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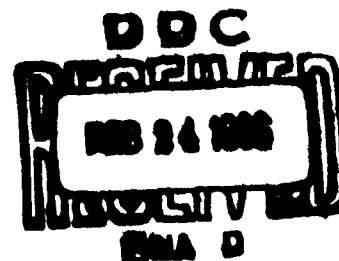
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**The George Washington University
HUMAN RESOURCES RESEARCH OFFICE
operating under contract with
THE DEPARTMENT OF THE ARMY**



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① Research Memorandum

⑥ A SURVEY OF HUMAN FACTORS IN MILITARY PERFORMANCE
IN EXTREME COLD WEATHER.

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Chapter 1

INTRODUCTION

BACKGROUND

The importance of American military effectiveness in extreme cold weather has increased in recent years, as tactical concepts have been modified to keep pace with changes in world geopolitical conditions.

Arctic and polar regions lie athwart possible routes of air attack on our country, and early warning sites and air defense units have been established across Alaska, Canada, and Greenland. It is imperative for the nation's safety that these defensive outposts function efficiently.

Nor is defensive effectiveness in itself enough. The Army must also be capable of mounting effective attack under conditions of extreme cold weather. Our arctic defensive outposts are attractive enemy objectives, since an air attack on the continental United States would be more likely to succeed if the early warning sites and air defense batteries along the route of attack were inoperative. If these outposts should fall to the enemy, the Army would be expected to retake them rapidly. Furthermore, circumstances might make it necessary to undertake other winter operations under cold weather conditions more severe than those normally experienced in the United States.

Military performance in extreme cold weather has special importance because of the difficulties of operating in this environment. Mobility through snow requires great effort and endurance on the part of men and equipment. In the arctic the lack of local resources makes freezing and starving ever-present threats, and accurate logistic support is essential.

Failure to deliver fuel and food to men on maneuver might mean disaster even when no enemy is present, for in the arctic winter the elements themselves constitute an enemy which must be defeated by a military unit. Cold weather operations can test the mettle of men and their leaders in a way unmatched by any other peacetime military activity.

Not enough systematic knowledge is available to the U.S. Army about the effects of arctic and subarctic conditions on specific military skills and unit capabilities, and on the human factors contributing to them. Likewise, more information is needed about ways of training troops that would help to overcome the detrimental effects of prolonged and extreme cold weather.

PURPOSE OF SURVEY

This exploratory survey of human factors in military performance in extreme cold weather was undertaken at the request of the Chief of Research and Development, Department of the Army. Its purpose was to suggest possible programs of human resources research in the Far North in response to Army needs.

To accomplish this purpose, three subordinate goals were pursued. The first was to review the systematic knowledge about human factors in extreme cold weather available to the Army at present and to become familiar with the research programs of military agencies that are likely to produce appropriate knowledge in the near future. The second was to assess the problems faced by the men who carry on military operations in the Far North, in order to identify those problems which human factors research might help to solve. The third was to investigate the

potentialities of using the arctic and subarctic as a field laboratory in which to attack problems of leadership, morale, and motivation which are faced by the Army as a whole.

APPROACH TO THE SURVEY AND PLAN OF THE REPORT

The survey, which was conducted during 1958, included a review of appropriate military and scientific literature, interviews with experts on arctic problems, visits to operating units and test sites in the Far North, and interviews with officers and men with operational experience there.

The results of the literature review are reported in Chapter 2. Agencies responsible for the works of greatest interest were visited, and the authors of many of the publications were interviewed in order to learn of their plans for future research and to elicit advice as to research needs. Among the agencies visited were the U.S. Army Quartermaster Research and Engineering Center; the Office of Naval Research; the U.S. Air Force Arctic Aeromedical Laboratory; the Canadian Defence Research Board; and Combat Developments, U.S. Army, Alaska. Among the authors of significant recent works who were interviewed were E.P. Torrance, E.R. Dusek, Bernard J. Fine, and John M. McGinnis.

Since much of the available knowledge of human factors in the Far North is unwritten, a number of men with wide experience in the region were interviewed in order to learn their suggestions for research. Among those interviewed were Dr. Paul Siple, Scientific Adviser to the Chief of Research and Development, Department of the Army; Mr. Joseph T. Flakne, Director of Programming, Arctic Institute of North America;

Commodore O.C.S. Robertson, Naval Member, Canadian Joint Chiefs of Staff;
and Sir Hubert Wilkins, Environmental Specialist with the U.S. Army
Quartermaster Research and Engineering Command.

In order to observe far-northern facilities and to interview troops
who had had recent cold weather operational experience, visits were made
to military installations in northern Greenland, northern Canada, and
Alaska. More than 500 officers and men were interviewed during the visits
which took place during the summer of 1958. Nearly all of those inter-
viewed had spent at least one winter in the Far North. Among the units
represented were:

Greenland.

7th Artillery Group (Air Defense)
549th Artillery AAA Battalion
U.S. Army Engineer Research and Development Detachment
U.S. Army Polar Research and Development Center
U.S. Army Transportation Arctic Group
U.S. Army Signal Research Unit

Fort Churchill, Manitoba, Canada.

