. The widely separated nature of these facilities will frequently require the organization of independent task forces. The conclusion is reached that the considerations for the organization of a task force in the North are no different from the considerations in the Temperate Zone. The techniques used by a task force in the North to seize assigned objectives will be different from Temperate Zone operations, but the tactical principles for the conduct of the attack will remain the same.

The basic conclusions reached as a result of this research are as follows:

1. The hostile environment of the Arctic is a dynamic and unrelenting force that will challenge the imagination, ingenuity, and physical resources of even the best trained military units that may be committed in this area of the world.

2. The winter season is the most favorable season for the conduct of military operations in the northern areas. Within the cold weather season, the period January to March offers the best possibilities for military operations because of improved trafficability of terrain.

3. The human body does not possess the physical capability to acclimate to extreme cold temperatures as it

does to extreme hot environments.

4. The large amounts of cumbersome clothing required for protection in the Arctic results in a loss of efficiency of the individual soldier due to a decrease in manual dexterity.

5. Military operations in the Arctic require the ultimate in physical conditioning of the participating troops.

6. A minimum of nine weeks of intensive preparatory training are required to ready an infantry division in the temperate zone for deployment to a combat theater in the northern areas.

7. The wheeled vehicle does not possess a satisfactory cross-country capability in the snow covered terrain of the Arctic.

8. The widely separated and poor communications systems, the difficulty of cross-country movement, and the increase in amounts and types of supplies required in northern areas tend to intensify and complicate logistical problems associated with arctic operations.

9. When practical, unit distribution of supplies will be preferred over supply point distribution during operations in the North.

10. Offensive military operations in northern warfare will not have extended, solid frontlines, but instead will consist of independent task forces of battalion, brigade, and in some instances, division size.

11. The considerations for tailoring of independent task forces for northern operations will be no different than those considerations for operations in the Temperate Zone.

12. Current and accurate meteorological data is essential for successful operations in northern regions. Temperature, wind, precipitation will influence the commander' decision and concept of operations.

13. The ROAD infantry division, as currently equipped for operations in a temperate environment, does not have the capability to conduct offensive operations in northern regions during the winter season. Equipment lists must be modified to reflect substitution of tracked vehicles for wheeled vehicles which are expected to operate in the forward combat areas where few roads exist. Additional changes in the equipment lists are necessary to provide the division with the special items of cold weather equipment to cope with the severe and hostile environment of northern regions.

U. S. ARMY COMMAND AND GENERAL STAFF COLLEGE

Name of Candidate WILLIAM G. CASH, Major, U. S. Army

Title of Thesis NORTHERN OFFENSIVE OPERATIONS

Accepted by:

[signature], Research and Thesis Monitor

[signature], Member, Graduate Faculty

_____, Member, Graduate Faculty

Date 24 May 1945

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CONTENTS

PREFACE

World history provides the reader an almost continous series of examples of conflicts among nations which have attempted to enlarge their influence and expand their possessions. The scope and magnitude of these conflicts have increased steadily as science and technology have provided man with the means to exert his influence over greater distances. Among the most significant developments are improved weapons systems, long-range communications, and transportation. The improved weapons systems form the base for a greater offensive capability; the long-range communications provide the means to control and coordinate armies deployed over extended areas; and the transportation equips the nation with the capability to maneuver large forces rapidly over greater distances and to resupply these forces.

A comparison of the land and ocean areas affected by the two most recent wars serves to illustrate the rapid strides in the ability of nations to exert influence and pursue national objectives on a broader scale. The 23 years separating these two world conflicts were certainly fruitful years of industrial and technological development as compared to earlier periods of history, and account, to a large

measure, for the sharp contrast in these two wars. Progress has continued since World War II and has introduced nuclear power and weapons, heliborne forces, jet aircraft, and the space age, all of which will have their affects on any future wars that may be conducted.

These technological developments, combined with the closer economic, political, and military ties of the nations of the world today, lead to the obvious conclusion that few countries could escape involvement in any future general war. The involvement of large numbers of countries not only implies that the size of the armed forces committed in such an encounter would be of greater magnitude than ever known before but would also encompass a greater range of climatic and terrain variations. Large armies of the future must be prepared to wage warfare simultaneously in all environments, ranging from the frozen Arctic to the hot and humid jungles of the tropical zones, from the open plains to the rugged mountains.

The numerous mutual defense treaties to which the United States has committed itself pose the possibility of still another type of warfare called "Limited War." As defined in the Dictionary of United States Army Terms, this is an "armed conflict short of general war, exclusive of incidents, involving the overt engagement of military forces

of two or more nations."[1] To support and assist in the fulfillment of the national objectives outlined in the various treaties, a recent reorganization of the Army divisions was completed. One of the main objectives of the reorganization was to facilitate strategic and external tactical tailoring. In essence, this permits the division to be organized with the type of maneuver battalions, equipment, and combat support units required by the mission and the environment which will be encountered.[2] The state of training of the personnel within the division is assumed to be of such a level as to permit a rapid adjustment with a minimum of training to the special environment which they may face.

Offensive operations in a northern environment will be examined to determine the special considerations which are required and the adequacy of current doctrine.

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[1]U. S. Department of the Army, Dictionary of United States Army Terms, Army Regulations 320-5, Washington: U. S. Government Printing Office, February 1963, p. 216.

[2]U. S. Department of the Army, The Division, Field Manual 61-100 (Washington: U. S. Government Printing Office, 4 January 1963, with Change No. 1, 27 March 1963), p. 5.

INTRODUCTION

"If it can be clearly determined how and to what extent the environment affects operations, then new and useful principles of recognition and prediction can be given the commanding officer. His judgments can more effectively promote the accomplishment of his military mission."[1] The basic ingredients of military operations are people, equipment, and environment. A study of the peculiarities and interactions of these ingredients under a given set of circumstances should provide a formula for their compatible employment to achieve the greatest efficiency.[2] Of these three ingredients, environment is the only one the commander cannot control or influence at a stated future time. The alternative then is for the commander to prepare his personnel and equipment to blend with and capitalize on the strengths and the advantages offered by the environment. "He who recognizes and respects this force can overcome it; he who disregards or underestimates it is threatened with

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[1] Effects of Environment on Military Operations, The George Washington University, (Washington, D. C., June 1955), p. 3.

[2] Ibid., p. 4.

failure or destruction."[3]

The purpose of this thesis is to examine the special considerations for offensive military operations in a northern environment and to determine the adequacy of the current doctrine for tactical employment of the ROAD infantry division. This study will be confined to three of the most influential aspects of military operations. These are: (1) Environment which includes terrain and climate, (2) the people who form the units to be deployed, and (3) equipment with which they will fight. The Northern Theater of Operations of World War II and troop tests conducted under arctic conditions since then will be the primary source of information used throughout this paper.

Thus far the only basis for assuming a future conflict will include the far reaches of the North has been the mention of treaty obligations and the fact that Alaska, the forty-ninth state, falls within this region. The strategic value of this area of the world can no longer be ignored. Technological advancements in transportation have eliminated many of the travel barriers in this area and now permit its remotest r gions to be readily accessible. Chapter I will be devoted to a discussion of the environmental aspects of the northern areas of the world and their effects on

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[3]U. S. Department of the Army, Effects of Climate on Combat in European Russia, Pamphlet, (Washington; U. S. Government Printing Office, February 1952), p. 79.

military operations. The importance of the strategic value of the northern part of the world as well as the firm conviction that our military forces must be prepared to meet the hostile environment in this area are the basic reasons which prompted the writing of this paper.

The current ROAD infantry division with normal augmentation for cold weather operations will be used as the reference vehicle throughout this thesis. This organization and its equipment will be examined in light of recent troop tests and will be compared with similar Finnish, German, and Russian organizations which were committed in combat in cold weather operations during World War II. Strengths and weaknesses will be discussed and recommendations made where applicable.

Chapter II is devoted to the effects of the arctic environment on personnel and how these effects will affect the overall accomplishment of the mission. The strength and energy of the soldier are two of the commander's most vital resources. To be successful in sustained operation this energy must not be wasted but must be directed toward fulfillment of the mission. Ignorance on the part of the commander or the soldier concerning effects of environment on personnel can result in the needless dissipation of body strength before the battle has begun. Conservation of body strength is especially important in the northern environment where a great amount of energy is directed toward maintaining body temperature. Proper clothing and

equipment are essential but are by no means the only requisite for survival. Know-how on the part of the soldier, and firm leadership at all levels in the supervision of the proper use of clothing and equipment are the key to success. However, the effects of the northern environment on personnel extend well beyond the psychological considerations of maintaining morale and creating a will to fight during the dead silence of this barren, dark, and frozen environment. The methods to cope with these obstacles are within the means of the alert and aggressive commander and will be discussed in length.

Following the study of the physical environment and its effects on personnel and equipment, Chapter III will discuss the training requirements necessary for successful operations in northern areas. This discussion will include the individual skills required to overcome the natural obstacles, indoctrination, training, and the use of special equipment.

Chapter IV will examine the logistical problems of the infantry division deployed in an arctic environment. Augmentation equipment which the support command will require to accomplish its mission will be discussed, along with the special problems which this equipment will create. Methods of overcoming these problems are submitted for the reader's consideration.

Tactical considerations for units operating in the North will be discussed in Chapter V. These considerations

and comments are based on troop tests which have been conducted recently in Alaska as well as experience gained by Finnish, Russian, and German units during World War II. The summer environment and mountain operations of this part of the world have been omitted deliberately from discussion in this paper; these subjects are extremely broad and are worthy of separate study.

CHAPTER I

MILITARY ASPECTS OF THE ARCTIC

This chapter is devoted to examining the military aspects of that portion of the world commonly known as the Arctic and subarctic. In military terminology, this region is referred to as the area of northern operations and is defined "as the area in the Northern Hemisphere which lies north of the Temperate Zone where climatic conditions require the application of special techniques and equipment that are not normally required for operations in a more temperate climate."[1] This definition will also apply to such terms as "arctic or subarctic operations," "far north," "cold weather operations," "northern regions," and other similar phrases as they are used in the following pages. Scientific papers and research reports will often refer to this area as the area north of the 50 degree isothermal line (figure 1). This line is further explained as "an isothermal line along which the temperature averages over 50^{o} for not more than three months of the year."[2] This line is

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[1]U. S. Department of the Army, Northern Operations, Field Manual 31-71, (Washington: U. S. Government Printing Office, 10 January 1963), pp. 3-4.

[2]U. S. Army, Alaska, Intelligence Reference Handbook on Alaska, (Assistant Chief of Staff, G2, Headquarters, U. S. Army, Alaska, 1953), p. 23.

commonly accepted as the dividing line between the Temperate Zone and the subarctic region. For the purpose of this paper, the 50 degree isothermal line is considered to be a more accurate description of the north than would the selection of a latitudinal line. The reason is explained as follows:

> An isotherm is a rather unstable line of demarkation and latitudinal variations must be considered. For example, there are isolated regions south of the isotherm which, by virtue of their altitude above sea level or the proximity of cold ocean currents, have climates similar to subarctic regions. A given latitude, on the other hand, is too rigid and independent of environmental variations to serve as a more accurate boundary for the Arctic or subarctic regions.[3]

The area under consideration is no small and isolated region but is one of significant size and importance to military planners of today. "Forty-five per cent of the North American Continent and 65 per cent of the U.S.S.R. lie in the Arctic and subarctic" (figure 1).[4] A study of this area shows that significant portions of Russia, Canada, Alaska, Norway, Sweden, Finland, and Greenland are included. In addition to the land areas involved, major oceans are also included. The Arctic Ocean is the central area of this entire region and touches the northern shores of all land masses in this study.

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[3]United States Army, Alaska, Possible North Eurasian War Theaters and North American Analogs Thereto, (Headquarters, United States Army, Alaska, October 1961), p. 1.

[4]U. S. Army Alaska, Intelligence Reference Handbook, p. 23.

To provide the reader with a clearer understanding of the military importance of this northern region, its strategic value will be briefly discussed. The shortest distance between North America and northern Eurasia is by way of this Arctic route (figure 1). For aircraft, the use of this route represents a decrease in flight time to destinations in the northern parts of Europe, Eurasia, and Asia. During peacetime, this decrease in flight time means a savings in fuel and turn-around time for both military and civilian transportation. In wartime increased range represents a capability of striking deeper targets than would otherwise be possible. For striking targets in northern Russia, this route decreases the time that an aircraft will be over land areas where it would be most vulnerable to missile attacks.

The most important shipping lanes from ports on the west coast of the United States to destinations in the Orient pass within 200 miles of Alaska and the Aleutian Islands. This sea route is referred to as the Aleutian route and is approximately 1400 miles closer to the Orient than the Hawaiian route. The strategic importance of the naval bases established at Kodiak and Adak Islands in the Aleutian chain has long been recognized for "whoever controls the Aleutians has a flanking position on the whole north Pacific Ocean."[5]

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[5]Jones, Clarence F., The Worlds Nations, (J. B. Lippincott Co., Chicago, 1958), p. 180.

All of the nations included in this area, with the exception of the U.S.S.R., are either friendly in their relations, or are signatory to mutual defense treaties with the United States. The location of these friendly nations would be extremely significant in the event of a general war. Not only could these countries cut Russia off from the sea, but they could serve as tactical missile sites and logistical bases for land forces executing a southward thrust through Leningrad to Moscow. This avenue of approach provides the shortest land route to the Russian capital available to the allied nations today. An allied operation from the north, conducted in coordination with thrusts through the Balkans on the south and through the north Eurasian plains on the west, would seriously jeopardize the position of Russian troops in Europe.

The winter climates encountered in the land areas of this part of the world vary in severity and duration. These variations are due primarily to their altitude above sea level and the prevailing wind currents which either have a warming influence or bathe the area in subzero gales. There are other isolated land areas south of the 50° isotherm which have equally cold climates but are not included in this discussion. These areas are comparatively small in size and derive their climates from high mountains.[6]

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[6]United States Army, Alaska, Possible North Eurasian War Theaters and North American Analogs Thereto, Study Project ARACD 001-61, (Headquarters, United States Army, Alaska), p. 1.

Winter comes suddenly to this northern part of the world and lasts from five months in the milder regions, such as southern Finland, to seven and one-half months in the more severe areas north of the Arctic Circle. Ice forms on the inland lakes and streams beginning in October, continuing through March and April in the more severe regions, and to late May in isolated areas.

One of the greatest factors which influences the climate in this area of the world is the Murman Coast current, a warm ocean current which is an extension to the Gulf Stream Current. As these ocean currents flow past northern Europe, warmth is transmitted to the prevailing winds which flow over the land masses of this part of the world. As a result of these warm air and ocean currents, this part of the world has a much milder climate than central Canada which is on the same latitude.[7]

> The greater portion of European USSR owes the mildness of its winter climate to the influence of the waters of the Baltic Sea and Gulf of Finland and thus, indirectly, to the influence of the Atlantic Ocean. The moderating effect of these waters is strongest, of course, in the west but is felt even in the eastern extremities.[8]

While the above are examples of warm currents, cold air currents also have their affects. These cold air currents are commonly referred to as "Northers" or "Boras." These winds are created by low-pressure systems moving south out

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[7]Ibid., p. B-2.

[8]Ibid.

from the Arctic Ocean dragging large volumes of extreme cold air along with them.[9] The effects of these cold air currents cover large areas and frequently cause high winds and snow to follow in their paths which produce blizzard conditions. While these conditions are comparatively short in duration, their effects are dynamic and sudden. They are characterized by a sudden drop in temperature and gale-like winds which produce blinding snow storms. During the winter months, it is not uncommon for the temperature to plunge downward 70 degrees in one overnight period. Troops caught unprepared and away from shelter will be tested to the fullest in their fight for survival against these hostile elements.

A committee of German generals and staff officers in preparing the German Report Series for the Historical Division, EUCOM had this comment regarding their experience with the climate on the Russian Front during World War II:

> The winter of 1941-1942 was most severe in European Russia. In the area northwest of Moscow the mean temperature during January 1942 was -32° F., and the 26th of the month in the same area saw the lowest recorded temperature of the entire Russian campaign: -63° F. The southern part of European Russia, too, had record low temperatures during the first winter, with readings ranging from -22° to -40° F., compared with temperatures of 14° to -40° F., in the same area during the following winter.[10]

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[9] Ibid., p. C-4.

[10] U. S. Department of the Army, Effects of Climate on Combat in European Russia, Department of the Army Pamphlet No. 20-291, February 1952, p. 4.

These described conditions are abnormal for this part of Russia. Normally, the mean daily minimum temperature for January is 5° Fahrenheit.[11] However, this example serves to illustrate, in no uncertain terms, the unpredictable climate to be considered and its susceptibility to extreme changes for prolonged periods.

The northern portion of European Russia has a mean daily minimum temperature for January ranging from 14 degrees Fahrenheit on the extreme western edge near the Baltic Sea to minus 4 degrees farther inland near the Ural Mountains. Finland, although considerably farther north than European Russia, has a mean daily minimum temperature of 5° Fahrenheit for the same period. The milder climate of Finland is attributed to the close proximity of the Murman Coast Current.

The amount of precipitation in the area under consideration varies widely, depending on the proximity of ocean bodies and moist air currents. Precipitation during the winter months will usually be in the form of light snow which may last several days without stopping. Occasional blizzards will also occur and will create drifts along highways and airstrips, which further restrict transportation means. During the spring thaws, flooding may result in flat or poorly drained areas as a result of the melting

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[11] United States Army, Alaska, Possible North Eurasian War Theaters and North American Analogs Thereto, Figure A-1-3.

ice and snow. Approximately 17 inches of uncompacted snow will equal one inch of water.[12] Since old snow will have compacted with time, caution must be exercised when attempting to use these measurements in computing the effects of melting snow.

The portions of northwest Russia covered in this study have a normal depth of undrifted snow of from one to three feet. The snow cover over this region can be expected to last from four months in the extreme western areas to eight months in the northeast.[13] "Snow depths of three to four feet are common in the north where wheeled vehicles can move only on cleared roads, and huge snow drifts build up in valleys and hollows."[14]

The amount of snowfall in Finland does not differ greatly from that found in north European Russia.

> Almost the entire mainland is normally covered with snow for over 150 days a year. The first snow usually falls in September in the north and most of Finland is snowcovered by early November. Snow depth increases gradually to a maximum in mid-March, when snow is normally about a foot deep along the coasts and 2 feet deep in the interior. During severe winters snow is generally 3 to 4 feet deep on the level. During mild winters there may be a foot of snow in the interior

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[12]U. S. Department of the Army, Basic Cold Weather Manual, Field Manual 31-70, (Washington: U. S. Government Printing Office, 24 February 1959), p. 68.

[13]Jones, p. 573.

[14]U. S. Department of the Army, Basic Cold Weather Manual, Field Manual 31-70, (Washington: U. S. Government Printing Office, 24 February 1959), p. 68.

and none at the coast. The snow usually starts thawing in April and, by mid-May, almost all of Finland is free of snow.[15]

The topography of northern Europe and European Russia was formed into its present configuration mainly by glaciation during the Ice Age. The mountainous areas of Norway and Sweden provided the sources of ice to form the glaciers which flowed over this region and virtually flattened the surrounding countries or created rolling hills. "The great weight of the glaciers over Northern Europe, where the ice was the thickest, had depressed that part of the continent several hundred feet below its former elevation."[16] The subsequent melting of the ice practically inundated Finland and the northern part of Russia. The level of the ocean was raised to the point where Northern Europe was detached from the mainland and Finland consisted of a group of small islands. The continued melting of the ice created racing currents which eroded the highlands and deposited this fertile silt and earth into the edge of the ocean or onto the lowlands as the current slowed. Through time, the gradual build up of the land caused the oceans to recede to their present positions and reveal the fertile soils of the lowlands.[17]

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[15]United States Army, Alaska, Possible North Eurasian War Theaters and North American Analogs Thereto, p. A-14.

[16]Jones, p. 155.

[17]Ibid., p. 465.

The consequence of this phenomenon is readily apparent today in that "lakes, swamps, marshes, and bogs cover about 40 to 45 per cent of the total surface area" of Finland.[18] "It is estimated that there are between 60,000 and 70,000 lakes in Finland. No place in the country is more than 5 miles from a lake or stream."[19] This area consists of undulating and level plains along the Gulf of Bothnia and gradually increasing in elevation toward the interior where low hills and ridges are predominant. The northern area of Finland, above the Arctic Circle, has isolated mountainous regions which may reach an elevation of 3,000 feet but consist principally of rolling plains and low hills. The rolling hills and plains are generally monotonous and offer no conspicuous relief variations.

The northwest Arctic coastal and the north central regions of Russia consist of the area north of Leningrad along the border of Finland and east to Gor'kiy. In many respects, it shares the same topography as Finland due to their close proximity.

> Elevations above sea level in this region vary from sea level to 1,000 feet, with the only exception of Khibing Mountain (approximately 3,600 feet) on the Kola Peninsula. Except for the hills and lowlands mentioned, and the extensive swamps surrounding the White Sea, Lake Onega, and Lake Ladoga, this region consists of a vast gently rolling plain about 550

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[18]United States Army, Alaska, Possible North Eurasion War Theaters and North American Analogs Thereto, p. A-12.