U.S. Army 1st Arctic Test Center
U.S. Army Ordnance Element, IGY Rocket Project

Fort Richardson, Alaska.

U.S. Army, Alaska Command
40th Armor Regiment
37th Artillery Regiment
96th Army Antiaircraft Battalion
23d Infantry Regiment

Ladd Air Force Base, Alaska.

U.S. Army, Alaska, Yukon Command

40th Armor Regiment

510th Artillery Detachment AAA

9th Infantry Regiment

Elson Air Force Base, Alaska.

502d AAA Artillery Battalion

9th Infantry Regiment

Fort Greely, Alaska.

U.S. Army Arctic Test Board

U.S. Army Garrison

U.S. Army Cold Weather and Mountain School

The interviews indicated that the problems of maneuvering elements in cold weather exercises differ considerably from those of passive defenders. These subjects are, therefore, treated separately in this report in Chapters 3 and 4 respectively.

In Chapter 5, the arctic as a field laboratory for the study of problems of the Army as a whole is discussed, and stations at which various types of research can best be carried out are described. Some possible research programs for the Human Resources Research Office are presented in Chapter 6.

Chapter 2

REVIEW OF THE LITERATURE

The available literature on the arctic is vast and unsystematic. The Arctic Bibliography, prepared by the Arctic Institute of North America for the Department of Defense,^{1/} contains some 43,640 references! The variety of scientific interest in the Far North is impressive, and so is the lack of coordination of effort in the area. Most of the material is in the physical and biological sciences, although there are numerous anecdotal and ethnological accounts. The latter are of interest to the sociologist and psychologist, but unfortunately they are not very useful to the student of human factors in military operations. A number of specialized bibliographies have been developed by military agencies.^{2/}

The material of greatest interest to military men has been brought together in field manuals and course materials developed for training and guidance of men in the field.^{3/} In addition, each of the Technical Services of the Army has been pursuing active research and development programs designed for greater combat effectiveness in extreme cold weather. Human factors research has lagged behind technical development except in the areas of medical-biological research and studies directed toward the design of protective clothing.

^{1/}Reference 4.

^{2/}References 3, 26, 29, 112, 115, 116, 117, 120, 124.

^{3/}References 11, 17, 18, 19, 20, 110, 111, 119.

The medical and biological research has primarily related to the prevention and treatment of various kinds of cold injury, especially frostbite and hypothermia. This work is of great importance because both in World War II and in the Korean conflict cold injuries were a significant part of the casualties suffered by the U.S. Army. Such research has been carried out by the U.S. Army Medical Research Laboratory at Fort Knox, Ky., the Quartermaster Research and Engineering Center at Natick, Mass., and the Arctic Aeromedical Laboratory of the U.S. Air Force at Ladd Air Force Base, Alaska.^{4/}

Quite a bit of work has been done on the effects of cold on motor response and perception. Manual dexterity is evidently degraded by both general and localized cooling of the body, and reaction time also seems to be slower under cold stress. There is evidence that both visual and aural acuity are affected adversely by large bodies of ice and snow, because of differential reflection patterns to which a man must adjust before he can localize sight and sound cues accurately.^{5/}

Considerable medical interest has developed as to the possibility of human beings becoming physiologically acclimated to cold weather after a period of exposure to it.^{6/} Most of the evidence seems to be equivocal. While it is true that men are more prone to suffer cold injury in the first few days of exposure to extreme cold weather, and express greater discomfort from cold early in their experience rather than later, it may be that they simply learn techniques for protecting themselves and become

^{4/}References 6, 14, 15, 67, 82, 88, 121.

^{5/}References 33, 41, 42, 80, 86, 87, 89.

^{6/}References 7, 10, 38, 48, 66, 85.

psychologically accustomed to cold. Nevertheless, recent reports from the Army Medical Research Laboratory indicate that men shiver less as they spend more and more time under controlled cold conditions, and it is hypothesized that a change in the heat production mechanisms within the body occurs under continued exposure to the cold.

As a part of the development of cold weather protective equipment and the generation of doctrine concerning its distribution, the Quartermaster has undertaken a number of climatological studies. They include a series of handbooks of the climatology of various cold weather stations manned by Army personnel throughout the Far North.^{7/}

A few studies have been carried on by the Personnel Research Branch of the Adjutant General's Office toward the development of procedures for selection of Army personnel for arctic duty.^{8/} The emphasis has been on stamina, good physical condition, and lack of prior history of cold injury. Psychological factors that seem to be important are stability, maturity, and masculinity.

There have also been a few studies directly concerned with morale, motivation, and leadership. Five of them were carried out at the Arctic Aeromedical Laboratory and are the results of a large-scale survey of human adjustment problems in the northern latitudes.^{9/} Many Air Force personnel assigned to various stations in the Alaskan Command were interviewed or required to fill out an extensive questionnaire concerning factors that might contribute to their morale. In general,

^{7/}References 2, 30, 31, 39.

^{8/}References 21, 22, 78, 79, 84.

^{9/}References 61, 63, 64, 70, 74.

the studies revealed that most of the maladjustment to life in Alaska was related to dissatisfaction with the manner in which certain services were provided for the men and their families; men complained, for instance, of the lack of interesting things to do, inadequate social outlets, and lack of faith in the Air Force system of military law. On the other hand, men who liked Alaska stated they enjoyed their jobs, liked their living conditions, looked forward to the opportunities for promotion available to them in Alaska, and so on. Unfortunately, the responses were not compared with responses to similar questions by men stationed within the continental limits of the United States. There was, therefore, no evidence that the factors contributing to high or low morale in Alaska were any different from the factors that contribute to morale elsewhere in the world.

The Defence Research Board of Canada has issued two reports in the human factors area, but they were not based upon experimentation or systematic survey.^{10/} Included were discussions about the effects of fear of the cold and of bulky equipment on military performance. The reports stressed the necessity for training in techniques of survival in the Far North and the importance of effective leadership.

Under U.S. Naval auspices studies of adjustment, clique formation, and personality breakdown in the antarctic were under way. No publications had resulted from them at the time of the literature review.

The Navy has published an extensive survey of human research needs in support of arctic operations.^{11/} This document emphasizes the

^{10/}References 12, 16.

^{11/}Reference 71.

need for selection research and for the development of administrative and leadership techniques to compensate for degradation of performance due to the stress of cold and wind, and the encumbrance of protective clothing.

Headquarters, U.S. Army, Alaska, has also assessed its human research needs.^{12/} It reviewed and analyzed available data on the effects of the northern environment on morale, leadership, efficiency, and physical conditioning, and prepared a detailed listing, in order of priority, of areas that require research, study, or development. Morale and leadership were identified as the areas in which the least systematic data are available. It was concluded that there is a need for (1) research to determine the specific qualities of leadership and morale that require emphasis under conditions of cold stress; (2) development of a program of physical conditioning designed for operations in a cold environment; (3) further studies of acclimatization and its possible advantages; (4) a means of selecting personnel for assignment under field conditions to a cold environment.

Not specifically related to the Far North, but of value to the study of leadership, morale, motivation, and training is a series of reports of research with aircrews in survival situations by the Human Factors Operations Research Laboratories of the U.S. Air Force.^{13/} The research was related to training aircrews to work their way back to friendly territory when they have been shot down in a hostile environment, and a group of excellent instructional pamphlets resulted. Of greater

^{12/}Reference 107.

^{13/}References 83, 90, 91, 92, 93, 94, 96, 99, 101, 103, 105, 106.

interest, however, were the methodology and the hypotheses developed about group performance in crisis. The research contains suggestive material about individual and group responses as they affect the ability to adapt to demands of a hostile environment, and about the effects of such factors as ideology, perception of group functioning, a trained cadre, sociometric variables, attitudes, and attitudinal changes during survival experiences. Of particular interest is a series of hypotheses developed after observation of a number of survival training groups caught out in a major blizzard. These will be discussed in Chapter 5 of this report.

In summary, scientific studies of human beings in the Far North have been primarily concerned with physiological and medical factors, and with the design of protective clothing and gear. Existing studies of morale, motivation, leadership, and training present more questions than answers. There seems to be consensus that adequate training, good leadership, and the ability to adjust to adverse conditions are of extreme importance in the Far North. The ways in which they are important, the factors that play a part, and the techniques for developing good leadership, high morale, and adequate training are, for the most part, unknown.

Chapter 3

HUMAN PROBLEMS OF MANEUVERING ELEMENTS IN THE FAR NORTH

Reports of maneuvers and exercises held in the Far North by U.S. Army units^{1/} and interviews with officers and men who have carried out cold weather operations have indicated that in many ways American troops might be better prepared for winter warfare.

Techniques for administration, operations, and personal survival in extreme cold weather are known. To people trained and experienced in the ways of the Far North, effective military maneuvers do not seem at all impossible--in fact, units stationed there for several years become expert at winter operations. The question arises, then, why the efforts of units new to cold weather are frequently unsatisfactory. One answer to that question probably lies in the Army's training programs.

After a year or two of service in the northern latitudes, military units solve the problems of winter maneuver in competent fashion. The men never find the environment very comfortable, but they learn to cope with its hardships. A significant proportion of them grow to love the Far North, and throughout the Army there are officers and men who repeatedly volunteer to return. The difficulties of northern winters can be overcome, and experience teaches the knowledges, skills, and attitudes necessary to do it.

On the other hand, maneuver reports and interviews indicate that Army efforts to train men for arctic duty, in a short time have not been successful. CONUS units sent to the Far North usually meet almost

^{1/}References 13, 37, 108, 113.

crippling difficulties. In fact, some observers hold that effective rapid training for winter warfare is impossible. Sir Hubert Wilkins, in a personal interview with the author, suggested the creation of an Arctic Corps; he feels that it takes years of experience to become an effective soldier in the Far North. Creation of such a corps would, however, be contrary to present policy. The Army needs to be able to train troops, quickly, in the diversified skills which would permit sending the men wherever they may be required. An important need therefore exists for effective training for army operations in extreme cold weather.