[19]Ibid., p. A-12.

feet above sea level, part of the Great Russian Plain.[20]

Major rivers in this area are the Volga, Medveditsa, and the Severnaya. It is interesting to note that, with the exception of the Volga, these rivers flow to the north toward the Arctic Ocean. The importance of the direction of water flow is the fact that the headwaters are located farther to the south than are the mouths of the rivers and, consequently, are affected by freezing temperatures for a shorter period of time. The snow and ice near the headwaters melt earlier in the spring and attempt to flow north through the river basins which are still frozen; the ice-filled river beds force this water to flow out of the normal river channel and inundate the surrounding flat terrain. The effects of flooding on military operations during this season of the year are drastic. This flooding is the cause of many bogs, swamps, and marshes which are located adjacent to streams and lakes and pose formidable obstacles to movement during summer months. With the exception of poor drainage, no other major topographical feature exists which constitutes a relief barrier to military operations. Considerations other than relief which would have an influence on military operations will be discussed later in this chapter.

Vegetation above the Arctic Circle in Finland and Norway varies from practically none on the mountain slopes

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[20] Ibid., p. B-1.

to large areas of tundra meadows and deciduous brush ranging up to five feet in height. Little or no firewood exists in this region, and no trees for construction purposes are to be found. Military units operating in this area would be forced to use manufactured construction materials or transport lumber and materials in from sources south of the tree line. Concealment in the form of dwarfed trees and low brush is abundant in the low areas where soil thickness and moisture permit growth. The short length of the growing season and low year-round temperatures are primarily responsible for creating this barren wasteland.

The area south of the Arctic Circle is much more favored, with vegetation being very plentiful in all areas except high mountains. The abundant water sources in the lowlands and plains are especially conducive to the growth of vegetation. It is here that extensive forested areas are to be encountered that impose serious obstacles to military operations. Dense coniferous forests are most predominant, but deciduous trees are also common.

Approximately 71 per cent of Finland is covered with forests, with trees in the south reaching a height of 110 feet and having diameters up to 15 inches.[21] In the Arctic coastal and north central regions of Russia, "forests form an extensive belt across the area. The evergreen needleleaf trees, which comprise 85% of the forest, form a belt of

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[21] Ibid., p. A-2.

varying density called 'taiga,' which is as much as 1,000 miles wide."[22]

The hostile and often nonproductive environment of these northern lands is primarily responsible for the sparse population of these areas. The vast majority of the population is concentrated in or near cities where job opportunities are most abundant. Small villages and scattered settlements are normally located along major communication links within these countries. The northern parts of Finland and Russia are practically uninhabited and have extremely poor transportation systems.

The lack of cultural features and population could have significant influence on military forces, which might be dependent on local procurement of supplies and labor resources. In general, military units moving into these regions must be self-supporting and have the means to maintain satisfactory levels of supplies within their own resources. Permanent structures which could be converted into command posts, hospitals, maintenance shops, and supply storage facilities are practically nonexistent in the northern portions of these countries. This situation improves somewhat in the more southern regions but does not begin to compare to the more populated areas of Europe.

Unlike their Eurasion counterparts, Alaska and Canada do not have the benefit of any major warming influence

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[22] Ibid., p. A-11.

such as the Murman Coast Current. Coastal areas do, however, derive some benefit from the warmth provided by the close proximity of nearby ocean bodies. This influence does not extend for any significant distance inland, due primarily to mountain barriers which parallel the coast lines of these areas. Consequently, a more severe winter is experienced by this area even though they may be located on the same latitude as the Eurasian countries in this study.

Alaska and Canada have mean daily minimum temperatures for January which extend from a minus four degrees Fahrenheit in the southern areas to a minus twenty-two degrees Fahrenheit in the northern regions.[23] These mean temperatures are subject to major deviations caused by sparodic wind and atmospheric changes. The central and northern areas of Alaska and Canada have the most severe and hostile environment of all the areas of the north. The average snowfall in the interior of these regions varies considerably from the coastal and mountainous areas. The difference is due primarily to the fact that the mountain barriers cause the moisture-laden ocean air to condense most of its moisture before moving inland. The eastern fourth of Canada and the area on the west coast to the Rocky Mountains have an average annual snowfall of 200 centimeters.

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[23]Jones, p. 155.

This depth is compared to approximately 100 centimeters for the interior areas.[24]

The depth of the snow cover and the duration of snowfall in a given area are certainly important considerations in planning offensive military operations; however, to understand the true implications of snow on military operations, another aspect of snow must be considered. This consideration is the condition of the snow over which the military forces plan to maneuver. The conditions of snow will usually fall into these categories: wet, dry, compacted, and uncompacted. Wet snow is characterized by the property to cling to itself and to objects which it touches. If you can pick up a handful of snow and easily make a snowball without the snow crumbling, it is said to be wet snow. Wet snow is usually a function of temperature and results from a partial melting of the ice crystals. Tracked vehicles moving through wet snow will be forced to stop occasionally to clean the suspension mechanisms to avoid interference from snow build-up, and wheeled vehicles have greater difficulty in maintaining traction. Troops using snowshoes or skis in wet snow will be hindered by the build-up of ice on bindings and on running surfaces. Dry snow is usually encountered in extreme cold conditions and is just the opposite of wet snow. It does not have a tendency to cling to objects with which it comes in contact and

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[24] Ibid.

consequently does not pose the problems of wet snow. On the other hand, dry snow is light and fluffy and is subject to blowing by wind. As a consequence, deep snow drifts are created which restrict cross-country as well as road movement. During high wind conditions visibility may also be reduced considerably by the loose snow being blown through the air. Compacted snow provides excellent hard-stand and running surfaces for vehicles. Uncompacted snow, depending on its depth, will seriously interfer with mobility of troops and vehicles. Troops on foot as well as wheeled vehicles will have extreme difficulty when attempting to move through snow in excess of 30 centimeters. Most tracked vehicles can continue to operate in snow up to a depth of 60 to 75 centimeters.[25]

Canada, like the other countries located in the northern part of the world, has suffered the effects of the Ice Age. Approximately 60 per cent of the country is ice-scoured and consists of crystalline rock uplands. This large area is referred to as the Laurentian Uplands and bears a marked resemblance to Finland with its many streams and thousands of lakes. Many of these streams are unfordable and join massive lakes which are many miles in width and length. During the winter months these water barriers are frozen and do not constitute interference to military operations.[26]

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[25]U. S. Department of the Army, Northern Operations, Field Manual 31-71, (Washington: U. S. Government Printing Office, January, 1963), pp. 16-17.

[26]Jones, p. 153.

The entire western portion of Canada is composed of the Rocky Mountains and the Coastal Mountains which extend from Alaska to the state of Washington. This area is extremely unsuitable for maneuver of large forces and would require special training and equipment to insure successful military operations.

Bordering the length of the Rocky Mountains on the east is the great Mackenzie Valley with its great plains. This area contains some of the most fertile land in Canada and has a flat to rolling topography.[27] The Mackenzie Valley is a continuation of the great plains which extend northward from the Gulf of Mexico to the Arctic Ocean. Military operations in this area are feasible throughout the year.

Major topographical features of Alaska consist of the Brooks Mountain Range on the north, the Alaska Range on the south, and the coastal mountain range which stretches from the Aleutian Islands to the southern tip of the eastern panhandle area. Elevation of these mountains varies. Brooks Range has a maximum elevation of 9,000 feet above sea level, the coastal mountains from 13,000 to 16,500 feet, and the Alaska Range has peaks up to 20,000 feet. These land forms present major obstacles to large scale military operations. Only a specially trained troops equipped with special equipment could be expected to operate successfully in these areas.

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[27] Ibid., p. 162.

The interior of Alaska has many large and unfordable streams that are flanked by extensive lowlands and plains. In addition to the major water bodies, an extensive network of smaller streams and lakes exist throughout the area due to poor drainage created by the lowlands and the subsurface perma-frost. This poor drainage creates bogs, marshes, and swamps that would drastically interfere with military operations during early winter months.

The remainder of the area consists mainly of gentle sloping hills and highlands which occasionally reach an elevation of 5,500 feet above sea level.[28] Many of these areas restrict the cross-country movement of wheeled and tracked vehicles except where trails and roads have been built.

Cultural features in Alaska and Canada are mainly restricted to the coastal and southern areas. The interior of Alaska and Canada is similar to Finland and Russia in that populated areas are restricted to main routes and centers of communication. The military significance of the lack of cultural facilities in the remote sections of Alaska and Canada are the same as those discussed earlier for Finland and Russia. These factors must be considered by military forces planning operations in these areas. Logistics will be the most important consideration, but the lack of

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[28]U. S. Department of the Army, Office, Chief of Engineers, Terrain Study of Alaska, Part II: Physiographic Regions, (Army Map Service, Corps of Engineers, Washington, D. C., April, 1961), Map.

roads, maps, and other man-made features will complicate cross-country navigation as well as aerial navigation. Troops positioned in these isolated areas will lack permanent shelters and recreational facilities which assist in maintaining morale.

Areas of Alaska and Canada below the Arctic Circle which border streams have tall, dense evergreen forests. These large trees would be especially useful for construction purposes but pose serious barriers to vehicular cross-country movement. With the exception of the mountainous areas, the remainder of the country has extensive forests which range from moderately tall and dense to generally low and varied.[29]

The last major environmental factor to be considered is the long polar nights associated with the winter months of northern areas. The length of the nights encountered in the Arctic is a function of latitude and season of the year. Extreme northern areas near the North Pole will have as much as four months of darkness in which the sun does not rise above the horizon.[30] In the extreme southern regions, the longest nights are experienced during the months of December and January. During these months, the very best of weather conditions will not yield more than six hours of

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[29]U. S. Department of the Army, Office, Chief of Engineers, op. cit.

[30]Jones, p. 599.

daylight. The darkness associated with the Arctic regions is different from the nights of the more temperate climates.

> Pitch darkness, however, is rare in the arctic regions. In winter when direct or indirect sunlight is absent much of the day, the ground is usually covered with snow which so magnifies and reflects whatever light that gets to it, that even at maximum darkness a dark-clad man on a light field can be seen 100 yards away. Maximum darkness will occur when the sky is densely overcast, when there is no twilight, when there is no moon in the sky, and when there are no northern lights behind the clouds. The stars succeed then, by themselves, in transmitting enough light through the clouds to prevent that type of pitch darkness which occurs in other regions.[31]

The military significance of these considerations and their influence on tactical operations will be discussed at length in the following chapters.

The suitability of the northern lands for military operations is measured in terms of a nation's capability to cope with the many and varied environmental factors which confront the military unit. The greater the capability of a nation to blend with and work in harmony with the natural laws which exist there, the more suitable and plausible these operations become. One way in which a nation can begin to prepare for Arctic operations is to train its soldiers to survive and fight in a cold environment. The problems of surviving and fighting in the Arctic will be discussed in the next chapter.

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[31]United States Army, Alaska, Intelligence Reference Handbook on Alaska, (Headquarters, U. S. Army, Alaska, 1953), p. 26.

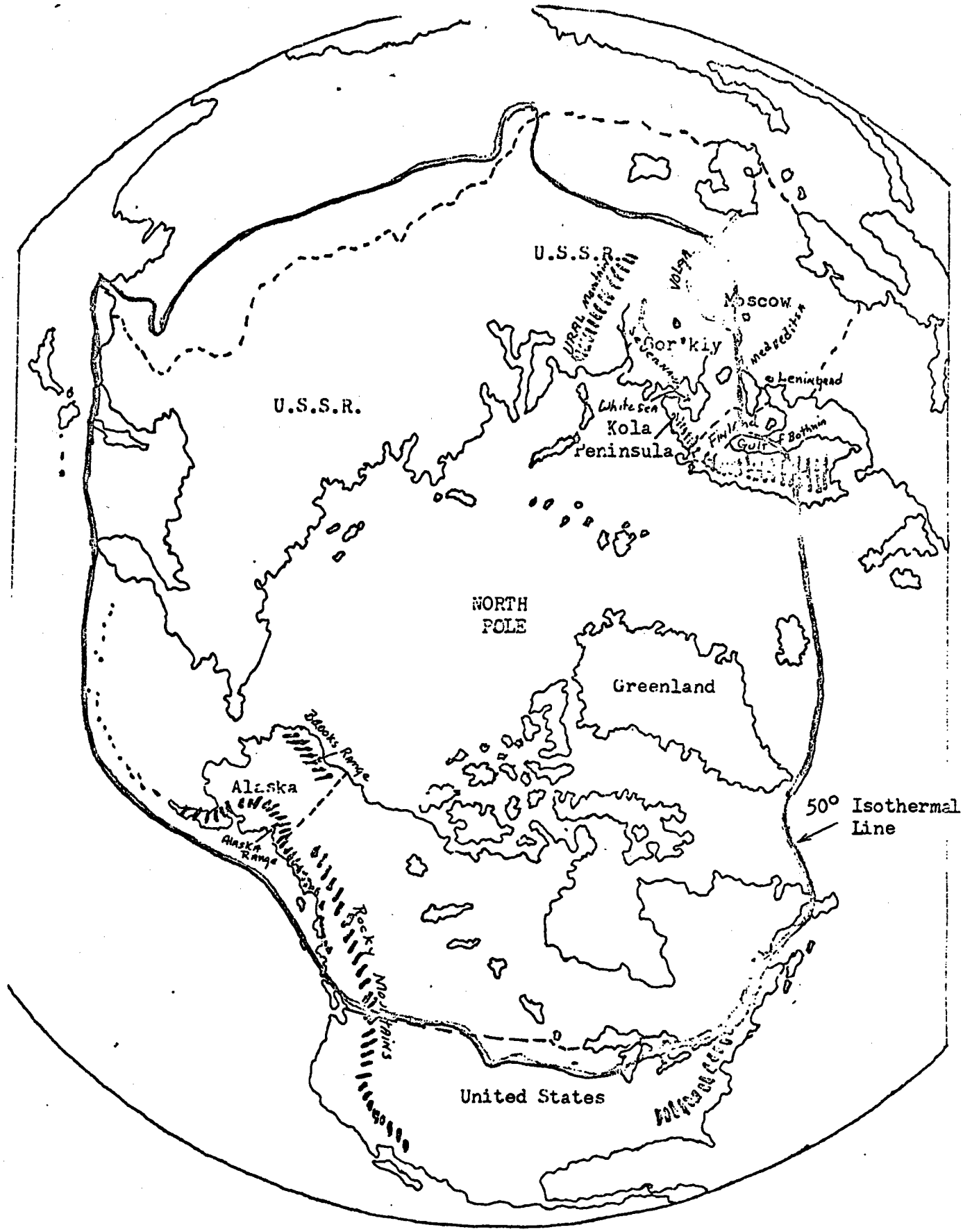

Figure 1.

Extracted from United States Army, Alaska, Possible North Eurasian War Theaters and North American Analogs Thereto, (Headquarters, United States Army, Alaska, October 1961).

CHAPTER II

EFFECTS OF NORTHERN ENVIRONMENT ON PERSONNEL

The soldier is the most important resource of a commander. It is through him that the commander can manipulate his material resources in order to generate the combat power required to overcome the enemy. The more proficient the soldier, the more efficient and effective the soldier will be in the utilization of the tools or materials necessary to accomplish his tasks. Commanders have long recognized the many advantages of a well-trained, disciplined, and motivated army as compared to a larger but unprofessional force. History books provide many examples of smaller units which have succeeded in overcoming and defeating larger forces. The deciding influences, in most cases, are the quality of the leader and the determination and proficiency of the led.

The purpose of this chapter is to examine those aspects of a cold environment which may affect the will of the soldier to fight or his capability to perform his job in an efficient manner. A reduction in either his will or proficiency, or possibly both, will in turn have an influence on the capability of his unit. The commander must be cognizant of these effects, be quick in detecting and

analyzing their symptoms, and overcoming them. Failure to recognize the limitations imposed by a cold environment or to underestimate their effects could seriously jeopardize the entire unit. The major areas to be discussed are the physiological and psychological effects imposed by the northern environment.

The first aspect of the effect of environment on personnel to be discussed will be the physiological effects. Since World War II the United States Army has conducted extensive research in this field for the purpose of developing clothing and equipment to protect the human body against the hostile effects of the northern environment. However, very little of this research has been directed toward determining the extent to which the body can adjust or acclimatize to a cold environment. The desirable solution to the problem of the soldier in a cold environment would be to have him effect the necessary biological and chemical changes within his body to counteract or reduce the limitations and dangerous conditions which currently exist. This not only would promote his own comfort and well-being but would also lighten, noticeably, the mammoth logistical loads associated with arctic operations. Included also would be improved efficiency through being able to work longer periods without the need of warming and more freedom of movement as a result of less clothing to hamper his actions. One researcher proposed this hypothesis regarding human acclimatization to cold:

> The mechanisms of acclimatization appear to involve an increased caloric intake balancing the increased heat output. From the data presented, it seems that due to readjustments which provide for an increased shell and reduced core temperature, acclimatized individuals should require less caloric input than non-acclimatized on intermittent exposure. This change is accomplished by a relatively increased circulation to the hands which should increase efficiency.[1]

The shell temperature above is the temperature of the peripheral (skin) tissues. The core temperature is the internal temperature of the trunk of the body where most of the vital organs are located. The basic claim of the above hypothesis is that the acclimatized individual would be able to retain dexterity of the fingers through increased circulation of blood and heat to the extremities. While not stated, this also implies a reduction in the possibilities of cold injuries to the feet and hands as a result of more heat being transmitted to these areas.

Unfortunately, subsequent tests in this field have not been able to substantiate the validity of this theory. Others who have researched in this area indicate contrary evidence and opinion. Another researcher who is a noted scientist, Arctic explorer, and medical doctor takes issue with such a hypothesis and states, "While it is known that human beings can become acclimatized to heat, it is still subject to dispute whether any real physiological

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[1]L. D. Carlson, et. al., Acclimatization to Cold Environment, Physiologic Mechanisms, (USAF Technical Report No. 6247, March, 1951), as quoted in United States Army Alaska, Effect of Northern Environment on Personnel, (Combat Developments Study Project ARACD-14, United States Army Alaska, 14 February 1958.)

acclimatization to cold is possible."[2] He continues in his discussion to point out that while the human body can make minor adjustments in its attempt to reduce the ill effects of cold, the greatest protective benefits are to be derived from know-how, experience, and accustomization.[3]

The Office of Combat Developments in Alaska has concluded that scientific research in this area is nonconclusive and does not warrant any positive recommendation at this time. Instead, it recommends that further controlled studies be conducted to determine the status of man in his efforts to adjust to a cold environment.[4] Meanwhile, research and development continue to point toward providing man with the clothing and equipment necessary to protect him against hostile elements of northern climates and to contribute to his comfort, efficiency, and morale. To provide the soldier with the necessary items of clothing and equipment to meet the varying degrees of severity of the northern climate, current doctrine calls for the issue of a full-field load totaling 118.85 pounds per individual. This load is broken down into: (1) battle load, (2) existence load, and ( ) protective and comfort load. The battle load for a rifleman consists of his individual weapon, ammunition,

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[2]Kaare Rodahl, North, (Harper and Bros., N. Y., 1953), p. 79.

[3]Ibid., p. 79.

[4]United States Army, Alaska, Effects of Northern Environment on Personnel, (Office of Combat Developments, Study Project ARACD-14, 14 February 1958), Annex A.

grenades, entrenching tool, and a protective mask - a total of 26.01 pounds. This is a fairly fixed load and will not fluctuate as a result of climatic conditions alone. On the other hand, the existence load is comprized of those items which the soldier must wear or carry in his pockets as protection against the elements. The combination of the existence load and the battle load is known as the combat load.[5]

For moderate cold weather (above 14° F.), the combat load weighs a total of 66.70 pounds. As the severity of the weather increases, the combat load will increase upward to 74.64 pounds. This is compared to a 40- to 45-pound combat load for temperate climates.[6]

The remainder of the full-field load, not with the individual, is the protective and comfort load. These items are carried in the rucksack (sleeping gear) and in the duffle bag (extra clothing). Whenever possible, these items are brought forward at night on unit transportation to be readily available to the individual. If the tactical situation, terrain, or other factors do not permit the movement forward of unit transportation, sleds pulled by individuals must be used to transport at least the sleeping gear to the unit.[7] Depending on the temperature, the failure to provide

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[5]U. S. Department of the Army, Basic Cold Weather Manual, Field Manual 31-70, (Washington: U. S. Government Printing Office, 24 February 1959), pp. 6-10.

[6]Ibid., pp. 6-10.