The Army has a fund of appropriate knowledge for this purpose, published in field manuals, training manuals, and school courses. The Basic Cold Weather Manual^{2/} and Northern Operations^{3/} are the primary field manuals, revised in 1959 by the U.S. Army, Alaska. The principles of utilization of cold weather clothing and sleeping equipment are also presented in a manual.^{4/} The content of a former manual on skiing and snowshoeing^{5/} has been incorporated in one of the revised basic manuals. Finally, the U.S. Army Cold Weather and Mountain School at Fort Greely, Alaska, conducts a winter course^{6/} which surveys the whole field. These sources present a vast amount of information, possibly more than the soldier can assimilate within a reasonable time.

^{2/}Reference 20.
^{3/}Reference 19.
^{4/}Reference 18.
^{5/}Reference 17.
^{6/}Reference 111.

What is important for the trainee to learn must be decided before effective training can be accomplished. Therefore, a primary need is to assess the skills, the knowledges, and the attitudes essential to effective cold weather warfare.

This is not as easy as it may sound for, unlike the sailor and the airman, the infantry soldier is not usually a specialist. He is not part of a single-purpose man-machine system, with functions easy to assess. Rather, he has to face crisis after crisis created by his physical environment and his enemy. Crises being difficult to predict, the infantryman's training needs cannot be determined simply by analyzing his job description. In part, however, determination of the most essential skills, attitudes, and knowledges must be based upon an analysis of tactical doctrine. Therefore, the consideration of cold weather tactics is an initial step toward the design of adequate training.

Nevertheless, much of what the soldier in the Far North needs to know, feel, and do is independent of tactical doctrine and is intrinsic to the environment in which he must live. Officers and men with cold weather operational experience were asked what they considered the most important things to teach a man soon to be sent to the arctic. The answers were many and varied, but the need to know how to use protective clothing was mentioned most frequently. In this connection, note may be made of a 1956 study by Arthur J. Riopelle,^{7/} which indicates that in two southern basic training centers the indoctrination relating to cold weather living and the use of quartermaster clothing and equipment

^{7/}Reference 72.

was very inadequate. Riopelle found that the man came away from training with misinformation, and without enough appropriate knowledge. However, the subjects of the study had little expectation of a cold weather assignment; the findings might not hold for men trained with an expectation of being sent to the Far North.

Also frequently mentioned as essential skills were skiing and snowshoeing; assembling, lighting, and caring for an arctic stove; guarding against frostbite; and land navigation.

Another matter frequently remarked on was the need to dispel fear of the cold. It was said that the word "arctic" often carries unfortunate connotations and produces irrational fears. Frequently these fears were attributed to such causes as the writings of Jack London and tales of explorers who, it was felt, exaggerate the dangers of the North. It is interesting to note that most of those holding this belief were officers, who are, perhaps, more likely to have read such works than are most of the men under them. Paradoxically, some junior officers who had spent two winters in Alaska expressed grave apprehension of the operations to come during the third winter they were about to face.

Evidently there is need for greater understanding of the part fear and anxiety play in conditioning the behavior of men on maneuver in the Far North. Lt. Col. Timmerman of the U.S. Army Medical Corps hypothesizes that military performance in a temperate climate would be degraded just by telling men they were going on an arctic maneuver. Dr. David Bass of the U.S. Army Quartermaster Research and Engineering Center suggests that fear and anxiety hasten the rate of cooling of hands and feet

because of vascular constriction associated with these emotions. Certainly fears and anxieties affect learning, decision making, and perception in one way or another, although not necessarily by degrading them. It would appear, then, that research which attempts to assess the nature, degree, and effects of fear of the arctic among American troops might contribute to better training and better leadership in the Far North.

Finally, throughout discussions of cold weather operations in the field, there recurred stories of failures to deal adequately with crises. Storms, whiteouts, supply deficiencies, and navigational errors all demand exceptional responses by the men involved. Tales were told of men who fought with one another when they should have been bending all their efforts toward raising a tent which would protect them from the bitter wind; of men who, having lost their way, left their vehicles and their protective equipment behind and wandered aimlessly through the arctic night; and of an occasion when an amphibious personnel carrier had foundered in a rushing stream and its men were calling for help while a whole platoon stood by helplessly, even though both the time and the equipment necessary for rescue were available.

While the data do not indicate how often such failures occur, they do indicate a need. An army, after all, exists to cope with crisis. Quick, correct decisions, effective coordination, and supreme physical effort are demanded of units engaged in battle, or faced with emergencies in the field. Crisis tests the mettle of men and the effectiveness of leaders. The Far North is productive of crises, and there is a need for preparing men to meet them.

In summary then, a major reason for inadequate military performance in extreme cold weather is probably inadequate training for cold weather operations. The knowledges, skills, and attitudes necessary to troops in extreme cold weather operations should be determined. Some of the content of training will be dictated by tactical doctrines, and some will be specific to the far-northern environments.

There is need for effective training in the use of protective clothing and equipment, in skiing and snowshoeing, in land navigation, and in protection against cold injury. There is need for research designed to assess the nature, degree, and effects of fear of the arctic among American troops. Finally, there is need to train groups of men to react successfully to crises, since crisis is the constant companion of men in winter warfare.

Chapter 4

HUMAN PROBLEMS OF PASSIVE DEFENDERS IN THE FAR NORTH

As the arctic and polar regions have grown in strategic importance in the defense of the United States, the number of manned military outposts in the Far North has grown accordingly. Many of those manned by the Army are air defense units which are placed to protect other important military installations. These play an essential role in the defense of our northern frontiers and any survey of human factors in operations in far-northern areas must include them.

Accordingly, officers and men were interviewed at antiaircraft artillery (pre-Nike) sites in Greenland and Alaska. Almost every one of the men expressed bitter discontent. Some even went so far as openly to criticize their officers to the interviewer when the officers were present. The men told of harassment, boredom, lack of recreational facilities, overwork, worries about family, crowded living conditions, dull food, and so on in an unending list of woes, real or imagined. Evidence of pride of unit was rare even on the part of officers in command.

In more than one hundred interviews with men of six different units, not one respondent reported that he knew of an antiaircraft artillery man who planned to extend his far-northern tour.

These responses were in marked contrast with those of men of maneuvering elements, where low morale did not appear to be a major problem. Yet the passive defenders lead much easier lives than do the men in the field. In fact, physically, they are almost extravagantly comfortable. Despite their complaints, they live in warm, insulated buildings which

can withstand the onslaught of any wind. They have movies, relatively large recreational areas, games, libraries, and food of remarkable variety.

Soldiers at such stations are not faced with frequent crises. Rather, their existence is marked by monotony and seeming purposelessness. Their lives are not actually purposeless, of course. Like other soldiers, they are there to meet crisis when it comes. The difference is that crisis does not come to them in peacetime and their lot is to wait and to watch. They do not do it well.

Some officers hypothesize that the cause of the men's inadequacy is their immaturity. That may be. However, there is also reason to believe that satisfactory adjustment to isolated passive defense requires a different set of personality characteristics than does satisfactory soldiering in the field. Passive defense, with its many vigilance tasks and its monotony, certainly offers different stresses and different rewards from those offered to the soldier in the field.

These differences would apply not only to men in the arctic but elsewhere in the world; after all, dull, monotonous isolation is experienced at air defense sites in the temperate zone too. However, the arctic environment intensifies the problem. C.J. Boag, in a preliminary study^{1/} of problems of adjustment of men in the Far North, calls attention to two effects. In the first place, the strangeness of the setting--the treeless expanses of white, the long nights and the long days--serves to emphasize the isolation and the loneliness of the outpost. In the second place, the harshness of the arctic winter serves to keep men

^{1/}Reference 9.

indoors, cutting off all activities outside their quarters, allowing no relief from close contact with companions, no change of scene or tempo. Thus the effects of isolation are emphasized in the Far North.

In the course of his study, Boag visited a number of small, isolated settlements in the Canadian arctic, observed behavior, and interviewed in depth the men assigned to these settlements. They lived a communal, bachelor life and tended to feel that work in the arctic was only an interlude to be lived through before returning to normal life down South.

Boag found that, although the men had little direct exposure to climatic stress, a constantly recurring complaint--mentioned spontaneously by almost all those interviewed--was of depression and irritability during storms. At these times all were confined to their quarters, sometimes for several days. Factors emphasized were the bitterness of quarrels because of enforced contact; a feeling of imprisonment as opposed to the normal feeling of staying indoors by choice; the actual noise of the wind and its buffeting of the hut; and finally a feeling of being at the mercy of an overwhelming force.

In contradistinction to his interviews, Boag's observations during the winter disclosed little in the way of spoken feelings of depression; verbal indications mostly took the form of indirect expressions of hostility. However, behavior frequently showed apathy, lack of interest in surroundings, motor retardation, greatly increased hours of sleep, lack of attention to personal appearance and to tidiness of quarters, and disinclination to undertake extra work or odd jobs, in spite of complaints of not having enough to do. Men would frequently start the

winter with extensive plans for spare-time activities, only to fail almost completely in carrying them out. Sexual satisfaction appeared to be sought mainly in the form of fantasy, but the content of the fantasies was predominantly home and family life.

Boag reports that tensions tended to reach a peak not, as one might expect, in the depth of winter when there is least daylight and the weather is at its worst, but at the end of the winter, when weather is usually good. In line with this, complaints were usually about the length of the winter rather than its severity. Tensions in general rapidly dissipated with the approach of the summer season.

Questions of leadership in this setting are important. The officers interviewed during the summer visits did not seem to have a clear understanding of the special problems they faced, perhaps because they, too, were not well adjusted to isolation. When asked what they thought could be done about the state of morale at their units, most answered by complaining about lack of maturity and inadequate training of their men and about harassment by their superiors. Some suggested that it was most important to keep the men busy, others called for better recreational facilities. Yet in those units where the officers did keep the men busy, the men responded by expressing their dissatisfaction and maladjustment in terms of being worked too hard and harassed too much. At one unit men even expressed a preference for the winter to the summer because during the winter it was less likely that they would be sent out on work details. As for recreational facilities, as previously remarked, those available to the men were rather sumptuous and yet they were not fully used.

The foregoing suggests a need for a thorough study of the social and psychological problems of life on remote outposts.