[7]Ibid., pp. 6-10.

shelter and clothing to the individual could pose serious consequences. An example is pointed out by German generals who were present on the Russian Front during the winter of 1941-42. Their comments on this subject follow:

> The Russian, too, suffered from the extreme cold when forced to remain out in the open. Their supplies did not keep up with them, and they became weak and exhausted. Consequently, they always made a great effort to capture villages for overnight shelter. For example, in the winter of 1941-42, north of Rzhev, the Russians unsuccessfully attempted to drive German forces out of a village and were forced to spend the night in the open. Cut off from supplies and stiff with cold, the Russians were so weakened by their ordeal that they were unable to hinder a withdrawal of German troops, including two batteries, from north of the village, even though the Germans passed within 100 yards of the Russian forces.[8]

Another illustration of the importance of shelter to troops at night on the Russian Front is presented by the authors of the above statement:

> Night temperatures dropped to between -30° and -40° Fahrenheit, and no shelter was available to the German troops. The near-by villages were destroyed and the entrenchments of the old German positions on the Lama were buried deep in snow. To remain exposed would have meant certain death to the troops who lacked adequate winter clothing.[9]

A withdrawal of German troops was required in order to gain the necessary shelter for protection. Properly clothed and trained troops can resort to field expedients such as snow caves, lean-to's, natural shelters, or snow holes and still be able to accomplish their mission the next day.

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[8]U. S. Department of the Army, Effects of Climate on Combat in European Russia, Department of the Army Pamphlet No. 20-291, (Washington: U. S. Government Printing Office, February 1952), p. 7.

[9]Ibid., p. 5.

Since the human body does not have the ability within itself to survive the cold weather encountered in the northern regions, the equipment described above is considered the minimum amount necessary to permit a soldier to perform his tasks and continue to function over a sustained period. To provide a better understanding of why the body requires this protective clothing and equipment, the physiological responses of man to a cold stimulus will be discussed.

The human body functions most efficiently when the core temperature is maintained close to 100° Fahrenheit.[10] To control this temperature at a fairly level rate, the circulatory system of the body functions as do a thermostat and radiator on an automobile. As the internal body temperature increases, the blood vessels near the surface of the skin will increase in size to permit a greater flow of blood and heat to the peripheral tissues. This excess heat is then transferred to the surrounding air through conduction. During exposure to extreme cold, the blood vessels in the peripheral tissues will contract to reduce the blood flow into those areas. This is done in an effort to reduce the amount of body heat being lost through the transfer of heat to the surrounding air.[11]

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[10] R. I. Cutting, Major, United States Army Medical Corps, Medical Doctor, Interview conducted at Fort Leavenworth, Kansas, 12 March 1964.

[11] Ibid.

This small physiologic response of the body has very definite limitations and is grossly inadequate to compensate for the great heat loss which occurs during prolonged exposure to extreme cold temperatures. As the surface skin temperature continues to decrease, the internal body heat is supplied at a greater rate to the affected areas in order to reestablish the desired thermal balance. In addition, an involuntary muscle contraction, commonly referred to as shivering, occurs. Shivering produces the same effect as muscular exercise and causes body heat to be generated through an increased metabolic output. Depending upon the severity of conditions, shivering may double the heat production in an effort to restore the body temperature to a more comfortable level.[12] However, "if this heat debt continues, lowered body temperature (hypothermia) results, and if untreated will lead to death from exposure."[13] Death is caused by a malfunction of the heart (auricular or ventricular fibrillation), which occurs when the core temperature is lowered to the vicinity of 88° Fahrenheit. This critical limit will vary among individuals due to many different physiological variations which exist among humans.[14]

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[12]Rodahl, p. 81.

[13]Ibid., p. 81.

[14]Cutting, Interview.

An interesting physiological difference between man and animals is the fact that animals can better control the release of body heat to extremities through a series of shunts in the blood vessels. An animal will stop or reduce the flow of blood and heat to an area which is losing an excessive amount of heat in order to preserve this heat to protect the main organs of the body. In other words, an animal will unconsciously sacrifice its extremities in order to preserve the heat for protection of vital organs. Man cannot do this. He will continue to supply heat to an area that is draining the body of its vital heat, and as pointed out, will eventually die as the situation worsens.[15]

Man can best combat the ill effects of extreme cold through insulation (clothing) and muscular exercise. As a result of contraction and expansion of the various body muscles, heat energy is liberated. This is accomplished as a result of a complex physio-chemical process in the combustion of products of foods. This is the reason that a person undergoing physical exercise in a cold environment feels the cold less than a person who is sitting or standing still. The conclusion to be drawn is the fact that a person in a cold environment will require more caloric intake to supply the energy needed for continued exercise or shivering for prolonged periods. In the absence of sufficient caloric intake, the body may call forth glycogen (animal starch) which is stored in all large muscles and in the liver.

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[15] *Ibid.*

Glycogen is readily converted to heat and is an immediate source of energy whenever a caloric debt occurs. Body fat can also be consumed, but it is not immediately available and must go through a series of chemical processes before becoming usable.[16]

To avoid a caloric debt, the Quartermaster Research and Development Command estimates a requirement exists for approximately 4,000 calories per day for active individuals involved in Arctic operations, as opposed to approximately 2,400 calories for temperate zone operations.[17] This figure will decrease as the activity level of the individual decreases and may vary with the severity of the weather if the individual is not properly clothed. A person who is properly clothed will not require as much of an increase in metabolic output to maintain the body temperature as a person who does not have the proper clothing to insulate him against the cold.[18] However, the activity level will be the main deciding factor as to the number of calories required to sustain the individual and avoid weight loss. It can generally be said that for any given outdoor task,

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[16] Ibid.

[17] Quartermaster Research and Engineering Command, Caloric Intake and Energy Expenditure in a Sub-Arctic Environment, Technical Report EP-33, (Environmental Protection Research Division, Natick, Mass., March, 1956), p. 10.

[18] Quartermaster Reserach and Engineering Command, Caloric Intake During Prolonged Cold Exposure, Technical Report EP-66, (Environmental Protection Research Division, Natick, Mass., September, 1957), p. lv.

the caloric expenditure in the northern area will be greater than if the same task were being accomplished in a temperate area.[19] The major reason for the increased caloric expenditure is the added weight of clothing, hampering action of clothing, the difficulty of moving through or over snow, and the additional body heat required in the northern environment. These factors must be considered by the commander in his planning of operations. To have more food stores on hand than are required would further aggravate his logistical problems; while on the other hand, to have inadequate rations would seriously jeopardize the capability of the unit to function efficiently. Knowledgeable planning on the part of the commander and his staff can result in the optimum stock of supplies.

Additional physiological effects of the northern environment on man are cold injuries. While these injuries rarely result in death when properly treated, they do produce casualties and consequently lower the combat effectiveness of an organization. The most common and most serious injury is frostbite.

At the risk of over simplification, frostbite is defined as the freezing of the skin. This injury most often occurs where the skin is exposed to the cold, such as the face and in the extremities where there is reduced circulation of blood and heat. As the body tissues are lowered to a freezing temperature, a crystalization of intercellular

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[19] Ibid., p. 4.

water of the affected skin tissues takes place. As this intercellular water is turned into ice crystals, the adjacent cells will give up water in an effort to maintain the liquid balance of the tissues. This results in the eventual dehydration of the cells, which will then die. A rupture of the cell membranes may occur by these sharp-pointed crystals as these skin tissues are rubbed, bent, pressed, or in any way forced to change their shape. While massaging is recognized as an excellent preventative measure to avoid frostbite, its use after frostbite has occurred will certainly insult the injury and complicate its effects.[20]

The seriousness of injuries caused by frostbite, and the period of recovery of the affected tissues will generally depend upon the following circumstances. The depth of the skin tissues which are frozen will influence the seriousness of the injury, and recovery time will be in direct proportion to the number of layers of tissues affected. The size of the crystals formed will, to a great extent, determine the number of cells which are damaged and punctured by the sharp edges. Speed or rate of freezing affects the extent of dehydration of the cells. Rapid or quick freezing will not dehydrate the cells to the extent that slow freezing does. Any refreezing of thawed out areas will further aggravate the injury through increasing the number of cells destroyed. Speed of rewarming and protection of the area from insults will also influence recovery time. The point

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[20]Cutting, Interview.

here is that frostbite is a casualty producer and must be recognized by the commander in safeguarding the health of his command. Adequate clothing, proper training, and active supervision by the leaders will assist in eliminating this type of nonbattle casualty.[21]

The next effect of cold weather to be discussed will be how it affects the efficiency of the individual. As has far been pointed out, man devotes considerable effort and time to merely surviving in this hostile environment; however, survival alone is not sufficient to win a war. Combat units must be capable of functioning with an acceptable degree of efficiency in accomplishing their mission. The commander must concern himself with the most efficient utilization of the resources which are at his disposal to accomplish the mission of his unit. To do this, he must be cognizant of the capabilities and limitations of these resources in the assignment of tasks to be performed. The cold weather factor is a major consideration which will affect the commander's resources and must be included in the plans of all units.

The weight of clothing and equipment which each individual must wear for protection against the cold is a serious limiting factor. As was pointed out earlier, the weight of the combat load of the rifleman will vary from 66.70 pounds in moderate cold weather to 74.64 pounds in extremely cold weather. In the latter case, this is almost

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[21] Ibid.

twice the weight (40-45 pounds) which a soldier in the temperate zone must carry. Supporting this additional weight will require an increased output of energy by the soldier and will serve to dissipate his strength more rapidly than in temperate climates. The extra clothing will also restrict his freedom of muscular movement, thereby requiring additional energy and stamina to overcome the hampering action of these bulky items.

Cross-country movement in loose snow is another factor which requires considerable energy. Regardless of whether the average soldier is using snowshoes, or skis, greater effort will be required to move through snow than is required to walk over hard surfaces.[22] The depth and type of snow will certainly have a bearing on how much of an obstacle to movement is created. The additional activities which may be assigned individuals, such as sled pulling or trailbreaking, will further consume strength and limit the soldiers' capabilities. In addition to these physical exertions which will be required of the soldier, large amounts of energy are required to maintain the normal body temperature during prolonged exposure to severe cold.

The results of the above influences on the rifleman are an increase in the amount of time required to conduct

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[22]Quartermaster Research and Engineering Command, Caloric Intake and Energy Expenditure in a Sub-Arctic Environment, Technical Report EP-33, (Environmental Protection Research Division, Natick, Mass., March, 1956), p. 10.

cross-country movements and a decrease in the total distance which he can move before overnight rest stops will be required. Time and distance factors in the planning of a coordinated attack will take on a new significance to the commander. He must plan according to the unit's state of training, and through experience be able to judge how far the unit can move during any conditions, i.e., terrain, weather, and enemy activities. Time and distance factors will be especially critical when planning for supporting fires to commence and end. To begin these fires too early can result in a needless waste of artillery and mortar rounds which will add to the overburdened logistical facilities. To lift these fires too early can be even worse by denying the assaulting troops the combat power needed to overcome the enemy in the seizure of their objective. The positioning of reserve units in the attack can have equally serious consequences. If they are too far forward, the commander runs the risk of having them subjected to the same fires and enemy activities as the assaulting units and thereby lose their freedom of maneuver. If they are too far to the rear, the commander will run the risk of not being able to commit them in time to influence the action. The commander and his staff must know the unit's capabilities and limitations and assign tasks accordingly.

In addition to the maneuver elements of the command, the cold environment will have its influence and will affect the efficiency of the combat support and combat service

support units. The degree to which the environment will affect the efficiency of support units in outdoor operations is a function of temperature; wind; indoctrination; motivation; training; supporting facilities such as warming shelters, maintenance tents; and many other variables. For this reason, it is extremely difficult to assess the effects of the cold on efficiency because many of the factors will be changing constantly due to the situation.

One of the most important influences on efficiency of troops working outdoors is windchill. This is defined as the "combined cooling effect of wind and air temperature on humans and animals, as well as equipment. It is the rate of cooling by which heat is dissipated. Windchill is expressed in kilogram calories per square meter per hour."[23] Figure 2 shows the windchill nomograph used by the Army today. While the accuracy of this chart has not been accepted by all authorities, it is the best guide available and should be used with this limitation in mind. A study of this chart reveals the relationship between ambient temperature and wind. The windchill factor increases with an increase of wind and thereby causes a more rapid cooling of the surface area exposed than would be the case if no wind were present.

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[23]U. S. Army Command and General Staff College, Mountain and Northern Regions, Division Operations - Lesson Plan, M6480, (Department of Division Operations, U. S. Army Command and General Staff College, Fort Leavenworth, Kansas), p. L2-1-10.

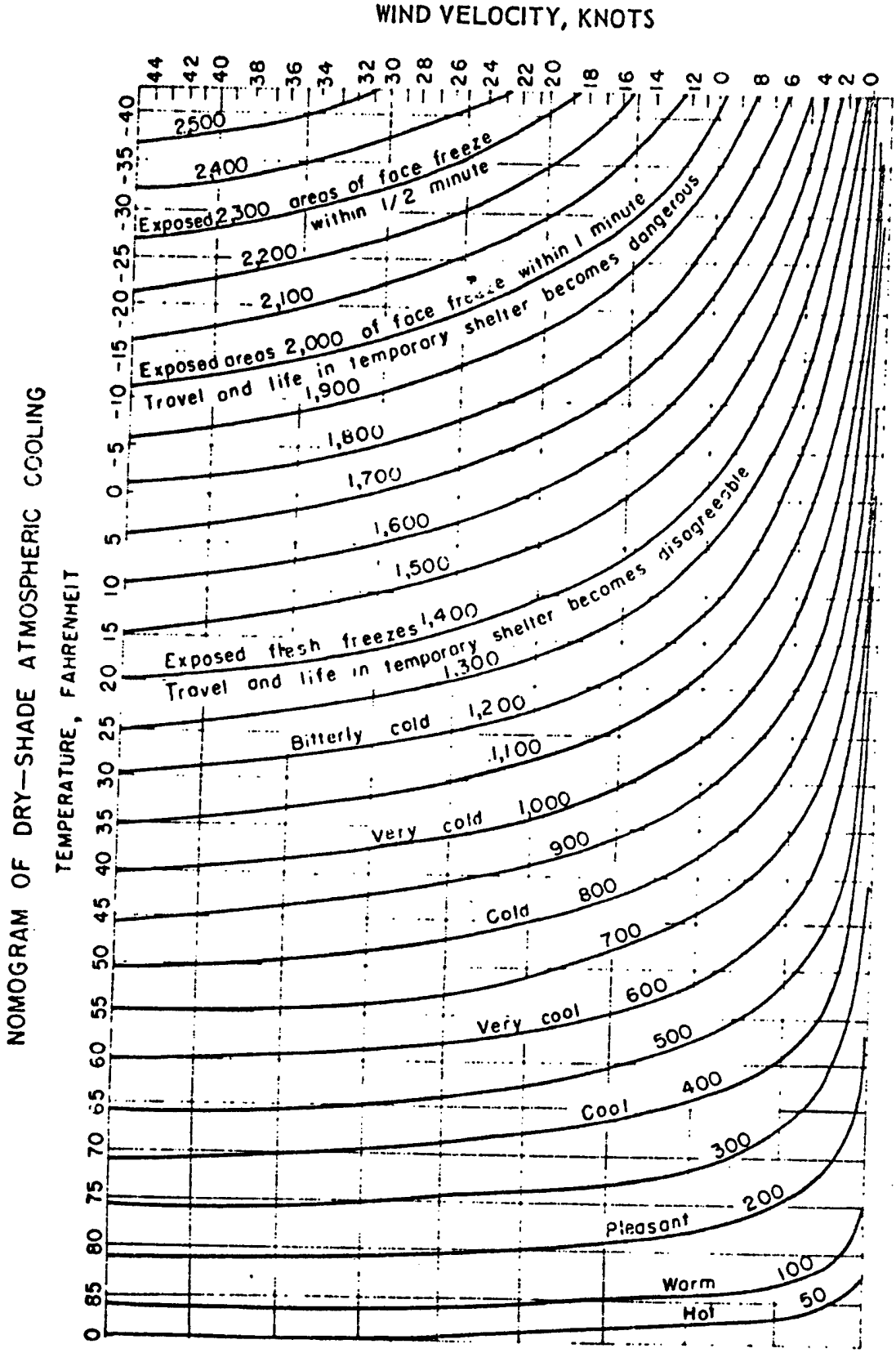

Figure 2.

Extracted from U. S. Army Command and General Staff College, Division Operations - Mountain and Northern Regions, Lesson Plan M6480, (Department of Division Operations: Fort Leavenworth, Kansas).

The time tolerance of crews to be able to continue work which requires dexterity of the fingers is directly proportional to the cooling effect of the environment. At a temperature of 0 degrees Fahrenheit, and under conditions of no wind, well-trained and highly motivated crews will be able to continue work all day without requiring warming shelters. Where individuals are in cramped quarters, such as working under vehicles, occasional breaks will be taken for the purpose of exercising to increase body heat and improve circulation to the extremities. The greatest detriment to efficiency under these conditions is the nuisance and hampering action of the Arctic clothing. There may be a tendency for the inexperienced person to remove his mittens when confronted with a very delicate task after failing in the first few attempts. Where metal is involved, such an action will result in the skin becoming frozen to the object. If it is a small object, separation will be a relatively simple task of warming the metal object until the skin and object are melted apart. In the case of larger objects, such as the side of a vehicle, the problems are somewhat magnified, and a casualty is the normal result.[24]

"Below 0 degrees F. outdoor maintenance falls off until it may reach zero for poorly motivated crews at minus

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[24]Andres Karstens, Effect of Weather Factors on Maintenance Crews, Arctic Area, Special Report, (Arctic Aero Medical Laboratory, 2 August 1954), as quoted in U. S. Army, Alaska, Effects of Northern Environment on Personnel, (Headquarters, United States Army, Alaska, 14 February 1958).

30 degrees F."[25] As the windchill factor increases, the time tolerance of the crews will decrease.

> The relationships between environment temperature, insulation, and heat production in maintaining normal heat balance and good circulation to the extremities applies in principle in the wind just as in dry cold without wind. The increased cooling power of the environment due to wind shortens the time tolerance at a given temperature. When wind chill factor is comparable to or greater than that produced by a 10 mile an hour wind and minus 15 degrees F. temperature, outdoor maintenance usually becomes essentially ineffective, although occasional crews will perform some maintenance under these conditions. Winds in excess of this amount produce a great chilling of the hands in attempting to perform work. Winds in excess of thirty miles per hour interfere with visibility both by forcing the crewman to turn his face away from the wind with his hood over his face, and by virtue of the fact that blowing snow frequently swirls around inside the ruff and by continuously blowing in the individual's eye, prevents him from seeing what he is doing.[26]

In summary, the cold environment may affect the efficiency of a unit due to the following factors: The additional clothing which must be worn to protect the body is a restricting factor. The colder the temperature or the higher the windchill factor, the more clothes will be required, which in the end will further reduce the efficiency of the individual in the performance of his mission. Extreme conditions will reduce the time tolerance of individuals to remain at their job site before taking breaks for warming. The greater the windchill factor, the more frequent these breaks will be, which in the long run means less work

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[25] Ibid.

[26] Ibid.

accomplished. Heated shelters will greatly improve the efficiency of such work as maintenance of equipment. Work which cannot be given the benefit of protective shelters, such as bridge building or barrier construction, will progress at a descending rate as the temperature drops. Realizing these factors, the commander can offset some of their effects by planning well in advance to allow maximum time for accomplishing the tasks and by providing as many shelters as practical for improved performance of units. Additional lighting facilities will be required for many support activities due to the short winter days.

The commander must not only concern himself with the physical effects of the northern environment on his unit and operations, but he must also be aware of the affect this environment may have on the mental attitude and will of the soldier to fight. Many of the problems and obstacles which will confront a unit operating in the North cannot be overcome with equipment alone but will depend heavily on the persistence and determination of the individual soldier. Anything which detracts from this drive and motivation of the members of a unit will in the end reduce combat effectiveness. While the psychological effects of the Arctic on personnel are less defined than are the physiological effects, they nevertheless must be considered. The reader is advised to accept the following information with a view in mind of the controversial nature of all psychological studies and concepts and be guided accordingly.

Percentage wise, not many American soldiers have been exposed to the rigors and potential dangers which exist in a northern environment. Most of them, however, have heard exaggerated tales or have read of isolated incidents concerning the North which has tended to create an unfavorable or negative attitude about an assignment to this area. For this reason, replacements scheduled to be assigned to units in the north must first pass through a period of reeducation and indoctrination. This training is designed to dispel any doubts or fears which may exist in the minds of these replacements, and in their stead, substitute the true facts about the North. The areas where the greatest misconceptions exist and which may adversely affect morale are long nights, extreme cold temperatures, long periods of isolation, and the dead silence of the Arctic. Caution must be exercised by the instructor to avoid overvivid descriptions and lengthy elaborations on the dangers inherent in this environment, least he magnify the misconceptions which may already exist.[27] On the other hand, periods of discrete, factual, and well-balanced instruction will serve greatly to reduce or eliminate hesitancy or reluctance on the part of the individual toward assignment to northern areas. Once inexperienced

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[27]Jerome G. Sacks, Psychologic Reactions to Winter Arctic Conditions, U. S. Armed Forces Medical Journal 2:309-313, as quoted in U. S. Army, Alaska, Effects of Northern Environment on Personnel, (Headquarters, United States Army, Alaska, 14 February 1958).

troops have reached their destinations in the Arctic, much will be gained by having experienced personnel accompany and supervise them initially until confidence and know-how has been established. This supervision will apply mostly to unit replacements in that individual replacements will automatically be surrounded by experienced personnel.[28]

Even among experienced troops, the commander must be alert to detect symptoms of psychological stresses brought on by this hostile environment and physical exhaustion. Some of these symptoms will be pessimism, lassitude, lethargy, "cocoon-like existence," and individual or group hibernation.[29] Pessimism, lassitude, and lethargy will most often result from fatigue and cold. Sleep will normally assist in alleviating these symptoms but will not necessarily eliminate them. The leader must set the example of aggressiveness for subordinates and require the same from them in overcoming these conditions. The men must be kept occupied and not be permitted to lounge in their sleeping bags or remain in their tents while neglecting their duties.

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[28]T. L. Boag, The White Man in the Arctic, American Journal Psychiatry, pp. 444-449, as quoted in U. S. Army, Alaska, Effects of Northern Environment on Personnel, (Headquarters, United States Army, Alaska, 14 February 1958).

[29]Anthony Debons, Psychological Research in Alaska, USAF Medical Service Digest II (5); 16, (June 1951), as quoted in U. S. Army, Alaska, Effects of Northern Environment on Personnel, (Headquarters, United States Army, Alaska, 14 February 1958), and U. S. Department of the Army, Basic Cold Weather Manual, Field Manual 31-70, (Washington: U. S. Government Printing Office, 24 February 1959), p. 235.

Proper consideration, of course, must be given the men's welfare by providing time for adequate rest, but idleness must not be tolerated or permitted to continue for extended periods. Work must be designed to be constructive and contribute to the accomplishment of the mission and not be just work for activity sake. Group chores will be more effective than individual work in eliminating these psychological stresses in that contact and communication between individuals will be reestablished. A feeling of teamwork, cooperative spirit, mutual trust, and individual responsibility to the group must be restored as soon as possible.

The stress which creates the "cocoon-like existence" is somewhat different and must be so treated. The Basic Cold Weather Manual (FM 31-70) has this comment concerning such a psychological condition:

> Many men, when bundled up in successive layers of clothing and with the head covered by a parka hood, tend to withdraw within themselves and to assume what has been termed a "cocoon-like existence." When so clothed, an individual's hearing and field of vision are greatly restricted and he tends to become oblivious to his surroundings. His mental processes become sluggish and although he looks, he does not see. These symptoms must be recognized by leaders and overcome. The leader must realize that it can happen to him and must be alert to prevent the growth of lethargy within himself. He must always appear alert to his men and prevent them from sinking into a state of cocoon existence. The remedy is simple and basic: Activity. Throw the parka hood back and engage in physical activity. Although the remedy is simple, the recognition of the condition requires leadership.[30]

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[30] U. S. Department of the Army, Basic Cold Weather Manual, p. 234.

The will of the soldier to face these psychological dangers and hardships and continue to maintain a high degree of esprit de corps and motivation will be dependent on many variables. The manner in which any man will react to the cold environment is difficult to predict. For this reason, a screening process is desired, where feasible, to detect and eliminate individuals who may be poor psychological risks as explained in this statement:

> Personnel who have displayed a degree of mental instability or lack of adaptability which is insufficient to be considered as special cases elsewhere, frequently create much greater problems in northern areas. While limitations in this area are most difficult to delineate, the factors exist and cause sufficient problems to warrant consideration and possible rejection.[31]

Some experimental selection tests have been conducted to determine which individuals will be most suitable for Arctic operations. Whether or not the Army can afford the luxury of testing, screening, and selecting replacements destined for the North during a general war is a matter of conjecture. This author does not attempt to determine its practicality or its feasibility, but instead offers this as a point of consideration for the reader.

When the physiological and the psychological effects of the cold are combined, a third factor known as psychophysiological reaction can result as pointed out in the following quotation:

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[31]U. S. Department of the Army, Northern Operations, p. 66.

> Cold can limit performance and endurance not only directly, but also indirectly, by causing other factors to become stresses. Dehydration, reduction of food intake, shivering, inability to sleep, extra work necessary to perform a task, all caused by cold environment, can lead to reduced efficiency and exhaustion even though the body has suffered no significant temperature drop or decrement in dexterity. Minor stimuli, e.g., wetness, reduced digital temperature, uncomfortable posture, etc., can sumate over a period of time to elicit psycho-physiological reactions and subjective distresses which limit endurance.[32]

In conclusion, the following considerations are submitted concerning the effects of a northern environment on personnel: The commander of a unit in a northern environment must be cognizant of the effects of cold weather on personnel so as to minimize any decrement in overall efficiency of the organization. Cold weather will have physiological and psychological effects on personnel. The physiological effects are cold injury and a decrease in individual efficiency due to cumbersome clothing. Cold injuries can be reduced to insignificant numbers through proper training of the troops in the use of the equipment issued today in Arctic regions. The decrease in efficiency of personnel due to the cumbersome clothing can be reduced by beginning work projects sooner than would be normal in a temperate climate and by planning for more time in mission accomplishment. The psychological effects of cold weather on personnel are less

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[32] G. W. Molnar, Observation with AGF Task Forces Frigid and Williwaw, Project No. 6-64-12-02, Report No. 13, (Army Medical Research Laboratory, Fort Knox, Ky., 12 January 1948), as quoted in U. S. Army, Alaska, Effects of Northern Environment on Personnel, (Headquarters, United States Army, Alaska, 14 February 1958).

defined and are consequently more difficult to detect and correct. Not all individuals will react the same under a particular set of circumstances; the manner of the reaction and the severity of reaction to prolonged exposure to extrem cold will depend upon the emotional stability of the individual soldier. Psychological reactions to cold will most oft be manifested in the form of pessimism, lassitude, lethargy, and individual or group hibernation. The commander must be quick in detecting an individual who is having a psychological reaction to the cold environment. Prompt detection not only assists in the medical treatment of the individual but also eliminates the possibility of this reaction spreading to other individuals and lowering the morale and efficiency of the unit. Proper training, which is discussed in the next chapter, will do much in developing the individual confidence that he can operate and fight in the Arctic and will render him less susceptible to psychological reactions

CHAPTER III

TRAINING REQUIREMENTS FOR NORTHERN OPERATIONS

The environment of the northern areas of the world requires special consideration and training that is not normally required by units operating in a more temperate area. An infantry division scheduled for deployment in a northern area must first complete the normal individual and unit training and should have satisfactorily demonstrated its proficiency in prescribed Army training tests. These fundamentals are necessary for combat in any theater of operations by establishing discipline, teamwork, individual skills, and providing a foundation of military knowledge on which more advanced training can be built. Once a unit has reached this state of training, it is then qualified to begin to master the special techniques needed for successful operations in a cold environment.

The United States Army has never been engaged in combat in a northern environment where large land mass armies have been employed. Certain isolated cold weather experience was gained during World War II by units operating in the mountainous terrain of northern Italy and by units deployed in the Korean War. However, the only true

historic experience of major military forces operating in an arctic environment is provided by the German, Finnish, and Russian Armies of World War II. With the exception of the Finnish Army, these forces were not prepared for this type of operations. Their failure to prepare for the rigors of operating in extreme cold temperatures contributed directly to their failure to accomplish their mission. "The environment is a dynamic force. He who recognizes it and understands this force can use it; he who disregards or underestimates it is threatened with failure or destruction."[1]

The German armies that invaded Russia in 1941 had anticipated an early victory in the rapid seizure of Moscow and had not prepared for a winter war. "In the year 1941 Germany had no practical knowledge concerning the effects of intense cold on men, animals, weapons, and motor vehicles."[2]

> "The German command had been under the impression that the Red Army could be destroyed west of the Dnepr, and that there would be no need for conducting operations in cold, snow and mud. To conquer the raging elements of nature was the more difficult because their fury and effect were not fully recognized by the Germans, who were neither trained nor equipped to withstand them."[3]

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[1]U. S. Department of the Army, Northern Operations, Field Manual 31-71, (Washington: U. S. Government Printing Office, 10 January 1963), p. 5.

[2]U. S. Department of the Army, Warfare in the Far North, Pamphlet No. 20-292, (Washington: U. S. Government Printing Office, October 1951), p. 1.

[3]U. S. Department of the Army, Effects of Climate on Combat in European Russia, Department of the Army Pamphlet No. 20-291, (Washington: U. S. Government Printing Office, 25 February 1952), p. 1.

Up until the time that climatic conditions began to hinder the German operations, they had succeeded in driving their forces to within nine miles of Moscow. A sudden drop in temperature to -30° F. created havoc and disrupted their operation to the point where a withdrawal had to be initiated in the face of a Russian counteroffensive.[4] This was the closest the Germans ever came to the Russian capital. Their collapse is credited in large part to the failure to recognize and plan for the effects of environment on military operations. They were never able to recover from the losses sustained during this first winter and were, therefore, limited in their future attempts to launch major offensives on the Russian front for the remainder of the war.

In retrospect, it seems incredible that such a large undertaking could have been initiated with such shallow foresight, planning, and preparedness. However, an equally ridiculous situation existed just two years prior to this incident on the Russo-Finnish Front. The Russian troops who initially invaded Finland were ill prepared for the rigors of the hostile environment which awaited them. As a result, thousands of Russian casualties were caused by extreme cold and their inability to cope with the forces of nature. Not only was the equipment inadequate for protection against the elements, but the majority of Russians marched into Finland wearing the khaki uniform. They made no effort to camouflage their vehicles and equipment to

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[4] Ibid., p. 4.

cause them to blend with the snow-covered landscape.[5]

The two illustrations briefly presented above point out the disregard of effects of environment on military operations by the planners of the nations concerned. Both nations later recognized the errors and instituted stopgap measures with varying degrees of success. While these mistakes are past history and cannot be changed, planners of the future must take cognizance of the importance of environment and use it to their advantage.

The United States Army has recognized the need of additional research in the effects of all types of environments on personnel and equipment. The first major official recognition of the necessity of organizing our environmental research program was through publication of SR 705-70-5, "Operation and Protection of Material Under Adverse Conditions of Temperatures," dated December 1950.[6] This basic directive spelled out the performance specification of Army equipment for operations in air temperatures from minus 65 degrees to plus 125 degrees Fahrenheit. Using this as a starting point, our research and development programs have since expanded to their present state of advancement. These development programs have produced an array of special

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[5]John Langdon-Davies, Invasion in the Snow, (Houghton Mifflin Company, Boston, 1941), pp. 15-16.

[6]C. W. Clark, Brig. Gen., Proceedings of the Symposium on the Environmental Factors Influencing Optimum Operation of Ordnance Material, (Department of the Army, Office of Ordnance Research), 27-30 September 1960, p. 5.

equipment, lubricants, and modification kits designed for use in arctic operations.

In addition to the programs established for the improvement of equipment, emphasis on training of units has been increased. This is evidenced by the fact that we now have two infantry brigades, with supporting arms and services, permanently assigned to the Alaskan Command. Each year, at least one infantry battalion from CONUS moves to Alaska for training and the conduct of winter maneuvers. To augment this unit training, the Northern Warfare Training Center at Fort Greely is operated by the Alaskan Command to instruct individuals in the techniques of fighting and surviving in this environment.

The most recent of these annual maneuvers was EXERCISE POLAR STRIKE which was conducted during February, 1965. This exercise was the largest ever to be conducted by United States Forces in an arctic environment with approximately 14,000 troops participating. Participating forces came from units of U. S. Army, Alaska; Alaskan Air Command U. S. Strike Command; 2d Battalion, The Royal Canadian Regiment; and elements of the Army National Guard from Alaska, Minnesota, and Washington.[7]

The Northern Warfare Training Center, located at Fort Greely, Alaska instructs students from throughout the Army. Courses of instruction range from two to six weeks

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[7]John Wiant, "Polar Strike," Army (Washington, D. C.), April, 1965, p. 22.

in length and cover techniques of combat in snow as well as mountain warfare. During the past year, 2,200 students attended this school in addition to those forces which participated in Exercise Polar Strike.[8] This school is invaluable in assisting units scheduled for northern operations by training their instructor cadre. This cadre will in turn instruct the personnel of their units prior to and during their tour in Alaska. It is estimated that a minimum of one officer and seven noncommissioned officers per company size unit should receive training at this school in order to provide an adequate base of qualified instructor personnel.

An infantry division scheduled for deployment in the Far North will generally be concerned with two phases of training. These are: Phase I, preparatory training prior to movement to the Arctic and, Phase II, training after arrival in the northern environment. The extent of preparatory training which can be conducted before the unit moves to Alaska (Phase I) will depend on the time available, climatic conditions, and geographical location of the unit. As an example, instruction such as skiing, snowshoeing, and winter driving will require snow in order to perform practical work. Units that are located at CONUS installations where snow is common during the winter months will be able to perform practical work and develop some proficiency in these skills. On the other hand, a unit at Fort Benning, Georgia could instruct only in the fundamentals of these

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[8] Ibid., p. 88.

subjects in that practical application would be impossible. However, much of the preparatory instruction conducted in Phase I to ready the unit for its move to the north will not require the presence of snow. The more classroom instruction which can be accomplished at the home station, the better. This background of instruction will then permit the unit to use the maximum training time outdoors in conducting practical work during Phase II once it reaches its arctic training station. This point may be extremely crucial in the event of imminent hostilities or after conflict has already begun.

Another advantage of a thorough indoctrination program of instruction at the home station is that of overcoming any fear or misconceptions which may exist concerning arctic operations. Such a program also serves to reduce cold weather injuries when the unit is initially introduced to the area. A very good example of the effects of this type of training is the recent Exercise Polar Strike. Of the 14,000 troops participating, only 21 cases of frostbite were reported. Officials credit this low number of casualties to an intensive indoctrination program. Another factor which must be considered, however, is that the temperature during this exercise was comparatively mild, with a steady 10 degrees Fahrenheit prevailing most of the period.[9] As was pointed out in Chapter I, the average temperature for

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[9] Ibid., p. 22

this part of the world for February is minus 22 degrees Fahrenheit.

A contrast to this experience can be noted in the results of Exercise North Star which was conducted in February 1954. This exercise involved about 5,000 troops operating in temperatures which ranged from a high of minus 13 degrees Fahrenheit to a low of minus 45 degrees Fahrenheit for a seven day period. A total of 243 casualties due to frostbite were reported.[10] Most all of these cases could have been avoided had the troops been alerted and applied the training which they had received. Careless mistakes such as continuing to wear socks which were sweat soaked when the unit stopped, excessive exposure due to skijoring (skiers being towed by vehicle) in extreme temperatures, failure to brush snow from clothing before entering warming tents which results in the clothing becoming wet, and frostbite resulting when individuals removed their mittens during work requiring manual dexterity. The importance of thorough training in the prevention of frostbite and active supervision by all leaders to enforce safe practices cannot be overemphasized.

Another extremely important subject which can be taught by the units during Phase I is the proper wearing and fitting of the arctic uniform. The layer principle of

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[10]United States Army, Alaska, Exercise North Star - Final Report, (Headquarters, United States Army, Alaska), February 1954, pp. 17-18.

gaining insulation from the cold and the requirement for loose-fitting garments must be thoroughly understood by all. Troops who do not understand this principle may have a tendency to exchange their clothing for a more tailored or snug fit which will defeat the purpose of the uniform. By issuing this clothing before the unit is deployed to its northern station, inspections can be conducted by the leaders to insure proper fitting, and practical work can be accomplished in the proper wearing of the clothing. Such precautions will permit adjustments to be completed prior to movement and will eliminate wasted training time at the new destination.

Special items of equipment peculiar to arctic operations can be obtained by a unit scheduled for such an assignment. Sufficient numbers of each type of equipment such as tents, stoves, sleds (200 lbs. capacity), etc., should be requisitioned early to permit practical work in their operation to be accomplished at the home station. This preparatory training will facilitate the comfort and welfare of the troops when they initially arrive at their final destination, and will also permit the unit to concentrate on more important training which requires the presence of snow.

The last major subject which the unit must concentrate on as soon as its assignment is known is that of physical conditioning. The requirement and necessity for excellent physical conditioning has already been pointed

out in Chapter II and is again emphasized. It is recognized that stamina and endurance are desired for combat operations under any climatic conditions, but their effects will be most noticeable under the rigors of the northern environment. In certain cases, such as when an individual is lost or has been isolated due to enemy action, his survival in this hostile environment could well depend upon his state of physical conditioning. In addition to his survival, the individual must be capable of carrying heavy loads while moving on snowshoes or skis over long distances and still be capable of fighting upon reaching his destination. The importance of physical conditioning is emphasized by the following comment from the final report on Exercise North Star:

> During the attack on 19 February the 1st BCT (BCT, 44th Div) overloaded its men with individual equipment and gave them the task of towing ahkios (sic, sleds) with a result that by midafternoon the personnel were generally in an exhausted condition. The 3d BCT, advancing with light packs and using track vehicles and sleds to move their equipment, advanced without excessive fatigue. Commanders must give detailed consideration to the condition of their men and must do everything possible to lighten their load. This is especially true dur[illegible]ng operations in extreme cold.[11]

The combination of proper leadership and physical conditioning will avoid such situations and will contribute significantly to the unit's combat effectiveness. A state of high physical conditioning also permits the individual to participate in muscular exercise for prolonged periods which

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[11] Ibid., p. 37

contributes materially to his comfort and well-being by avoiding frostbite.

The subject areas discussed above will apply to all individuals and units in their preparation for the move to an arctic assignment without regard to rank or military occupational speciality. In other words, these are basic individual requirements which all men must be prepared to apply immediately upon reaching their destination in the north. Specialist training, if time permits, will greatly facilitate the unit's integration into this new environment and will reduce the training time required during Phase II of the training program. A list of subjects pertaining to specialist training which can be conducted in the absence of snow is listed in Appendix 1 to this paper.

Phase II of the unit's training program will be conducted in an arctic environment and should be designed as a continuation of the training program of Phase I. This phase should be focused on the development of individual and unit skills required for northern operations. The firs part of this training should concentrate on the individual and provide as much practical work as possible in his specialty to develop proficiency for operations in the northern environment. The infantry elements will strive to gain a reasonable state of proficiency in cross-country movement, survival training, and bivouac procedures as soon as possible. This training is a requirement in preparation for the conduct of field exercises which will follow.

A recommended training program for Phase II is contained in Appendix II.

The specialist training of members of the division will initially be devoted to developing proficiency in skills relating to their primary job positions. Drivers must learn to operate and maintain the special vehicles peculiar to this environment. Mechanics must not only learn to maintain these special vehicles but must also learn the special techniques required to work effectively under the adverse conditions of an arctic environment. Medical corps personnel will be concerned with recognition and treatment of cold weather injuries, diseases, over-snow evacuation procedures as well as the operation of heaters and the construction of aid station shelters. Aviation crews, engineers, signal specialists, and others must be instructed in those subjects listed in Appendix I to be able to function efficiently in these new surroundings. Throughout this period, further orientation and indoctrination training is introduced as dictated by terrain and climatic conditions. Physical conditioning is emphasized continuously to maintain and improve the endurance and stamina of the individual as well as to assist him in developing confidence in his ability to combat the effects of this cold environment.

When the division has completed its individual training, unit training can then be started with reasonable assurance that individuals will be able to function

effectively in their missions. Small unit training at squad and comparable level must first be mastered before attempting integration into larger units. This small unit training may well be the most important training period which the unit will undergo. The adage about good squads make good platoons, good platoons make good companies, etc., will continue to apply under these circumstances. The small unit leader will be put to the most severe test in accomplishing his mission. Not only must he concern himself with the tactical aspects of the problem, but he must pay particular attention to supervising, inspecting, and checking on the men and equipment of his unit to prevent needless loss through effects of the environment. Throughout this period, he is also learning the capabilities and limitations of his unit under varying conditions in this new environment. He will, by this time, begin to understand how the elements can affect the operation of equipment and the efficiency of individuals. His troop leading procedure must be perfected to allow sufficient time to accomplish the tasks which he orders. In essence, he is gaining the experience and control of the situation which will permit him to issue reasonable and timely orders. Since the larger unit leaders are present and supervising this small unit training, they too have an opportunity to learn and gain an appreciation of the situation. Proficiency in individual skills continues to be stressed. As these skills improve, unit assignments can be gradually adjusted to correspond with its capabilities.

The most noticeable gain in this area will be a reduction in the time required to accomplish a given task. Until skills and unit standing operating procedures have been perfected, difficulty in the planning of available time will be evident. An example of difficulty in planning is expressed by an observer during Exercise North Star, as follows:

> In such weather the time required to get ready to move or fight in the morning while in bivouacs and assembly areas, is greatly increased. It was found that a unit required from 2 to 3 hours for getting personnel up, preparing and eating breakfast, packing rucksacks, striking tents, and packing vehicles and sleds. Likewise, time required to "bed down" in the evening is increased. This additional time must be considered in tactical planning.[12]

Considering that this unit had aggressive and positive leadership, this time could be reduced considerably by refining standing operating procedures (SOP's) and development of individual skills.