The first goal of such a study should be to isolate and identify the psychological correlates of adjustment and maladjustment to the roles of the passive defender. Is the man who successfully adjusts to monotony and isolation basically a different kind of man from one who is able and aggressive in the field? If so, is he likely to be able to cope with the crisis of enemy attack if and when it comes? Is it possible to train men to adjust to monotony and isolation, or are special selection procedures necessary? The answers to these questions are not known, but they are of immediate importance to our defense effort.

The area of leadership at remote outposts is also one of great importance. In some ways, less is known about the nature of successful leadership in such a setting than is known about leadership in the field. Successful field leadership can be measured by the success of units in getting jobs done and effectively responding to crises. While these factors are also important in the passive defense setting, the frequency of jobs related to the purpose of the unit and also the frequency of crises are much lower than in the field. On the other hand, the less overt, harder-to-understand problems of adjustment, morale, and the like, come up more often. The roles leaders must play to handle these problems are not well understood.

There is a need, then, to analyze leadership roles in passive defense, and to develop methods of training and administrative procedures that will serve to alleviate stresses resulting from monotony and isolation.

Chapter 5

THE ARCTIC AS A LABORATORY FOR HUMAN FACTORS RESEARCH

THE STUDY OF BEHAVIOR IN CRISIS

In Chapter 3, it was noted that the ability to respond effectively to crisis was an essential requirement of units on cold weather maneuver. The Arctic environment frequently produces situations that demand quick, correct decisions, effective coordination of men and equipment, and often supreme physical effort, if the viability of the organization and its ability to accomplish its military mission are to be maintained.

Effective response to crisis is equally essential on the battlefield. S.L.A. Marshall writes:

" . . . there is no system of safeguards known to man which can fully eliminate the consequences of accident and mischance in battle. Hence the only final protection is the resiliency and courage of the commander and his subordinates . . . /so that they/ can cope with the unusual and the unexpected as if it were the altogether normal. . . ."1/

It seems reasonable to assume, then, that training for effectiveness in crisis would result not only in more effective maneuvering elements in the Far North but also in more successful combat performance.

Crisis (as the term is used here) has an important advantage as a focus of study: It is applicable to groups as well as to individuals. It can be defined in normative terms as a class of situations that tend to degrade the viability and capability of military organizations.

The following discussion is offered as illustrative of these points. A news story in the 4 October 1958 issue of Army Times concerned

1/S.L.A. Marshall, Men Against Fire, Combat Forces Press, Washington, and William Morrow and Company, New York, 1947, p. 116.

Col. Cecil H. Bolton, a Medal of Honor winner, who was driving home when a wall of water from a flash flood struck his car.

"Although all windows were up, the vehicle quickly filled with water. Bolton took a deep breath as water reached his chin. A second later the water was above his head. Holding his breath he opened the left front window, reached out and felt mud. This avenue of escape sealed off, he reached over and opened the other front window and got out of the car. When he reached the surface, Col. Bolton was about 170 feet from the road. The current took him about 50 yards downstream before he was able to grab a limb and hold on. Waiting until he had recovered strength, Bolton then swam toward higher ground about 50 feet away."

This incident was critical because Colonel Bolton was facing loss of his life unless he made correct decisions quickly and responded in the proper manner. The action he took was objectively effective--he lived through the experience.

Although, in actuality, Colonel Bolton's effectiveness in battle has been demonstrated, his effectiveness in this situation would not necessarily justify the prediction that he would be a good combat soldier. Combat performance is more than individual performance. Men fight in teams and the members of a unit must coordinate their efforts to achieve effectiveness. Suppose, for instance, there had been several others in the car with Colonel Bolton and all had taken action in the manner he did, but independently. They probably would have blocked one another's exits, automobile windows being as small as they are. Coordination would have been essential if all the passengers were to escape.

In a group in crisis there is need for specialization: for a leader and for followers--in the flooded automobile, for quick thinkers and strong swimmers. It would not have been necessary for all to have been both quick thinkers and strong swimmers, for teamwork makes up for individual weaknesses and capitalizes on individual strengths.

This is true in combat too, and the point must be made that there is more than one way to be an effective fighter. In fact, any behavior that contributes to unit effectiveness is effective behavior on the part of the individual. The important thing is unit performance.

In sum, critical situations involving group response are an aspect of combat that can be studied in a noncombat setting. Since the arctic is productive of critical situations, it is an excellent laboratory for studying group response in crisis.

The study of crisis involves observation designed to categorize roles and responses within units faced with critical situations, as either contributing to or not contributing to effective unit response. After the functional roles and responses have been identified, the problem of training men for crisis can be approached.

Some work has already been done which would be of value. For instance, considerable research in group behavior in crisis was carried out by the Human Factors Operations Research Laboratories of the Air Research and Development Command in a long series of studies on survival training for aircrews. Of particular interest is a set of hypotheses developed by Torrance, LaForge, and Mason^{2/} on the basis of observations made when a number of survival training groups had been caught out in a major blizzard of such violence that all the groups ultimately had to be evacuated:

(1) Group adaptation lags in emergencies when official subgroups break down and are replaced by groupings of the most able with the most able and the least able with the least able.

^{2/}Reference 106.