As individual skills improve, unit SOP's must be modified to take advantage of the time and gains realized. A good example of how a unit's skill can affect its capability is reflected in the following observations during Exercise Little Bear which was conducted in 1960:

> The STRAC troops were not very effective in cross-country movement on skis. Trailbreaking parties were not dispatched sufficiently ahead of the main body and the general level of skiing proficiency was so low that ski columns moved no faster than columns on snowshoes. At no time did a ski column manage to move more than nine miles in the course of a day. This is a marked contrast with highly skilled troops who can

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[12] Ibid., p. 40.

generally be counted on to march 30 miles or more over terrain such as that encountered in the maneuver area.[13]

It should be noted that the unit referred to in this observation had received 24 hours of formal training on skis while in Alaska and 8 hours of training with skis on straw at the home station. In addition to this formal training, the units had an opportunity to gain practical experience in skiing during 110 hours of field exercises. From this illustration, it becomes obvious that a unit will require considerably more experience and training time to develop the desired cross-country mobility using skis. As this experience is gained, it can reasonably be anticipated that their capability will increase and their mission can be expanded accordingly. By comparison, the units using snowshoes had received two hours of formal instruction on their use plus the experience gained on previous field exercises.[14]

The commander must continue to revise his estimate of unit capabilities based on its state of training and experience in order to allocate tasks realistically. A variety of weather conditions ranging from 14 degrees Fahrenheit to minus 60 degrees Fahrenheit will be desired to permit units to gain experience in all types of environmental conditions which they must be prepared to face. This requirement

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[13]Norman F. Washburne, Cold Weather Operational Training of Infantry Forces in the Strategic Army Corps, Human Resources Research Office, Technical Report 86, (The George Washington University, Alexandria, Va.), February, 1964, p. 14.

[14]Ibid., p. 14.

will generally limit winter warfare training to the period October through March of each year if Alaskan training sites are used. Should the demand for terrain require additional training areas to be established elsewhere, the period of cold weather available will vary depending on its geographical location. Training areas in central and northwest Canada, if available through governmental agreements, would be especially desirable since they would be very similar to conditions found in Alaska. The political and world situation may dictate the use of United States owned or controlled territory. In such an eventuality, areas near Fort Devens, Massachusetts; Fort Carson, Colorado; Camp Drum, New York; or other areas offering suitable winter conditions can be resorted to with reasonable success.[15] The major disadvantage of these areas will be the reduced period of desirable climate conditions available for realistic training.

The situation could develop that requires units to be committed to a northern area during the spring or summer months as a result of a surprise attack. An eventuality of this type would mean that the unit will not have had any winter training when the cold months arrive. While this situation is undesirable, circumstances may dictate these conditions. Some of the disadvantages can be offset by scheduling training in winter subjects during periods of inactivity. Units in reserve can conduct some preparatory

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[15]U. S. Army, Alaska, Exercise Timberline, Final Report, (U. S. Army, Alaska, February 1963).

training, and a rotation of units as soon as feasible after snow arrives will assist in alleviating the situation. The best solution to this problem is to have a portion of our units prepared at all times to perform combat missions in a northern environment.

In summary, the basic purpose of this cold weather training is to develop experience and proficiency of units in combating the hostile effects of the northern environment. A well rounded training program designed to prepare an infantry division for combat in northern areas will require a minimum of nine weeks of intensive training. The training program will be divided into two phases; Phase I training will be conducted at the division's home station, and Phase II will be conducted in an arctic environment.

The purpose of the training program during Phase I is to provide cold weather orientation training and background information for the individual soldier. Much of the Phase I training will be classroom or theory type of instruction in which the individual is prepared mentally to perform his assigned tasks in an arctic environment. The Phase II training, which is conducted in a cold weather environment, is organized to teach individual and unit skills required for the conduct of military operations in northern areas. The Phase II training period is characterized by practical work training periods and outdoor training in order to develop proficiency in individual and unit skills. Classroom type instruction is held to the minimum to permit the maximum

training time to be devoted to practical work.

A vigorous physical training program is integrated throughout the nine-week training period. Experience of units participating in recent training exercises in Alaska clearly demonstrates the requirment for all men of a unit to be in a high state of physical fitness. Higher standards of physical fitness are required for arctic operations than are required for the temperate zone due to the difficulty of cross-country movement and the heavy loads of special equipment carried by the individual. The problems of resupplying these items of special equipment for northern operations will be discussed in Chapter Four.

CHAPTER IV

COMBAT SERVICE SUPPORT

The infantry division support command mission of providing supply, field maintenance, medical service, and miscellaneous services to assigned and attached units of the division remains unchanged when operating in an arctic environment. These basic logistical functions are required by the division for sustained combat operations regardless of the geographical location in which it may be operating. However, the techniques used in accomplishing the mission will be different in northern areas from that of temperate zones due to the influence of environmental factors.[1] Some of the environmental factors are: (1) Widely separated and poor communications systems, (2) difficulty of cross-country movement, and (3) increased amounts of supplies required to offset the effects of extreme cold.[2] Each of these factors will be examined to determine the extent to which they will affect the techniques of carrying out the combat service support operations and methods of alleviating the problems incurred.

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[1]U. S. Department of the Army, Northern Operations, Field Manual 31-71, (Washington: U. S. Government Printing Office, 10 January 1963), p. 55.

[2]Ibid., p. 48.

The first of these environmental factors to be considered are the poor communications facilities that exist in most areas of the northern countries of the world. As discussed in Chapter I, the countries which lie north of the 50 degree isotherm are sparsely populated as opposed to their southern neighbors in the temperate zone. The sparse population is credited chiefly to the physical environment of these areas. This cold environment has served to dissuade population expansion in this direction due to the hardships imposed by climate; lack of coal for industrial purposes; short growing season for food crops; and until recent years, poor means of transportation. Technological advancements in the fields of transportation, construction, and industrial fuels will enhance the development of these areas in the future; but until then, we are faced with an underdeveloped wildnerness. Most of the current development has been centered on or near seacoasts and navigable inland waterways. Cultural features in these major population centers are the same as those which you would expect to find in any large city in the temperate zone.

Major highway routes along the coastal areas will be hard surfaced and bridges will be adequate to support most combat loads; however, this will not be true as you progress further into the interior of these countries. The few roads which do exist will be, for the most part, constructed of gravel or local topsoil. They will be very narrow, and in many cases, will support only one-way traffic. On roads

where one-way traffic does exist, the problems of traffic control may be of extreme importance, especially if combat vehicles and supply vehicles are trying to use the road at the same time. Priorities of movement must be determined as well as the direction of traffic flow. Stalled vehicles could completely immobilize wheeled vehicle columns which are road bound. Turn-around time will be increased considerably because of the poor condition of the roads and because of delays due to traffic control posts directing the flow of traffic. Roads will often be impassable to wheel vehicles following heavy snows, and full-time engineer maintenance crews will be required to repair and clean them. Until snow clearance has been completed, no wheel vehicles will be able to move.

In most of these areas, there will be no roads at all. Movement of supplies cross-country will be the only means of resupply available, with the exception of aerial delivery when weather conditions permit. It is not reasonable to expect to continue aerial resupply for any extended period, consequently the only alternative for units operating in the north is to possess a capability for cross-country movement. The point to be made here is that combat service support units must possess the capability for cross-country mobility equal to or greater than the units being supported. The requirement for additional cross-country mobility has

been reaffirmed during field exercises in Alaska by U. S. Forces.[3] The conclusions reached are that "tracked vehicles must be provided to supply units that make deliveries forward of the improved MSR's."[4] The term "tracked" is very limiting and may have to be changed as combat developments are improved and new types of equipment are perfected; however, it is concluded that wheeled vehicles and trailers presently in our inventory do not possess the cross-country mobility capability required to support the infantry division in an arctic environment. Equipment modification lists will have to be published to reflect substitution of full-tracked vehicles for wheeled vehicles in amounts deemed appropriate by the major unit commander. Wheeled vehicles will still have some use in rear areas where main supply routes can be maintained by the engineers on a 24-hour-day basis. The use of wheeled vehicles will be more appropriate in regions where no major hills or slopes are encountered.

The authorizing and issuing of tracked vehicles to the infantry division does not automatically solve the problem of logistics; in fact, new problems are created. Fuel requirements for tracked vehicles are considerably greater per-road-mile traveled than would be the case of wheeled vehicles. The stockage level of spare parts for

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[3]U. S. Army Alaska, Exercise North Star, Final Report, (February 1954), p. 60; U. S. Army Alaska, Exercise Great Bear, Final Report (8 June 1962), p. 169.

[4]U. S. Army, Alaska, Joint Exercise Timberline, Final Report, 3 June 1963), p. 155.

this new type of equipment must be determined through replacement and consumption experience. These parts will further add to the weight and amount of supplies required to sustain the division in combat. The greatest problem generated as a result of the issue of this equipment will be proper maintenance. For the normal infantry division on active duty today, the substitution of tracked vehicles for wheeled vehicles will create many problems which cannot be overcome by merely changing the military occupational speciality of the drivers and mechanics. Proper training and experience are the only solution to the problem, and this cannot be accomplished overnight. As pointed out in Chapter II, the effects of this environment on maintenance crews is an overall reduction in efficiency, depending on maintenance facilities available and windchill factors. Vehicles of all types require increased maintenance while operating in a northern environment as opposed to operating in the temperate zone. This increase in maintenance will apply to tracked vehicles as well. Until the division has had an opportunity to gain experience in northern operations, it is faced with the problem of increased maintenance due to weather; inexperienced drivers and mechanics; reduction in efficiency of maintenance crews; and an increase in the supply of spare parts, petroleum, oil, and lubricants. How well and how soon it can overcome these problems will depend upon the type of leadership exercised from the division commander to the lowest leaders. This problem has not yet been

solved for units moving to Alaska from CONUS stations for winter maneuvers. During both Exercise Great Bear and Exercise Timberline, unsatisfactory maintenance was reported by observers.

In addition to tracked vehicles, aircraft and railway transportation can serve useful purposes in moving supplies to the frontlines. While aircraft have the ability to resupply almost anywhere troops can move, railway transportation will be restricted and will normally be used by larger units. The payload limitation of the helicopter will normally restrict its logistical role to emergency resupply of critical items and evacuation of casualties. The use of cargo aircraft will be most valuable in resupply roles employing air-drop or low-level extraction techniques. Aerial resupply will be a common means of moving supplies to units in remote areas and in support of independent task-force operations; however, consideration of weather and visibility factors must be made when planning air operations. As a general rule, flying conditions due to weather are good in the northern areas and will not restrict flying any more than is common in the temperate zone. In some cases, visibility due to the short winter days may limit resupply by air. An added feature about flying in northern areas is the increase in the number of landing sites available to aircraft. Large lakes freeze over to depths which will support aircraft and create excellent landing areas. German generals had this comment about air operations in northern areas:

> Modern air forces may revolutionize Arctic warfare. In summer every lake provides a convenient water landing; in winter an extensive airfield. Anticipating measures to use the Arctic for air operations can be taken at any time. Such preparations can counteract to some extent the difficulties presented by lack of overland routes and the inhospitality of polar regions.[5]

A word of caution is offered in regard to use of lakes for either aircraft landing sites or roads for vehicles. Engineer surveys should be taken in order to determine the type of ice present and its load-bearing capability. Some lakes are fed by warm water springs and, as a result, will not freeze to the desired depths for these types of operations. However, if the survey does indicate that lakes and rivers can be used as roadways or airstrips, considerable engineer effort will have been saved which can then be directed toward new priority tasks. The German armies found that:

> An ice cover of three feet or more on a lake supports the heaviest loads, and the Germans made ice roads simply by clearing snow with a conventional or rotary plow.
> Snow roads were built over swamps by removing snow and then pouring water over the cleared surface until a frozen surface was built up. The Russians used forty-four regiments in the construction of snow roads on the Kandalakasha front in 1944. Each man was made responsible for about five square yards a day, and in this manner, two 65 mile stretches were completed virtually overnight.[6]

Since railway transportation will not normally be available for use at division level, the Army Research and Development Program has produced a trackless train. This large

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[5]U. S. Department of the Army, Effects of Climate on Combat in European Russia, Pamphlet No. 20-291, (Washington: U. S. Government Printing Office, February 1952), p. 77.

[6]Ibid., p. 72.

vehicle is designed for cross-country movement and uses the same principle as a railway train in that it has an "engine" which guides a series of trailers which follow. Each trailer or car has its own power and depends on the engine for commands and guidance. This vehicle has been delivered to the Army by the manufacturer and has the following characteristics: (1) "A payload equivalent to sixty $2\frac{1}{2}$ ton trucks," (2) two power cars and 10 cargo cars, with one control car for a total length of 572 feet, and (3) a six-man crew with crew quarters and cargo handling equipment. Although designed for use on permanent ice packs such as Greenland, its use in other arctic areas is entirely feasible.[7] Such a vehicle could replace 54 long-haul drivers and has excellent cross-country mobility with its 10-foot diameter wheels. While this vehicle is not a cure-all for mobility requirements of the northern areas, it does add considerably to the logistical capability of units in transporting heavy loads over difficult terrain.

The problems associated with evacuation of the wounded in extreme cold weather have been eased as a result of the helicopter ambulance. Patients requiring emergency medical treatment can be moved comfortably and rapidly over snow covered areas to hospital sites. Facilities aboard these aircraft permit medical aid and transfusions to be performed while enroute to a mobile or fixed hospital.

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[7]U. S. Army Command and General Staff College, Division Operations - Mountain and Northern Regions, Lesson Plan M6480/5, (Fort Leavenworth, Kansas), p. LP2-18.

This prompt treatment of the wounded has saved many lives in the past and will continue to do so in the future. The major disadvantage of this method of evacuation is that it is restricted by weather and visibility requirements. When these factors will not permit the use of helicopters, movement by overland transportation is the remaining alternative.

The types of overland transportation available for the evacuation of wounded are: (1) Litter bearers, (2) sleds of various sizes and capacities, (3) wheeled vehicles where roads permit, and (4) tracked vehicles. The slowest and most undesirable of these choices is the litter bearer. The difficulty of moving cross-country with a litter will require at least four bearers in order to provide adequate relief. Otherwise, the time required for two bearers will be so great that the casualty stands an excellent chance of being frostbitten due to his state of immobility. If unconscious, he will be completely still and cannot generate the required body heat, through exercise, required to survive under extreme cold conditions. This type of evacuation should be limited to short distances due to the physical difficulties involved. Sleds of the 200-pound capacity will be much more desirable. Two men can pull one sled at approximately the same rate as their normal cross-country capability, depending on whether they are using snowshoes or skis. This will be a more normal means of moving casualties than is the litter method; however, it is limited and will normally be restricted to movement of casualties

from the frontline to the battalion aid station. Wheeled vehicles, where terrain conditions permit, are obviously more desirable than either of the two previous methods mentioned. Speed of evacuation is the greatest advantage, and in certain instances such as the litter ambulance, the casualty can be placed in a heated compartment. By keeping the patient comfortable, the chances of shock are reduced, thus his chances of recovery are improved.[8] The tracked vehicle offers the greatest number of advantages in that it is less restricted by terrain and snow conditions and, consequently, can move to the location of the casualty in most situations. Most tracked vehicles have a heated cargo compartment and space to permit medical aid to be rendered to the patient while enroute to a medical treatment facility. The advantages of tracked vehicles have been recognized by medical personnel operating in Exercise Timber Line and is included in the recommendation of the final report of this maneuver.[9] Due to the need for prompt treatment of casualties and the difficulty of evacuation in bad weather, medical installations should be positioned further forward than they would normally be positioned in the temperate zone. In addition to the medical considerations, the tactical situation will make it imperative that medical installations, especially at battalion and brigade level, be able

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[8]U. S. Department of the Army, Northern Operations, p. 118.

[9]U. S. Army, Alaska, Joint Exercise Timber Line, p. 170.

to displace to new locations in short order. The terrain and snow cover may not permit the use of wheeled vehicles, consequently, there must be tracked vehicles available to permit medical personnel to be able to continue their mission. The conclusion reached by this author is that medical units operating forward of the division support area must either have tracked vehicles assigned, or at least readily available from a pool established at brigade level. The use of tracked vehicles will require ambulance drivers to be qualified to operate both wheeled and tracked vehicles.

The next major area to be discussed is the increase of supply requirements of the division when operating in a northern environment. The type of supply most affected by this environment is Class III (petroleum, oil, and lubricants). In addition to the requirement of furnishing gasoline for vehicles, the heaters used in personnel shelters, maintenance tents, aid stations, command posts, storage areas, etc., will require gasoline. The smallest tents normally used by combat units is the 10-man tent, with some smaller crews, such as tank crews, using the five-man tent. Each of these tents, regardless of size, requires gasoline at the rate of five gallons-per-day per stove.[10] The larger tents which are used for maintenance purposes will require larger stoves, and consequently larger volumes of fuel. In addition to this fuel for heating, units will

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[10]U. S. Army Command and General Staff College, p. LP2-12.

require gasoline for kitchens, squad stoves, operation of electric generators on a 24-hour basis, battery chargers, and a host of other equipment. At the present time there are no consumption experience factors for division-size units to determine just how much of an increase there is over temperate zone requirements, but to say the least, it will be considerable.

The augmentation of tracked vehicles for certain wheeled vehicles in the division will increase the normal consumption rates to which the division is accustomed. Since much of the vehicle movement will be cross-country due to the lack of roads, an increase in fuel will be required. Field Manual 101-10 states that "cross country battle consumption is at a rate of 2.5 times that given for road movements."[11] Where roads do exist, the rate of consumption is increased by 25 per cent for arctic operations as compared to temperate zone operations.[12] In addition to the fuel required to move the vehicles, personnel heaters in vehicles operating in the Arctic should be equipped with a gasoline-type heater to preclude running of the engine to generate heat. Not only does the vehicle engine use more fuel than the personnel heater, but idling

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[11]U. S. Department of the Army, Organization Technical and Logistical Data, Part I, Staff Officer's Field Manual 101-10, (Washington: U. S. Government Printing Office, October 1961), p. 249

[12]Ibid., p. 244.

of the engine creates more wear and increases the maintenance problem.[13] During periods of extreme low temperature, vehicles which may be needed on short notice should be started and the power train "exercised" for about 15 minutes every hour to insure its availability in the event of emergency.[14] This requirement will further aggrevate the fuel consumption problem, but it is necesssary for successful operations. From the above description of activities, it is expected that the reader will gain an appreciation of the fact that the resupply of fuel to units in Arctic operations will be increased substantially over similar units operating in the temperate zone.

The additional requirements for Class I supplies will considerably increase the logistical load of the division. "The ration augmentation required for the most extreme cold conditions will add approximately 30 per cent to the weight and bulk of the standard ration."[15] This weight can be reduced as the temperature increases, but even under the mildest conditions, an increase of 10 per cent will be required.[16] The following weights of different types of rations which can be used over extended periods are provided to give a better insight into the problem

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[13] U. S. Army, Alaska, Exercise North Star, pp. 61-62.

[14] U. S. Department of the Army, Northern Operations, p. 78.

[15] Ibid., p. 123.

[16] Ibid.

at hand: Each figure represents the average weight per ration. (1) Field A ration - 6.0 pounds, (2) standard B ration - 6.0 pounds, and (3) the five person small detachment ration 5.8 pounds. An increase of 30 per cent over these figures will increase the weight by 1.8 and 1.74 pounds, respectively. For a division of approximately 14,000 men, this will be a total increase of 25,200 pounds, or 12.6 short tons daily.[17] This increase in weight will require approximately five or six additional two and one-half ton vehicles to carry rations daily. The increase in rations will not constitute any problem in getting them up to division in that current doctrine states that field army will deliver rations to division. The problem arises when division must sort, load, and transport these rations down to brigade level. Under temperate zone conditions, this would not ordinarily pose any major problem, but in the Arctic the situation is somewhat magnified by the fact that transportation is at a premium, and the more it is used, the more fuel is consumed, and the more maintenance will be required on the vehicles.

Class II supplies will also be increased but not to the extent of the supplies mentioned above. The increase in these supplies is mainly attributed to a more rapid breakage and depreciation of equipment due to the influence

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[17]U. S. Department of the Army, Organization, Technical and Logistical Data, Part I, p. 218.

of extreme cold and the large amounts of special equipment required for Arctic operations.

The high rate of breakage of equipment in northern operations is directly due to the extreme temperatures prevalent in this area. Metal becomes brittle when exposed to the extreme temperatures, and as a consequence, it is weaker and may not perform the task for which it was intended. As an example, "a chain, which during warm weather would be capable of supporting the weight for towing a vehicle, may break under the strain during cold weather. A slight blow from a hammer may cause a pin to shear or a hook to break."[18] While the example of a chain is used, the reader should apply this same principle to other metal equipment, which undergoes great stress, in order to grasp the significance of this quotation. This point will have application in many areas such as heavy engineer equipment, recovery equipment, and heavy maintenance equipment used for track vehicles. Weapons are also subject to this phenomena but in a different manner as pointed out below:

> 'nother problem that faces the soldier in the areas of severe cold is a higher rate of breakage and malfunctions. These can also be attributed primarily to the cold, although snow in a weapon may cause stoppage and malfunctions. The tempered metal of automatic weapons, for example, will cool to a point where it cannot be touched by human flesh. This extreme cold makes the metal brittle. When the weapon is fired at subzero temperatures, the temperature of the barrel and gun will rapidly rise to between 200 and 700°, depending upon the number of rounds fired. This again

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[18]U. S. Department of the Army, Basic Cold Weather Manual, pp. 240-241.

> reduces the temper and, because the parts are working, breakages will occur early in the firing while the weapon is warming up.[19]

The above discussion is continued and points out that the parts most subject to breakage are those which are moving or bear the blunt of recoil. The author used the automatic weapon as an example, but this also applies equally to individual weapons and artillery pieces. The fact is, greater breakage of metal parts will occur in the north, and as a result, the direct support maintenance facilities will be required to increase their spare parts stockage level.

Some other materials which will be affected by the cold are rubber, canvas, glass, leather, paint, and wood. Rubber becomes brittle when exposed to extreme cold temperatures. Tires will flatten out when parked for several hours and will remain that way after the vehicle is started until they have warmed up. In the event they come in contact with a sharp object before they warm up, they will chip or break open. Rubber insulation on electrical components will break when flexed at extreme temperatures. Glass will crack if exposed to sudden changes of temperatures. Canvas items become stiff and difficult to fold without damaging the item. Rifle stocks which have been wet by snow will crack open when exposed to freezing temperatures.[20] There are

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[19] Ibid., pp. 269-273.

[20] Ibid., p. 241.

numerous other examples such as these which will cause an increase in the replacement parts and items of equipment required by the soldier. The amount of parts which break as a result of cold will be in indirect proportion to the state of training of the unit. Proper care and operating procedures will reduce the number of breakages to an acceptable level. An indifferent attitude or poorly trained troops will do much to add to the logistical problems of the unit.

The large number of special items of equipment required in northern theaters will also add to the normal logistical load of the infantry division. The large tentage requirements for shelter, storage, and work space of the division's units are certainly worthy of consideration. They are not only heavy but are extremely bulky. The space heaters and their associated parts to warm these tents will be a constant problem. Individual clothing and equipment (approximately 118 pounds in the Arctic compared to 45 pounds in the temperate zone) will be no small problem in maintaining. Thermal boots, clothing, mittens, etc., which become torn, worn out, or lost must be replaced if the soldier is to accomplish his mission. They should be immediately available when required, otherwise the soldier may not be able to report to his duty assignment without undue risk of becoming a cold weather casualty. There are many more items that will add to the logistical load, such as pioneering tools, sleds, white camouflage material,

winterization kits for equipment, skis, and snowshoes. The division supply officer is going to be a busy man and will require the utmost cooperation and assistance from all commanders in keeping the supply loads as small as practical through sound supply economy practices.

Another consideration which will require attention is the storage of equipment. Supplies which are off-loaded from transportation should not be placed on the snow. Periodic thawing of the snow may dampen these supplies or freeze them to the ground. Dunnage in the form of trees, boards, and empty boxes should be provided to prevent damage to equipment. Waterproofed tarpaulins should completely cover these supplies to prevent snow from blowing in or piling up beside the stack for the same reason mentioned above. Small stacks of supplies should be carefully marked and located to prevent snow storms from completely concealing the location of these supplies. Individual small items of equipment must not be left lying on the ground. Snow storms will completely cover them and the possibility of locating them later is small. Perishable items will require special attention in that alternate thawing and freezing will ruin certain foods and medical supplies. Warm storage areas must be provided those items which should not be frozen. Strict camouflage must be exercised to deny the enemy intelligence as to where these supply dumps are located.

Nuclear weapons and the nature of operations in the Arctic will make rear area installations vulnerable

to attack as pointed out in this quotation:

> Division support areas, brigade and battalion trains areas, as well as the MSR are extremely vulnerable to guerrilla and enemy airmobile operations. Therefore, plans must be prepared to protect these areas, movements between them and the supported unit.[21]

Depending upon the level of activity of guerrilla and infiltrated enemy units operating in the rear areas, combat troops may be required to guard supply installations and supply convoys. At any rate, the support command commander must prepare for the security of his operations. Security will be enhanced by the use of tracked vehicles if they are armored and armed with machine guns. Sentries must be posted to avoid surprise attacks during the long winter nights. In addition, combat service support personnel should also be trained to operate as infantrymen to provide protection of these supply installations.

The employment of independent task forces of battalion and brigade size will be common in northern operations. To support these forces which may be operating at considerable distances from the main force, mobile direct support elements will be attached to the combat units. These mobile support elements will be formed by fragmenting the support command. The size of the support element will depend on the size of the task force being supported. Regardless of size, however, these support elements should be capable of providing maintenance and repair of vehicles, weapons, electronics, and

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[21]U. S. Army Command and General Staff College, p. LP3-19.

quartermaster equipment. Included also will be a supply section to handle rations, POL, ammunition, and other supplies required by the situation. Services will be needed in the fields of medical evacuation, communications, military police, and transportation.[22] While operating under these conditions, aerial resupply to the task force will help to eliminate some of the cargo haul over extended distances and cross-country. Aerial resupply can be accomplished from general support units directly to the task force, bypassing the division support area and thereby easing the load of these supply activities. Division will attempt to provide as much unit distribution as possible to relieve the task force of long-haul requirements. This is current doctrine for units operating in the temperate zone and does not change in an arctic environment.

As discussed earlier, when brigades and battalions are operating under division control, the technique of providing services and supplies to the forward units will not change. Whenever possible, maximum use should be made of general support units from higher headquarters by having them move supplies forward to brigade trains to ease the handling and transportation loads at division level.

In summary, it has been pointed out that combat service support units are not only faced with the normal

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[22]U. S. Department of the Army, Northern Operations, p. 58.

problems of supporting the division but are also confronted with many additional tasks imposed by the hostile environment of northern areas.

The first problems which will become evident to a newly arrived division in an arctic environment will be the difficulty of cross-country movement and the poor communications facilities in northern areas. The widely separated communications facilities which do exist in this sparsely settled area of the world are inadequate to support most military loads and the volume of traffic required to sustain the combat units. Considerable engineer effort must be expended to keep these roadways free of snow and in a reasonable state of repair. Roads forward of the division combat service support area will be rare. The lack of roads between the support area and the brigades will require the use of tracked vehicles for cross-country operations in that wheeled vehicles are valueless for off-road operations in northern areas. The lack of roads dictates that tracked vehicles be substituted for wheeled vehicles that will be operating forward of the division support area. The introduction of additional tracked vehicles into the infantry division will create the problems of driver training, increased maintenance, and Class III requirements. The instruction of drivers and maintenance crews in the operation and maintenance of tracked vehicles must be started before the division departs its home station. This pool of trained drivers and mechanics

will greatly facilitate the division's operations once it reaches the northern area.

The second major combat service support problem which the division must overcome when arriving in a northern area is the increase in comfort and survival supplies. To survive in the extreme temperatures of the Arctic, the troops of the division must be supplied with individual protective clothing and equipment, tents, stoves, sleds, increased rations, skis, snowshoes, and many more items of special equipment as discussed earlier in this paper. These supplies will increase considerably the division's supply loads. Because of the increase in the number of items required to sustain the infantry division in combat, as compared to a temperate zone operation, the factor of supply economy becomes especially important. To successfully accomplish this mission, the combat troops and commanders will be required to render maximum cooperation and assistance to the supporting units in limiting requirements to essentials through sound use of supplies.

CHAPTER V

TACTICAL CONSIDERATIONS FOR NORTHERN OPERATIONS

The word "tactics" as defined in the Dictionary of United States Army Terms, means:

> "1. The employment of units in combat. 2. The ordered arrangement and maneuver of units in relation to each other and/or the enemy in order to utilize their full potentials."[1]

This chapter will discuss considerations for the tactical employment of the maneuver elements of the infantry division during offensive operations in an arctic environment. The mission of the infantry division continues to be that of closing with and destroying the enemy; however, the factors of terrain, climate, visibility, and reduced mobility in the northern areas will reduce the unit's overall capability to perform this mission during sustained combat. The manner in which and the extent that the northern environment affects the maneuver elements will be discussed in the following pages. No attempt will be made to include all possible combinations of environmental conditions which may exist at any one time but instead, the most common situations will be used as the vehicle for discussion.

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[1]U. S. Department of the Army, Dictionary of United States Army Terms, (Short Title: AD), (Washington: U. S. Government Printing Office, February 1963), p. 391.

The area of northern operations is a vast, relatively unexplored region which is often referred to as the "land of contrast." It has rightly gained this title through the contrast noted between its extreme cold winters and temperate summers, the dense forest to the barren tundra, the long summer days to the short winter days, and the rugged mountains to the flat plains.[2] These are the major environmental factors within which the division commander must maneuver his forces. He must be prepared to command his unit under all of these extremes even though this discussion will not include summer or mountain operations. The winter season has been selected for this study because it offers the best opportunity for the conduct of offensive operations. The frozen rivers, numerous lakes, and muskeg swamps provide excellent routes of communication during this period, whereas during summer months they constitute formidable obstacles to land forces.

During the winter months the best period for offensive action is from mid-winter to early spring. By that time the ice will have had an opportunity to freeze to sufficient depths to support division loads, and the snow will have compacted with time to form a firm base for

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[2]U. S. Army Command and General Staff College, Division Operations - Mountain and Northern Regions, Lesson Plan M6480/5, (Department of Division Operations, United States Army Command and General Staff College, Fort Leavenworth, Kansas), p. LP3-46.

cross-country movement.[3] Although the daylight hours will be at their shortest during the mid-winter season, the number of hours of daylight will continue to increase as the offensive gains momentum, and will be very favorable (15-16 hours)[4] by the time the unit is approaching the final objectives in March and early April. If operations should commence in early winter, attacks must be preceded by a thorough route reconnaissance to insure that routes are frozen to sufficient depths to support the type loads to be moved over them. Failure to do so can result in the loss of vehicles and personnel by their breaking through the ice cover on lakes, rivers, and muskeg swamps. This requirement for route reconnaissance not only exists in early winter but must continue throughout the winter months because of soft spots created by warm water springs which feed some lakes and marshy areas.

Communication routes and centers will be of significant importance in northern operations and will frequently be designated as objectives for the maneuvering forces. While the infantry division may be able to operate cross-country, the supporting logistical units of higher headquarters will require roads and railroads to move the supplies forward to support the offensive operation. The use of

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[3]U. S. Department of the Army, Northern Operations, Field Manual 31-71, (Washington: U. S. Government Printing Office, 10 January 1963), p. 7.

[4]U. S. Army Alaska, Intelligence Reference Handbook on Alaska, (U. S. Army, Alaska, 1953), p. 5.

existing roads will greatly facilitate the rapid displacement forward of the supporting units since road construction in the northern areas will require considerable resources and will be time consuming. As explained in the preceding chapter, the severe winter weather of the Arctic causes the maneuver elements to be especially dependent on logistical support for sustained operation. These over-land, and in certain instances over-ice, communication routes will be of vital importance if the frontline units are to hold and consolidate the gains achieved through offensive operations. Since both forces, enemy and friendly alike, will be exposed to the same environmental factors, it stands to reason that the enemy will place the same importance on these objectives as will the friendly forces. As a consequence, the major battles which will be fought in northern areas will be primarily directed toward the seizure of these routes and attempts to cut the opposing forces supply lines. This is exemplified in the study of the major battles of the Russo-Finnish and the Russo-German campaigns of World War II.[5]

Since the routes of communication are few and widely separated, many areas of the battlefield which are remotely located will not be strongly defended. This fact is clearly pointed out by the U. S. Army Command and General Staff College in the following statement:

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[5]Langton-Davies, Invasion in the Snow, (Bouton, England: Houghton-Mifflin Co., 1941); U. S. Army Command and General Staff College,
Allen-Muratuff, Russian Campaigns of 1941-43, (Harmondsworth: Middlesex, England: Penguin Books, 1946).

> There are no extended, solid frontlines in northern warfare. Rather, there are more or less independent forces in the open. This means the flanks are open and envelopment is always possible.[6]

This statement is not meant to imply that no combat will take place between major strong points. The amount of activity in these areas will depend entirely on the ability of the two forces opposing each other to move troops and the necessary support units over snow. The over-snow movement of units has been considerably improved as a result of the introduction of heliborne operations since World War II, but essentially these forces will still be employed against objectives associated with routes of communication. The helicopter does not negate the importance of the land routes of communication, it merely improves the means of moving troops over difficult terrain and permits them to conduct raids on deeper targets than would otherwise be normal. Improved means of battlefield surveillance through radar and light helicopters will reduce, but not entirely eliminate, the threats posed by gaps in frontline positions.

Regardless of the type of objectives which may eventually be selected, the commander must properly evaluate the capabilities of his unit to move up to the objective. It has been concluded in the preceding chapters that cross-country movement for a unit in this environment will be more difficult and slower than for a similar type unit operating in a more temperate area. The difficulty of movement not

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[6]U. S. Army Command and General Staff College, p. Anx B-15.

only applies to the maneuver elements that will be conducting the attack but will also apply to combat support and combat service support units that will be supporting the attack. This point is emphasized in the following statement which was extracted from the conclusions section of the final report of Exercise Polar Siege in 1964:

> Commanders at all levels must learn to appreciate the difference in time values that applies in cold weather operations. In order to maintain morale on the level required for effective performance, every minute of the 24-hour day must be preplanned and controlled. Double or even triple, the normal time will be required for the completion of fatigue details, care of equipment, housekeeping details, and conduct of combat operations.[7]

The nature of dispersed communication routes will frequently create the requirement for independent task force organizations of brigade and battalion size. Since the communication routes will usually be along terrain which offers the least resistance, the area between these routes will often be extremely difficult to traverse. Independent task forces consisting of maneuver elements, fire support elements, and combat support and combat service support units will be required. The organization of the ROAD division favorably lends itself to this type of tactical deployment through the internal tactical tailoring of the brigades according to the assigned mission.[8] The brigade

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[7]U. S. Alaskan Command, Exercise Polar Siege, Final Report, (Exercise Director Joint Headquarters: APO 949, Seattle, Washington, 15 June 1964), p. 155.

[8]U. S. Department of the Army, Infantry, Airborne and Mechanized Division Brigades, Field Manual 7-30, (Washington: U. S. Government Printing Office, 17 January 1962), p. 4.

headquarters has a capability to command up to five attached combat battalions plus the combat support and combat service support units which are attached. The restricted mobility of arctic operations, however, will usually dictate that these brigades be kept as small as the situation will permit. This not only reduces the awkwardness associated with the maneuver of large forces but will also reduce the size of the attached administrative elements. As discussed in Chapter IV, the logistical support required for northern operations will be substantially greater with the resulting increase in the size of the logistical tail. Since the task force will often be far removed from the remainder of the division, its flanks and rear area will be open and susceptible to enemy attacks. This vulnerability will require that the administrative elements be as mobile as the maneuver elements in order to be well forward in the march column and benefit from the protection offered by the combat elements. The road-bound Russian forces that invaded Finland were slow to recognize the vulnerability of supply units and suffered great losses as a consequence.[10] The Finn's favorite tactics were to use the cross-country mobility inherent in their ski units to move in the wooded areas parallel to Russian columns until they located their trains areas. Once the trains areas were located, they would deploy and attack the field kitchens

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[9] Ibid.

[10] Langdon-Davies, Invasion in the Snow, (Bouton, England: Houghton-Mifflin Co., 1941).

and supply vehicles which the Russian Army depended on to a great extent. Once these supplies were destroyed, the Finns set about harassing and cutting the column into small isolated groups which were defeated one at a time. These tactics continued until the entire division force was eliminated. The reason these tactics were possible was that the Russian troops were road-bound and had no over-snow capability, either on skis, snowshoes, or by vehicle. Although captured supply vehicles revealed that an adequate number of skis were available to the Russians, they had recieved no training in their use and as a result, "Russian troops were never encountered more than 300-400 yards from the main road."[11]

One might stop to think that these tactics would not be possible in our Army today with the helicopters and over-snow vehicles that are available; however, it can happen in the dense forests of the northlands where tracked vehicles cannot move off roads due to dense forest and the landing sites for helicopters are miles apart. The only saving factor is for the combat units to have at least an equal over-snow capability as the enemy. This requirement will mean that infantry units must be proficient in the use of skis and use them for their intended purpose. As late as 1964, during Exercise Polar Siege, infantry combat unit commanders were still relying heavily on the use of vehicles to

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[11]U. S. Army Command and General Staff College, Annex B-14.

transport their troops as indicated by this comment: "Ground mobility was hindered by commanders' undue dependence upon mechanized transport to the exclusion of foot movement of larger forces."[12] Helicopters and mechanized transports, even if available, should only supplement the infantry's capability and should not be depended upon exclusively. Many tactical and environmental situations will not permit the use of these modes of transportation and will instead require the use of dismounted troops.

Once the objective of the division has been determined, plans for the attack are begun. One of the first requirements in planning the attack will be to complete an accurate and current analysis of the area of operations. While this has always been an important consideration for any operation, it assumes an even greater significance in arctic operations. Terrain features which constitute obstacles to movement in the temperate zone, become desirable avenues of approach during winter in the Arctic, while obstacles in the Arctic are desirable avenues in the temperate zone. To clarify this, let me point out a few examples. Swamps, rivers, and lakes are considered to be obstacles to cross-country movement in the temperate zone. In the Arctic, these terrain features are very desirable as avenues of approach in that when frozen, they form a flat and smooth surface over which vehicles and troops can

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[12]U. S. Alaskan Command, Joint Exercise Polar Siege, p. 149.

move rapidly. Road construction effort by the engineers is significantly reduced where these features can be linked with overland routes. Small lakes form excellent landing sites for helicopters and large lakes are ready made airfields with a minimum of construction effort. Maximum advantage must be taken of these environmental effects to facilitate the forward movement of troops and supplies and to offset some of the other disadvantages presented by this hostile environment. The reader is cautioned that the use of frozen waterways must first be preceded by a thorough route reconnaissance to insure that ice conditions will support the loads which will be moving over them. "The strength of ice is dependent on its structure, thickness, temperature, and underlying support."[13] The division engineer battalion will conduct this reconnaissance to determine the feasibility of using the route and to determine which loads cannot be moved over it, if appropriate. Figure 3 provides a guide for determining load bearing capacity of fresh water ice.

In the Arctic, forest or thick vegetation will become an obstacle to foot movement, while in the temperate zone this is considered to be an excellent route for moving dismounted troops. The forest will considerably reduce the speed of cross-country movement of troops on skis or snowshoes. For skiers this poses the arduous task of constantly

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[13]U. S. Army Command and General Staff College, p. L2-1-4.

LOAD BEARING CAPACITY OF FRESH WATER ICE[14]

Load	Minimum Thickness
Single rifleman on skis	4 cm (1½")
Infantry column; a single pack Animal or an unloaded cargo sled	8 cm (3")
105-mm Howitzer; ¼ ton truck	15 cm (6")
2½-ton truck with light load	35 cm (14")
5-ton truck	45 cm (18")
Light tanks	50 cm (20")
Howitzer, SP, 105-mm	55 cm (22")
20-ton vehicles	40 cm (16")
M-116 (Personnel Carrier)	30 cm (12")
M-113 (Armored Personnel Carrier)	40 cm (16")
D-8 Tractor	50 cm (20")

Figure 3

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[14]U. S. Army Command and General Staff College, Division Operations - Mountain and Northern Regions, Lesson Plan M6480, (Department of Division Operations: Fort Leavenworth, Kansas), p. L2-1-4, L2-1-5.

changing direction and the difficulty in the use of the ski pole in forward movement. For the troops on snowshoes, the low brush becomes tangled in the webbing and tears it up in short order, thereby increasing maintenance problems and slowing the unit. The towing of sleds is slowed due to the frequent change of direction and tow ropes become entangled in the brush and low branches. Skijoring under these conditions is out of the question. Forest with little or no underbrush and wide spaced trees could be used to advantage if a reconnaissance can verify that these conditions exist within the area planned for use. The above is not meant to imply that camouflage and concealment are not important in arctic operations. The converse is in fact true due to the trails which are easily pinpointed in aerial photographs.

Following the terrain analysis, current meteorological data is compiled to determine what weather conditions will exist at the time of attack. In the temperate zone, the weather primarily affects visibility and in some cases trafficability of the soil. In the Arctic, weather will play a much more important part in assisting the commander in reaching his decision. As discussed in Chapter II, windchill is an important factor in determining the load of each individual rifleman. The object is to provide the individual with those items required to offset the weather conditions and at the same time, reducing his load to the bare essentials to increase his mobility and prevent unnecessary fatigue before reaching the objective.