(2) When danger strikes, nonadaptable groups resist or delay acceptance of the seriousness of the situation for a dangerously long time.

(3) In emergencies and extreme conditions, a history of conflict among the various echelons of power within a group inhibits adaptation.

(4) Failure of official power figures (i.e., the designated leaders) to accept the informal power structure of the group impedes continued adaptation.

(5) In emergencies and extreme conditions, designated leaders tend to abdicate their power roles.

(6) When danger is great there is a tendency for the leader to reduce the power of the group, thus increasing the hostility of the group and decreasing the group's capacity to adapt.

(7) Interpersonal stresses resulting from differences in values and personality defects interfere with adaptation in emergencies.

(8) Communications failures within groups tend to increase in frequency and reduce the group's capacity to adapt in emergencies and extreme conditions.

(9) As stress increases, the "lack of will to survive" tends to become a group phenomenon and contributes to the group's failure to continue adapting.

(10) In crisis, concessions to immediate comfort operate as a group phenomenon and result in failure to take appropriate action.^{3/}

The refinement and verification of these hypotheses is an appropriate goal for preliminary research into the responses of groups in crisis.

^{3/}Reference 106.

THE STUDY OF MAN IN ISOLATION

Camp Fistclench, one of the sites of the U.S. Army Polar Research and Development Center, is located on the Greenland icecap, about two hundred miles east of Thule Air Force Base. It is very isolated because surface travel from headquarters at Camp Tuto (near Thule) takes a minimum of three days, arctic weather makes flying uncertain, and polar atmospheric conditions frequently disrupt radio communications.

The 120 soldiers and scientists who spent the summer of 1958 at Camp Fistclench had a joke. They referred to their camp as "Planet Fistclench," and when a sled train or an airplane arrived, the men would rush out shouting, "Welcome, Earthmen!"

In many ways, life at Fistclench does seem like life on another planet. The camp consists of a number of canvas huts in snow-covered trenches 30 feet below the surface of the icecap. Since the trenches are interconnected, men need never emerge from their narrow confines. The temperature outside may rise as high as 32° F. or plunge very much lower, but inside the trenches it usually remains within 5° of 15° F. Since the trenches are covered, the light as well as the temperature always remains the same, supplied by lamps powered by a diesel generator, the sound of which is ever present. With no diurnal variation in either light or temperature, men frequently experience difficulty in maintaining their sense of time.

Climbing outside the trench does not bring back a feeling of reality. Throughout the summer, the sun never sets. It circles to the north at night, the east in the morning, the south at midday, and the west in the evening. But it is hard to tell the direction, for there are no landmarks.

The white icecap stretches in all directions to the indistinct horizon. The surface seems almost perfectly flat; there are no hills, trees, or structures to be seen. The impression is one of utter desolation--bright, shining, white desolation.

The cold, the high altitude (7000 feet above sea level), and the abnormal space and time relationships all contribute to the effect of extreme isolation at Camp Fistsclench. The joking reference to the place as another planet suggests that a snow camp on the polar icecap might serve as an excellent laboratory for studying the reactions of men in isolation. No other experimental conditions could better the polar snow camp in removing men from outside aid, giving them the urgent sense of having to fend for themselves in a remote and hostile environment, and requiring them to carry out military and scientific tasks in an army setting.

SITES FOR COLD WEATHER RESEARCH

Greenland

The U.S. Army Polar Research and Development Center (PR&DC) maintains several sites in Greenland. The Center is administered by the Corps of Engineers in support of scientific effort by all of the Technical Services. Headquarters is at Camp Tuto, which is located at the edge of the polar icecap, 14 miles east of Thule Air Force Base. The Camp Tuto site is free of snow and ice for about three months in the summer, but is practically inaccessible during the winter. Housing is provided for several hundred men during the summer in canvas jakesway huts and metal quonset huts.

Camp Tuto is at the base of a ramp to the icecap and is the point of take-off for sled trains making swings over the surface. There is a marked trail leading to Camp Fistsclench 220 miles away. Another snow camp, Camp Century, is being established at mile 100 on that trail; a nuclear reactor will provide electric power for the new camp. Several long-distance surface explorations leave from and are supported by Camp Tuto each summer. Convenient to Camp Tuto are several air defense units which operate in support of Thule Air Force Base. There also are Coast Guard, Air Force, and Army outposts at which navigational, radar, and meteorological facilities are manned in the Thule area.

Advantages of PR&DC, Greenland for research are that Camp Tuto is in a true arctic environment, and is convenient to isolated passive defense outposts. It is the only available northern facility at which cold weather research can be carried on in summer, and the only one with established camps on the polar icecap.

Disadvantages include the high cost of transportation to Thule, the fact that no dependents can be accommodated, and the lack of operational maneuvering elements of the U.S. Army in Greenland. The troops assigned to PR&DC are, for the most part, volunteers, whose work is to carry out or to support research. As such, they are not a representative sample of Army personnel. Military tasks involving the use of weapons require prior clearance from the Danish government.

Canada

The U.S. Army First Arctic Test Center (FATC) is located at Fort Churchill, Manitoba, Canada. Fort Churchill is a Canadian Army installation, and is the site of the Canadian Winter Warfare School.