The temperature will have an influence on the condition of the snow. Wet snow will cling to vehicles, snowshoes, and cause ice to form on ski runners. Dry snow will be subject to being blown in the eyes of the advancing units, drifting, and forming a poor base for skiing. Blowing snow may also obscure targets and interfere with adjustment of air strikes and artillery fires. Under no-wind conditions and extreme cold temperatures, ice fog may create serious problems. Ice fog is created by "the conflict between locally generated warm moist air and the surrounding cold air."[15] Ice fog is created by most heat sources such as vehicle exhaust, weapons firing, large concentrations of troops, cooking, or a herd of animals.[16] This fog will definitely restrict automatic weapons firing and will require that they displace to new positions so as to see the targets. Troops can be detected by this ice fog hanging over their positions and artillery and mortar positions can be detected at long ranges by the vapor cloud which will form over their locations. If these conditions are predicted during the attack, the commander may decide to take advantage of the night in conducting the attack to reduce the chance of detection.

Current meteorological data is required for accurate artillery firing. Not only must wind conditions be

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[15]U. S. Army Command and General Staff College, p. Annex A-4.

[16]U. S. Department of the Army, Basic Cold Weather Manual, Field Manual 31-70, (Washington: U. S. Government Printing Office, 24 February 1959), p. 195.

considered but temperature as well in that both will affect the trajectory of the rounds. Snow conditions may favor the attacker providing that the wind is to his back and is blowing in the eyes of the enemy. Such conditions will provide concealment of the attacking units and will add to the element of surprise as well as hinder the enemy's ability to direct accurate fire.

After a thorough analysis of the area of operations has been completed and the estimate of the situation has been made, the route to the objective can be selected based on the factors discussed above. "As a general rule terrain features which offer least resistance will be followed."[17] Plans for trail-breaking should commence as soon as possible. Trail-breaking is the preparation of the trails over which the main body will pass. Trail-breaking includes compressing the snow, selecting the best terrain along the route, cutting brush below the snowline that might interfere with skiing or snowshoeing and acting as the advance guard. The purpose of trail-breaking is to permit the main body to move as rapidly as possible toward the objective with the minimum of effort. Approximately one-fourth of the unit will be involved in trail-breaking tasks, in that frequent rotation of lead elements is necessary due to the fatiguing nature of the job. For a brigade-size force of three battalions, usually one battalion will be designated. A brigade-size

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[17] Ibid., p. 165.

force in a march column formation will usually require three tracks to be broken.[18] The trail-breaking parties must precede the main body sufficiently to insure that they are not overtaken. The general rule for lead time is that the trail-breaking party will depart one hour early for each five kilometers of march distance to be covered. This would mean two hours for a 10-kilometer march.[19] If skijoring is planned, no trail breaking will be required in that the skiers follow in the tracks of the vehicle.

Flank security during this type of march will be essential, but it stands to reason that ground units conducting flank security on unbroken trails could not keep up with the main body that is traveling on broken trails. To overcome this the cavalry squadron will conduct aerial surveillance using helicopters.

At the time objectives are selected and units positioned for the attack, distance to the objective must be considered. The units in the attack must be capable of seizing their objective within the daylight hours available and complete the reorganization and consolidation phase. To determine this will require an evaluation of many factors: for example, physical conditioning of the troops, amount of equipment being carried or pulled by the troops, weather conditions, enemy situation, state of training, and

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[18] U. S. Army Command and General Staff College, p. L2-1-2.

[19] Ibid., p. L2-1-2.

proficiency of troops in the use of skis or snowshoes, supplementary transportation available, such as helicopters or tracked vehicles, and so forth. To be caught in the open short of the objective with nighttime closing in could mean failure of the mission. Temperatures drop severely during darkness, as pointed out earlier. To attempt to continue the attack as a night attack, without any previous planning, would be wishful thinking and foolhardy. Since the number of daylight hours available in the northern areas during winter are very limited, consideration should be given to short attacks or when necessary, require the troops to begin their forward movement well before the beginning of morning nautical twilight. The use of helicopters or vehicles to position troops in forward positions would facilitate their rapid advance as well as conserve their fighting energy.

Time is all important in planning operations. For this reason, it is essential that supporting units begin their preparation to support the attack well in advance of time of attack. Artillery units should plan to displace well forward just prior to the attack. This will lessen the requirement for displacement during the attack. Displacement of towed artillery units will be especially slow since they must be positioned on sleds or special runners before they can be moved forward.[20] In addition, the prime movers of these artillery pieces must be tracked vehicles in order to attain the degree of cross-country mobility

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[20]U. S. Army Command and General Staff College, p. LP3-11

required to keep up with the maneuvering force. Wheeled vehicles, as has been pointed out, are practically useless in cross-country operations. All recent reports of major field exercises conducted in Alaska have emphasized the need of tracked vehicles and a lightweight artillery weapon of greater range than the 105-millimeter howitzers and the 75-millimeter pack howitzers currently used in Alaska today.[21] From this discussion, it stands to reason that a lightweight, self-profelled artillery weapon will be more desirable than a towed weapon. The use of self-propelled artillery not only would permit an improved cross-country capability but will reduce displacement time, reduce the construction effort in the preparation of positions as well as provide protection to crew members from small arms fire and the cold environment.[22] In addition, the self-propelled artillery vehicle affords protection of the howitzer itself from the adverse effects of extreme cold. Artillery pieces which have been exposed to cold must be "warmed up" before employing the sustained rate of fire due to the recoil mechanisms and operating parts.[23] Other adverse effects of

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[21]U. S. Army Alaska, Joint Exercise Timber Line, Final Report, (3 June 1963), p. 163; US Army Alaska, Exercise Great Bear, Final Report, (8 June 1962), p. 52; U. S. Alaskan Command, p. 49.

[22]U. S. Army Command and General Staff College, p. LP 3-11.

[23]Ibid., p. LP 3-12.

extreme cold on artillery support are: (1) dispersion of rounds due to meteorological changes and temperature variations of powder charges, (2) reduced fragmentation effects due to snow, (3) frequent periods of poor visibility due to weather conditions and, (4) slow operation of crews due to cumbersome clothing and preparation of artillery rounds which must be kept in their cannister until ready to be fired. These effects can be reduced by alert crews who are experienced in arctic operations.

The current doctrine of maintaining centralized control of artillery fires at division level will in many instances be violated for northern operations. While the doctrine itself is still valid and desired, the dispersed nature of operations in the Arctic will not always permit this. Independent task forces of brigade and battalion size will be common place due to trafficability of the area and the wide dispersion of significant objectives. Division artillery units will often be attached to the brigades to provide the type and amount of fires required by the assigned mission. Consideration should be given to augmenting these attached battalions with tracked vehicles for ammunition resupply.[24]

The environment of the northern areas is not conducive to large-scale armor operations. The capability of the tank cannot be fully utilized in these areas primarily

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[24]U. S. Alaskan Command, Joint Exercise Polar Siege, p. 151.

due to trafficability conditions. Ice fog created by the tank engine and muzzle blast will reduce visibility. The adjustment of rounds fired becomes extremely difficult, if not impossible. The tank must either be shifted from that position or receive adjustments from nearby tanks. Tank maintenance becomes a major problem in cold weather and under extreme conditions may require as much as five times the normal maintenance time as in the temperate zone.[25] For heavy tanks, lakes and muskeg swamps will not often have the load bearing capability to support the weight of these vehicles. This is also true of light tanks but to a much lesser extent. When conditions are suitable for tank employment, however, their shock action and fire power are employed in the same manner as in temperate areas. Most often, circumstances will cause the tank to be used only in a support role of company or battalion size.

The increased difficulty of cross-country movement in northern areas puts a premium on Army aviation. The ability of aircraft to move rapidly to any location on the battlefield with troops and supplies lends flexibility to the commander's means of influencing the battle. Through proper use of this means of transportation the commander has the ability to extend his ground reconnaissance and surveillance activities into difficult areas that heretofore would have been extremely risky and time consuming. Long-range

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[25]U. S. Department of the Army, Northern Operations, p. 79.

patrols can be landed deep in enemy territory and retrieved without undue risk. These patrols, which formerly would have required days, can be accomplished in a matter of hours. The absence of solid frontlines permits heliborne forces to be moved with relative ease to the enemy's rear areas to conduct raids on supply and command post installations or to seize objectives to linkup with ground operations. The extent to which the helicopter can be used to assist in accomplishing the mission is limited only by the imagination of the commander and his staff. The ability of this mode of transportation to overcome the difficulty of mobility in the north will place it in great demand and as a consequence, it must be closely supervised to insure its most efficient utilization.

The method of employment of the helicopter in the Arctic will be no different from that used in the temperate zone. There are certain considerations, however, that should be applied. Where heliborne forces are to be employed to seize an objective for later linkup with ground forces, load planning and weight factors will be different due to the environment. As indicated in Chapter II, the infantry elements must be provided with fuel and shelter in order to be able to engage in sustained combat. This requirement for shelter will mean that sleds loaded with tents, fuel, food, and ammunition must accompany the attacking troops. The weight of the infantrymen themselves will be increased due to the additional clothing and equipment which the must carry.

The protective and comfort load must also accompany the individual if the scheduled time of linkup extends through an overnight period. In essence, the total weight of the unit will be increased substantially over that of temperate zone operations. Care must be exercised to insure weight restrictions are not exceeded when loading the helicopter. This additional weight will increase the number of helicopters required for the mission or increase the number of round trips necessary to deliver the unit.

The increased difficulty of maintenance in cold weather will apply to aircraft as it does to vehicles. The difficulty of maintenance may lower the rate of availability of aircraft, depending on protective shelters available in which maintenance can be performed, proficiency and motivation of crews, and the number of flying hours logged by the unit. The factor of maintenance may cause the commander to place rigid controls on the use of these aircraft to insure that they are available at the time he needs them. The helicopter will be an extremely important resource of the commander during northern operations and consequently must be used with discretion and thorough planning.

The large, undeveloped areas of the north will tend to complicate the mission of the engineer battalion. Most of the engineer effort will be directed toward the construction and maintenance of roads and airfields. The construction effort will be slowed by the effects of extreme cold on personnel as well as the difficulty of excavating in

frozen ground. Demolitions and power equipment will be essential to the accomplishment of the mission in this difficult environment. Engineer construction under the most ideal of conditions will not produce the permanent type roads common to temperate zones. Most often this construction will be directed toward improving existing trails and roads to permit use by military traffic. Maximum utilization will be made of frozen waterways to expedite the effort and reduce the amount of labor required. At any rate, regardless of the type of construction, the commander should realize that this work is going to be slow and should be planned and started well in advance of the time it will be required. The many field expedients available to the engineer in overcoming construction problems will not be discussed except to point out that extensive training is required to teach road crews the tricks of the trade. While ice often works to his disadvantage and complicates the overall effort, it can be used to advantage. If the engineer is to be successful, he must know these advantages and employ them in his favor. In addition to training the members of the engineer battalion in their primary mission, the division engineer must also train his men to fight as infantrymen in order to be able to accomplish their secondary mission. As discussed in Chapter III, this is no short training program and must be begun in Phase I of the training cycle.

Another major engineer task will be the preparation and reproduction of maps. While much of this effort will not

be accomplished at the division level, the division engineers will be required to assist in the gathering of information required. Since the Arctic is relatively unexplored, military maps are nonexistent for large areas. Aerial photomaps, photographs, and sketch maps must be relied on in many areas. As information becomes available, these map substitutes must be improved in order to assist pilots, fire control, and land navigation.

Night operations in the northern theater will not differ from night operations in the temperate zone. The basic considerations of security, surprise, control, and the massing of combat power on the objective are applicable to the northern environment the same as for the temperate zone. The problem of troop control for night operations is somewhat eased in the northern environment due to the fact that snow reflects whatever available light may exist. The available natural light is so magnified and reflected that pitch darkness is rare in the Arctic regions. "Even at maximum darkness, a dark-clad man on a light field can be seen 100 yards away."[26] Night operations conducted during Exercise Polar Siege point out the feasibility of night attacks in northern theaters:

> Operations at night is practicable. It imposes no greater hardship than movement by day. Snow reflects sufficient material light to permit control of troop

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[26]U. S. Army, Alaska, Intelligence Reference Handbook on Alaska, (Office of the Assistant Chief of Staff, G-2: Anchorage, Alaska, 1953), p. 26.

> movement, while at the same time, visibility is insufficient for the execution of precise observed fire.[27]

A commander should be on the alert to use the night attack to advantage, using the same considerations as are applicable for the temperate zone.

In summary, offensive operations by the infantry division in a northern environment are feasible. Additional considerations are required, however, as compared to temperate zone operations due to the environmental factors of northern areas. The major environmental factors which will influence the division commander's concept of operations are extreme cold weather, difficulty of cross-country operations, short daylight hours, widely separated communication routes, and meteorological conditions.

The extreme cold weather of the Arctic environment requires considerable individual clothing and equipment to protect the soldier from becoming a cold weather casualty. The higher the windchill factor, the more clothing will be required to protect the individual from the cold. The cumbersomeness of this heavy protective clothing hinders the action of the individual with the results of an increase in time for the accomplishment of even the most simple tasks. Attack plans must include additional time for the completion of assigned tasks. The amount of additional time which will be required will depend upon the state of training of the unit

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[27]U. S. Alaskan Command, Joint Exercise Polar Siege, p. 154.

The difficulty of cross-country operations for the individual soldier and for supporting vehicles will influence route selection and distance to the objective. Trail-breaking parties must be dispatched in sufficient time to precede the main body to break trail. This broken trail will permit the main body to move at a more rapid rate than would be the case if movement over an unbroken trail and conserves the strength of the rifleman so he will not be exhausted by the time the objective is reached. As a general rule, the route of least resistance is selected for the forward advance of the unit. Frozen rivers and lakes are excellent routes from the standpoint of ease in movement and the amount of engineer effort required. Caution must be exercised in the selection of lakes and rivers as routes of advance to insure that the ice cover is strong enough to support the type loads expected to move over them. The distance to objectives is another important consideration. For daylight attacks, troops must be capable of moving to and seizing the assigned objective before nightfall. Sufficient daylight should be available after the seizure of the objective to permit the pitching of tents for protection against the cold Arctic nights.

The few communication routes which do exist in the Arctic regions are extremely important for logistical operations. As a consequence, communication facilities assume greater significance in arctic environments than in temperate zone operations. The seizure of widely separated

communication facilities will often require the use of independent task force operations. These task forces should be self-supporting with artillery and logistical units when the distance from the main body is so great that direct support from division units is not possible. Independent task force operations will be common in northern regions.

Accurate and current meteorological data is essential for successful operations in the Arctic. Temperature forecasts must be considered in determining the type and amount of clothing to be worn by the infantrymen. Too much clothing will unnecessarily restrict the movement and rate of advance of the infantryman, while insufficient clothing may result in non-battle casualties due to cold injuries. Temperatures will also reveal the condition of the snow which will affect the rate of cross-country movement of troops on skis or snowshoes. High wind conditions will cause dry snow to be blown about which will cause snow drifts, reduce visibility, and interfere with adjustment of fire support. Dry cold conditions will cause ice fog which will reveal the locations of troops and obscure adjustment of direct fire weapons. A thorough analysis of meteorological data is necessary to permit the commander and staff to make an accurate estimate of the situation and consider all factors which will affect the plans for the attack.

Successful offensive operations in a northern environment requires well trained troops, detailed planning by the staff and the integrated effort of all units in the infantry division.

CHAPTER VI

SUMMARY AND CONCLUSIONS

SUMMARY

Northern operations encompass all of the earth's surface in the Arctic and subarctic zones. This is no small and isolated area, but it is one of significant size and strategic importance to military planners of both the allied and the Soviet bloc nations. Approximately 45 per cent of the North American Continent and 65 per cent of the USSR lie in the Arctic zone. This vast and relatively unexplored area of the world has served as a natural barrier against intrusion from the north for the nations involved during the past centuries. The advent of major technological improvements in transportation vehicles during the past two decades has lessened the significance of terrain barriers and has exposed these areas to possible invasion.

Finland and Northwest Russia are very similar in climate and topography. This area consists of numerous streams, lakes, and swamps which are surrounded by very dense forest called "taiga" or "boreal" forest. The topography varies very little, with low rolling hills and flat plains being the predominant land forms. The climate of this area is mild compared with other areas of the world on

the same latitude due to the warming influence of the Murman Coast Current. This ocean current is an extension of the Gulf Stream as it flows northward from the warm and tropical areas of the Caribbean Sea. The Murman Coast Current warms the ocean air of the North Atlantic area. This warm air is then carried southeasterly over Northern Europe and deep into the interior of Russia.

Alaska and Canada do not have the benefit of any warming influence and consequently experience much more severe winters than do the north Eurasian countries. With the exception of the major mountain chains, such as Brooks Range, Alaska Range, Rocky Mountains, and the Appalachian Range the topography and vegetation of this area is very similar to Finland and Russia. Boreal forests dominate the subarctic and southern Arctic regions and constitute serious obstacles to vehicular movement.

The area considered has included the frozen and barren tundra north of the tree line to the dense taiga and comparatively mild climates of the subarctic regions. This land of contrast, with its flat and open plains, rugged mountains, dark wintry days, and extreme temperatures offers some of the greatest challenges today to the military commander. It is an environment which will quickly sort the intelligent and resourceful from the lazy and indifferent. It is an environment that gives no quarter and is ruthless in its treatment of the uninitiated and the unprepared.

The suitability of the Arctic for military operations is dependent upon the capability of a nation to cope with the environmental factors which exist there. A nation that has prepared for these conditions will be able to wage warfare without undue interference; a nation that is unprepared to cope with these forces of nature is doomed to failure.

The ability of the soldier to protect himself from the hostile effects of this cold environment is dependent on clothing and training. With adequate clothing to insulate him from the cold and the necessary training to use it, the soldier will suffer no permanent physical affects of extreme cold. In war, however, the commander is not only concerned with the health of his command but its efficiency as well. Efficiency will be affected by extreme cold conditions due to the cumbersome clothing which must be worn by the individual and the influence of the windchill factor or cooling power of the environment. The greater the cooling power of the environment, the shorter will be the time tolerance period that the individual can remain on his job before warming is required. As the temperature is lowered and the wind is increased, the more clothing will be required to protect the individual. This increase in clothing serves to reduce efficiency by limiting manual dexterity. The combination of these environmental factors, wind and temperature, may in some cases increase the period required to accomplish a task as much as five times that

required in the temperate zone.

The commander can increase efficiency by providing shelters for certain types of tasks, such as maintenance, which can be accomplished indoors. For other tasks which cannot be accomplished indoors, the decrease in efficiency can be partially offset by beginning tasks in sufficient time so they will be completed by the time they are required.

Prolonged exposure to a cold environment can have adverse psychological effects on individuals, particularly when associated with physical fatigue. The most common of these effects are lassitude, lethargy, pessimism, and "cocoon-like existence." To overcome these, strong and positive leadership is required in the early detection of symptons and immediate corrective action must be taken.

The German and Russian Army experience provide us with two very excellent examples of large forces that attempted to fight in a northern environment without prior training and preparation. The futility of this course of action is quite obvious and lends to the conclusion that extensive training will be required to prepare an army for northern operati ns.

The minimum time that will be required to develop a reasonable state of proficiency in Arctic skills for the infantry division is nine weeks. This training should be in two phases. The first phase is of two weeks duration and is conducted at the home station to prepare the unit to meet the environment which awaits them. The second phase

is of seven weeks duration and is conducted in an arctic environment for the purpose of developing individual and unit skills. It is emphasized that this is the minimum training that is required to prepare the division to conduct sustained combat operations in the northern areas during winter months. Additional training time, if available, will be desirable and will further improve the chances of success in combat.

The support command of an infantry division conducting operations in a northern theater will require tracked vehicles to carry out its mission of combat service support. This requirement is generated due to the difficulty of cross-country movement of wheeled vehicles. Wheeled vehicles will be able to continue a limited function in northern areas where MSR's can be maintained but are useless in cross-country operations. Since tracked vehicles require increased maintenance over that received by wheeled vehicles, an augmentation of maintenance personnel will be required. The number of maintenance personnel required will be in proportion to the number of tracked vehicles which have been substituted for wheeled vehicles.

The environment of northern areas will substantially increase the logistical load of an infantry division. This increase is primarily in the field of Class III supplies, due to fuel requirements for shelters and a 25 per cent increase in fuel consumption of vehicles for Arctic operations. Increases in other classes of supplies will also be

necessary, such as in Class I where a 30 per cent increase will be required in extreme cold temperatures. Tents, stoves, special arctic clothing and equipment will increase the Class II load considerably.

Unit distribution of supplies will be favored over supply point distribution in the Arctic and will be practiced when feasible. To assist the division in the forward movement of supplies, Army supply points will be requested to make unit distribution of supplies as far forward as possible. Division will then move the supplies cross-country to the brigade trains locations. In situations where independent task forces are operating under division control, mobile direct support forces are employed. These support forces should be capable of supporting the task force for three days without resupply.

The best time to conduct offensive operations in an arctic environment is after the waterways and swamps have had time to freeze to sufficient depth to support division loads. These frozen waterways and swamps become excellent communication routes, and in certain instances, excellent avenues of approach for infantry units.

Operations in the Arctic rely heavily on adequate and timely logistical support. For this reason, communications routes become of increased importance and will often be designated as objectives for both friendly and enemy forces. Much of the fighting in Arctic areas will be directed toward the seizure and control of these routes. This type

of warfare will not have solid frontlines but instead, it will involve a series of independent task forces. This will mean that larger areas of the battlefield will not be occupied and flanks and rear areas of units will be open and subject to envelopment.

Due to the difficulty of cross-country movement, selection of routes to objectives assume greater significance. Careful terrain analysis and reconnaissance are essential to insure the selection of routes which can be traveresed by the division. Meteorological data will be influential in planning in that weather conditions dictate the type of snow, hours of daylight, combat load of the infantryman, visibility, flying conditions, and so forth.

Time is all important in planning the coordinated activities of the division. Often the operations officer must double and sometimes triple the lead time of units in performing assigned missions.

Combat support units of the infantry division must have tracked vehicles to be able to move forward at the same rate as the maneuver elements and provide the support requirea for successful operations.

The increased difficulty of cross-country movement in northern areas puts a premium on Army aviation. The versatility and flexibility of this mode of transportation will cause it to be in great demand by all units. Careful planning and the establishment of priorities by the division commander will be necessary to insure the most efficient utilization of aircraft.

CONCLUSIONS

The following conclusions are submitted regarding the environmental factors of northern areas and their effects on military operations:

1. The hostile environment of the Arctic is a dynamic and unrelenting force that will challenge the imagination, ingenuity, and physical resources of even the best trained military units that may be committed in this area of the world. This environment is ruthless and unforgiving in its treatment of the indifferent, uninitiated, or unprepared. The suitability of the Arctic for the conduct of military operations is dependent upon the capability of the committed forces to cope with the inhospitable environment that exists there. A military force that has accurately anticipated the adverse effects of the northern environment and has prepared to overcome these effects, can conduct military operations with a minimum of interference. A military force that has not prepared, or is indifferent to these forces of nature, is doomed to tragic failure and ultimate defeat. The extreme cold temperatures present the most formidable obstacle to military operations of all the environmental factors of the Arctic regions.

2. The central areas of Alaska and Canada have the most severe winter conditions of all the areas included in this study. The successful completion of a winter training program in Alaska or Canada will qualify a military unit

for deployment to a combat theater in the less severe areas such as Northern Europe and Northern Eurasia.

3. The winter season is the most favorable season for the conduct of military operations in the northern areas. Within the winter season, the period January to March offers the best possibilities for military operations because of improved trafficability of the terrain. The many streams, extensive muskeg swamps, and numerous lakes will have frozen to sufficient depth by this time of the year to support most military loads and serve as excellent communication routes and avenues of approach.

4. The human body does not possess the physical capability to acclimate to extreme cold temperatures as it does to extreme hot environments. Large amounts of protective clothing must be worn by the soldier to insulate his body from the hazards of extreme cold temperatures common in northern areas. The amount of protective clothing which the individual will require for Arctic operations is directly proportional to the windchill factor that exists at a particular time. Only that amount of clothing actually required should be worn in order to avoid overheating.

5. The large amounts of cumbersome clothing required for protection in the Arctic results in a loss of efficiency of the individual soldier due to a decrease in manual dexterity. The awkwardness of movement imposed by the successive layers of clothing will not only require more energy

than the same movements in the temperate zone, but will also result in a much longer time period for job accomplishment. Commanders must be aware of this decrease in efficiency and schedule task assignments accordingly. Work efficiency can be increased by providing protective shelters for those tasks, such as vehicle maintenance, which can be accomplished indoors. For tasks which cannot be accomplished indoors, such as bridge construction, longer time periods for completion must be scheduled.

6. Military operations in the Arctic require the ultimate in physical conditioning of the participating troops. The difficulty of cross-country movement in deep snow, the heavy individual loads, and the awkwardness of movement while wearing arctic clothing will rapidly dissipate the strength of the soldier. A high state of physical conditioning is mandatory in creating the endurance and stamina required in overcoming these barriers to movement.

7. A minimum of nine weeks of intensive preparatory training are required to ready an infantry division for deployment to a combat theater in the northern areas. Approximately two weeks of this period are spent conducting indoctrination training at the home station before moving to an arctic training site. The indoctrination training is designed to provide the individual soldier with the necessary knowledge to work and survive in an arctic environment and to dispel any fears which may exist concerning the hazards of cold areas. The remaining seven weeks are spent in a

northern training area and are organized to develop individual and unit skills required for the conduct of military operations under cold weather conditions. It is emphasized that the nine-week training program is the minimum training requirement. Additional experience will be required for the division to eventually develop a high state of combat readiness.

8. The tragic experience of the Russian Army in 1939 and the German Army in 1941 vividly demonstrate the requirement for extensive training and preparation of forces prior to the deployment to a northern area. The successful operations of the Finnish Army during the period 1939-1944 serve to illustrate the feasibility of military operations in an arctic environment when the units are properly trained, equipped, and highly motivated.

9. The wheeled vehicle does not possess a satisfactory cross-country capability in the snow covered terrain of the Arctic. Wheeled vehicles are capable of operating only on roadways which have been cleared of deep snow and that receive regular engineer maintenance. Since few roads exist i· the Arctic, wheeled vehicles will be practically useless in areas forward of the brigade trains area. Consequently, tracked vehicles must be substituted for wheeled vehicles that are expected to operate forward of the division support area. (Tracked vehicles as referred to above do not imply an armored vehicle, but instead refer to a lightweight cargo vehicle which is currently under

development in Alaska and Canada).

10. The widely separated and poor communications systems, the difficulty of cross-country movement, and the increase in amounts and types of supplies required in northern areas tend to intensify and complicate logistical problems associated with arctic operations. The widely separated and poor communications facilities cause extensive engineer effort to be directed toward building and maintaining supply routes. The development of adequate roadways forward of the division support area will often not be feasible and cannot be completed in time to be of value to an advancing infantry division. The remaining alternative is for the support command to deliver supplies to brigade by using cross-country routes. Since wheeled vehicles are valueless in cross-country operations in the northern areas, tracked vehicles will be required as a substitute in order that the mission can be accomplished. The increase in the number and type of tracked vehicles in the infantry division will create additional problems in the fields of maintenance, fuel resupply, and operating level of supply parts. The requirement for special items of equipment needed in northern areas, such as tents, stoves, skis, snowshoes, and protective clothing, will materially increase the logistical load of the division. An increase of approximately 30 per cent in Class I supplies will be required by the troops operating in a northern environment. The number and type of vehicles which must be added to the division to support

these loads cannot be determined until such time as accurate replacement and consumption factors have been computed based on experience factors.

11. When practical, unit distribution of supplies will be preferred over supply point distribution during operations in the North. The unit distribution methods of distributing supplies to brigade trains will lighten the brigade and battalion commanders' requirement for transportation and will permit them to concentrate more on the combat mission. When possible, higher echelon supporting units will be requested to deliver supplies directly to brigade trains areas, thereby bypassing the division support area and consequently reducing the workload of the division. Requests of this nature will be especially applicable during the aerial delivery of supplies.

12. The employment of independent task forces of battalion and brigade size will be common in northern operations. These task forces should be self-supporting and as a minimum should contain maintenance elements, a supply section, a medical unit, and a control headquarters from the support command. The support command commander and units should be prepared to fragment the support command on short notice to support these independent operations.

13. Offensive military operations in northern warfare will not have extended, solid frontlines, but instead will consist of independent task forces of battalion, brigade and in some instances, division size. Increased

logistical requirements for support of northern operations and the lack of adequate communications facilities cause the existing roads and railroads in Arctic areas to assume greater tactical significance than would be the case in temperate zone operations. Major battles will be fought in northern areas for the purpose of seizing and controling existing communications facilities or key terrain features which dominate and control these facilities.

14. The considerations for tailoring of independent task forces for northern operations will be no different than those considerations for operations in the temperate zone. The force must possess the combat power, combat support, and combat service support activities and security units to accomplish the mission. These operations will be characterized by centralized control at division level and decentralized execution at brigade or battalion level. The tactical principles which govern the employment of independent task forces in the Arctic will be the same as for the temperate zone, except the techniques used in accomplishing the mission will be different as discussed in the following conclusions.

15. The difficulty of cross-country movement will be of vital concern to the commander. The slow movement of troops, the difficulty of displacing crew-served weapons and ammunition on sleds, the fatiguing effect of long marches on troops, and the slow movement of reserve forces when needed will influence the commander's decision in the

selection of objectives and the use of avenues of approach. The distance to objectives should be as short as is tactically possible in order to reduce the number of displacements necessary for supporting weapons. The distance involved should be within the unit's capability of seizing and occupying it before nightfall. This will permit the unit to consolidate the position, establish security, move reserves into position, and locate the combat support and combat service support units during daylight hours. Shelters for troops should be pitched during daylight whenever possible.

16. Current and accurate meteorological data is essential for successful operations in northern regions. Temperature, wind, and precipitation will influence the commander's decision and concept of operations. The temperature will dictate the combat load of the rifleman, establish the condition of the snow which affects the rate of movement of the attacking echelons and determine ice fog conditions. The wind may influence visibility by blowing snow and obscuring targets, affecting aircraft operations, creating drifts, and covering broken trails. Precipitation in the f rm of snow will affect operations by reducing visibility and causing control to be more difficult, it may ground aircraft which were planned for use, it will obscure targets and cause adjustment of observed fires to be more difficult and maybe impossible. The combination of all of these factors and their interrelation must be considered when planning offensive operations.

17. Helicopter operations will be an important aspect of northern operations. The helicopters have the capability of overcoming the difficulties of cross-country mobility. Helicopters may be used for the rapid movement of reserves to critical areas, security of flanks during the approach march, movement of troops to objectives behind enemy lines, resupplying critical items, etc. The employment and use of helicopters to support combat operations in the Arctic are the same as for temperate zone operations.

18. The tactical principles of mass, security, surprise, maneuver, simplicity, unity of command, and economy of force will be as equally important to northern operations as they are to other types of military operations. The techniques through which these principles will be applied to military operations will be different from temperate zone operations in the manner as discussed earlier in this paper.

19. The ROAD infantry division, as currently equipped for operations in a temperate environment, does not have the capability to conduct offensive operations in northern regions during the winter season. Equipment lists must be modified to reflect substitution of tracked vehicles for wheeled vehicles which are expected to operate in the forward combat areas where few roads exist. Additional changes in the equipment lists are necessary to provide the division with the special items of cold weather equipment to cope with the severe and hostile environment of northern regions.

APPENDIX I

MINIMUM TRAINING REQUIREMENTS FOR WINTER OPERATIONS

PHASE I

I. Indoctrination training conducted at home station. Indoctrination training for all arms. (Minimum of two weeks of training).

A. Living in the field. (16 hours)

1. Living in cold climate - utilizing the help offered by nature.
2. Demonstration of field cooking, rations, protecting water from freezing.
3. Survival training.
4. Camp routine and organization of work teams, field expedients.
5. Camp security.

B. Clothing. (4 hours)

1. Principles of cold weather clothing, fitting and adjustment.
2. Supply economy during arctic operations.

C. First aid and hygiene.

1. Discussion of first aid, hygiene and medical evaluation in cold weather operations

2. Prevention of cold weather injuries.

D. Equipment. (24 hours)

1. Care of weapons in the Arctic, malfunctions and corrective action.
2. Fitting and adjustment of skis, binding, and poles.
3. Skiing on straw.
4. Skiing on snow (if available).
5. Fitting and adjustment and emergency repairs of snowshoes.
6. Practical work in snowshoeing.
7. Packing, adjustment, and carrying of rucksack.
8. Pitching and striking of tent, arctic 10-man.
9. Use and operation of stoves, arctic and gasoline lanterns.
10. Loading and lashing of sleds.
11. Camouflage of weapons, positions, and vehicles.
12. Winter marches, security, and trail-breaking.

E. Tactics. (8 hours)

1. Peculiarities of winter warfare.
2. Field fortifications and obstacles.
3. Land navigation procedures for arctic operations (dead reckoning).

4. Trailbreaking and security of tactical marches.
5. Individual combat techniques on snow-covered terrain.

F. Physical training. (1 hour daily)
Emphasis on leg muscles and weight-carrying ability.

II. Specialist training conducted at home station.

A. Vehicle operators. (35 hours)

1. Introduction and orientation of winter operation of wheel and track vehicles.
2. Before, during, and after operation maintenance services.
3. Cold weather starting by use of slave kit and warm-up periods.
4. Types of lubrication, amounts, and importance.
5. Effects of cold weather on batteries, tires, and rubber parts.
6. Effects of cold weather on brakes, axles, transmissions, and steering mechanisms.
7. Winter driving problems and methods of overcoming them.
8. Convoy control on icy roads.
9. Methods of performing maintenance in extreme cold.

10. Common malfunctions and failures due to cold weather.

11. Winterization of vehicles.

B. Vehicle mechanics. All of the above subjects included. (35 hours)

1. Special tents, heaters, and equipment used to perform maintenance.

2. Outdoor maintenance techniques in extreme cold.

3. Orientation on maintenance of special vehicles (if available).

C. Artillery. (35 hours)

1. Effects of cold on artillery mechanisms - warm-up procedures.

2. Lubricants - types and uses.

3. Maintenance procedures of artillery weapons, care and cleaning.

4. Problems peculiar to artillery weapons and corrective measures.

5. Effects of cold on trajectory, accuracy, and effects of artillery rounds.

6. Effects of cold on optical equipment, proper handling, and storage.

7. Magnetic variations in northern latitudes.

D. Signal. (35 hours)

1. Effects of extreme cold on electrical components, handling, storage, and care of signal equipment.
2. Effects of cold on radio batteries and methods to overcome them.
3. Effects of aurora borealis and other atmospheric disturbances on radio transmissions.
4. Warm-up procedures for electrical components exposed to extreme cold.
5. Special techniques for handling tactical wire at extreme temperatures.
6. Care, handling, and maintenance of telephone equipment.
7. Trouble shooting of communications failures and corrective action.

E. Engineers. (35 hours)

1. Road construction and maintenance.
2. Construction of ice roads.
3. Field fortification and construction of obstacles and ice minefields.
4. Effects of demolitions in snow and frozen terrain.
5. Operation of water points in extreme cold.
6. Photointerpretation, mapping, and charting problems.

7. Computation of ice thickness and load-bearing capabilities.
8. Use of special equipment designed for arctic operations.

F. Medical. (35 hours)

1. First aid and evacuation of wounded in extreme cold using sleds, vehicles, and aircraft.
2. Shelter construction for aid stations and operation of heating and lighting equipment.
3. Prevention of frostbite.
4. Detection and treatment of cold weather injuries.

APPENDIX II

MINIMUM TRAINING REQUIREMENTS FOR WINTER OPERATIONS

PHASE II

I. Training conducted at arctic training site.

Maneuver battalions. (Minimum of six weeks of training).

A. Living in the field. (16 hours)

1. Practical forrestry.
   a) Handling and caring for tools.
   b) Cutting and trimming trees.
   c) Temporary shelters.
   d) Types of camp fires and safety precautions.
2. Camp routine - selection of sites, security, organization of work teams, camouflage, cooking, and conservation of supplies.
3. Operation of solid and liquid fuel heaters, safety precautions, care and cleaning.
4. Sanitation procedures, problems and methods of overcoming them.
5. Construction of emergency shelters and their use.

6. Use of the arctic sleeping bag, its capabilities and limitations, care, and repairs.
7. Methods of obtaining water, storage, and safety precautions in its use.
8. Demonstration of sounds and light under arctic conditions and their importance to security.

B. Clothing. (2 hours)

1. Practical application of the use and adjustment of clothing under arctic conditions.
2. Importance of cleaning, care, and drying of clothing.

C. First aid and hygiene. (4 hours)

1. Review of first aid measures to prevent frostbite, trench foot, carbon monoxide poisoning, and snow blindness.
2. Practical work in evacuation of casualties by use of sleds, ski litters, tracked vehicles, and aircraft. Proper handling and care of casualties while enroute in extreme cold.
3. Necessity of personal hygiene under arctic conditions and methods to accomplish it.

D. Equipment. (16 hours)

1. Fitting and adjustment of skis and snowshoes

2. Pitching and striking of arctic 10-man tent in snow.
3. Loading and lashing of tents and stoves on sleds and pulling procedures while on skis and snowshoes.
4. Loading and lashing of weapons and ammunition on sleds.

E. Camouflage. (4 hours)
1. Methods of individual camouflage, weapons, and positions.
2. Methods of group camouflage, crew-served weapons, tents, vehicles, aircraft, and covering of trails of vehicles and ski columns.
3. Effects of ice fog and methods to reduce its effects.

F. Weapons firing. (40 hours)
1. Individual qualifications and field firing.
2. Crew-served weapons firing.
3. Effects of cold on weapons before, during, and after firing and methods to reduce its effects.
4. Effects of ice fog created by weapons firing.

G. Construction of obstacles in extreme cold. (4 hours)

Use of road blocks, concertina wire, and mines.

H. Skiing and snowshoeing. (50 hours)

These subjects are integrated into all training including movement of troops outdoors. Infantry troops, artillery forward observers, etc., should concentrate on the use of skis while other personnel practice in the use of snowshoes.

I. Physical training. (1 hour daily)

Maximum emphasis on physical conditioning is continued throughout the training period.

II. Combat unit training conducted at arctic training site.

A. Small unit training. (44 hours)

1. Winter marches and security.
2. Trailbreaking and track discipline.
3. Navigation using dead reckoning procedures.
4. Firing positions in winter.
5. Combat techniques in snow - use of skis and snowshoes to support weapons during firing.
6. Patroling - daytime and night, selection of routes, ambush procedures, land navigation.
7. Squad as an outpost, as flank protection, or as line filler in gaps.
8. Squad in attack - control measures and fire control.

9. Squad in defense.
10. Platoon as advance guard and trail-breaking party.
11. Platoon infiltration of enemy lines and attack of key installations and exfiltration.
12. Platoon in attack in woods.

B. Unit training. (44 hours)

1. Company in bivouac - security in bivouac of a separate company.
2. Peculiarities of attack in winter conditions - mobility, control, route security, resupply and evacuation of casualties.
3. Envelopment tactics to cut enemy lines of communications and routes of withdrawal and resupply.
4. Company as advance guard for the battalion.
5. Use of tanks in the arctic environment.
6. Infantry and tank team in the attack.
7. Company as a raiding party. Use of helicopters.
8. Company in the night attack.
9. Two-day company FTX.
10. Conduct of company test.

C. Battalion problems. (44 hours)

1. Battalion in attack with exposed flank.

2. Battalion in perimeter defense.

3. Independent battalion attack.

4. Conduct of battalion tests.

III. Specialist training conducted at arctic training site. Review as required the preliminary training conducted at home station. In addition, the following training is considered the minimum requirements:

A. Vehicle operators. (6 weeks)

1. Conduct of driver training under arctic conditions of those vehicles to be used by the unit.

2. On-the-job training in maintenance procedures, lubricants, and trouble shooting in correcting malfunctions.

3. Cross-country driving.

4. Harmful affects of engine idling and dangers of carbon monoxide poisoning.

5. Engine and power train warm-up procedures, frequency required, depending on climatic conditions.

6. Towing of sleds and disabled vehicles.

7. Practical work in driving under arctic conditions.

B. Mechanics. All of the above subjects included. (6 weeks)

1. Pitching maintenance tents and operation of tent heaters.

2. Special problems associated with gasoline-engine-powered equipment to include electric generators and air compressors.
3. Maintenance and repair of special arctic vehicles assigned to the unit.
4. Hazards of outdoor maintenance in extreme cold.
5. Practical application through normal support of division units.

C. Artillery. (6 weeks)

1. Field service firing to include forward observer training.
2. Practical work in overcoming effects of extreme cold or recoil mechanisms, hydraulic jacks, optical equipment, and lubricants.
3. Camouflage and concealment of positions.
4. Importance of accurate meteorological data in computing firing data.
5. Storage and care of ammunition in extreme cold.
6. Practical work in support of maneuver units.

D. Signal. (6 weeks)

1. Review of subjects taught at home station as required.
2. Practical application in operation of signal equipment under extreme cold conditio

3. Direct support of division units.

E. Engineers. (6 weeks)

1. Practical application in road construction and maintenance.
2. Practical application in construction of ice roads.
3. On-the-job training in techniques of operation of water points to prevent components from freezing.
4. Field training in use of demolitions.
5. Use of ice augers, manual and powered.
6. Construction of field fortifications in frozen terrain.
7. Mapping techniques in arctic environment.
8. Airfield construction techniques.
9. Use of ice mines and construction of minefields.
10. Practical work in support of division units.

F. Medical. (6 weeks)

Practical application through on-the-job training of subjects taught at home station.

G. Aviation. (6 weeks)

1. Effects of whiteout on navigation and flight attitude.
2. Use of skis on fixed-wing aircraft.
3. Effects of dry snow on helicopter landing and take off.

4. Aerial resupply procedures.
5. Maintenance problems in extreme cold and methods of overcoming them.
6. Practical application in flying under a variety of climatic conditions and support of division units.

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