The Defence Research Board Northern Laboratories are there, as are Canadian Naval and Transportation Research Centers.

The terrain and climate around Fort Churchill, which is located on the western shore of Hudson Bay just north of the tree line, are typical of the eastern continental subarctic. Winters are very cold and very windy.

Among the advantages of Fort Churchill as a locus for research is the fact that it is served by rail, sea, and air facilities, so transportation is reasonably inexpensive. The buildings are permanent, comfortable and ample. There are accommodations for dependents of permanent personnel, although not for dependents of test team or transient personnel. Ample land area is available for experiments involving fire and maneuver, even though there is a town nearby.

Disadvantages include the lack of any suitable accommodations for civilians in the town of Churchill, and the fact that there are no American troops nearby except those attached to FATC. The proximity of the fort to the town and the railroad reduces the sense of hazard and isolation.

Alaska

There are a number of locations in Alaska suitable for human factors research activities. Armored, infantry, and field artillery units are stationed at Fort Richardson (near Anchorage) which is the headquarters of U.S. Army, Alaska; Ladd Air Force Base (near Fairbanks) which is the headquarters of the Yukon Command; and at Eielson Air Force Base. There are a number of Army air defense units near each of these locations. The Arctic Test Board and the U.S. Army Cold Weather and Mountain School are located at Fort Greely. Winters at Anchorage are relatively mild, but Ladd, Eielson, and Fort Greely are north of the Alaska Range, and are

subject to severe winter weather with less wind but more snow than is experienced at Fort Churchill. All of these posts are south of the Arctic Circle.

The Navy maintains an arctic laboratory at Point Barrow and has expressed willingness for the Army to use it. Point Barrow is well above the Arctic Circle on the shore of the Arctic Ocean.

Alaska offers the advantages of accommodations for dependents either on post or in Anchorage or Fairbanks. There are both maneuvering elements and passive defense units permanently stationed there, and U.S. Army, Alaska, is responsible for cold weather tactics and training.

Disadvantages include the very high cost of transportation and living, and the fact that the relatively highly developed American culture of Alaska reduces the sense of isolation and hazard.

CONCLUSION

The Far North can be used as a setting in which to conduct research of interest to the Army. The arctic is productive of critical situations which demand rapid, correct decisions, efficient coordination, and extreme physical effort in response. It would serve as an excellent laboratory for the study of responses of military units to crisis. The polar icecap and camps could be used as laboratories for the study of human responses to isolation in highly hostile environments.

The Army maintains bases in Greenland, Canada, and Alaska which are suitable locations for human resources research. The Polar Research and Development Center in Greenland provides a true arctic environment, and the most extreme isolation and hazard. Fort Churchill, Manitoba,

Canada, is by far the most convenient, has outstanding facilities for research, and plenty of terrain available for fire and maneuver. Alaskan bases provide permanently stationed passive defenders and maneuvering elements, and an economy that can support dependents of research workers.

Chapter 6

SOME POSSIBLE PROGRAMS OF RESEARCH

It would be difficult to rank, in order of importance, the research needs which have been discussed in the preceding chapters. All of them are important, and each could be carried out by HumRRO. Three general programs of research suggest themselves.

(1) The problems of maneuvering elements in the Far North. This would involve aiding in reappraisal of the information needed for winter warfare and development of an effective training program for cold weather operations.

HumRRO could aid in the development of new tactical doctrines by providing predictions of what troops can accomplish in various cold weather conditions, so that commanders inexperienced in arctic and sub-arctic operations can be helped to plan realistically and more effectively.

It is necessary first to define training goals more precisely, and to eliminate the unessential from arctic training course content. Of course, some of the material to be taught would be specific to the far-northern environment. The use of protective clothing and equipment, skiing and snowshoeing, land navigation, and the prevention of cold injury are examples. The program would include an investigation of the prevalence and effects of fears of the North, and the development of a method for counteracting these effects. Finally, it would include the development of unit training to increase effectiveness in responding to the crises which are inherent in an arctic environment.

This research would be specific to the needs of military units operating in the arctic and subarctic. It would serve to make them more effective and, in the event of mobilization, would enable more rapid attainment of combat readiness of units sent to cold climates.

(2) The problems of men engaged in the passive defense of remote outposts. These problems are probably the same in the arctic as they are elsewhere in the world, except that the arctic serves to intensify them. Discontent and maladjustment on the part of passive defenders are probably greater in the arctic than elsewhere. Such problems may therefore be easier to define and to study there.

The first goal of such research would be to isolate and identify the psychological correlates of adjustment and maladjustment to the roles played by passive defenders. Methods of training and implications for selection would be investigated, as would leadership roles in passive defense. A study of leadership would focus upon behaviors necessary to deal with problems of adjustment and morale, while still maintaining readiness to cope with enemy attack.

While not specific to the Far North, this program would aid in the solution of a general military problem of selecting and training men and officers for duty as passive defenders on remote outposts and would include the development of organizational and administrative principles designed to alleviate the stresses of monotony and isolation.

(3) The study of the military unit in crisis. Here the emphasis would be on the unit rather than on the individual. The goal would be to develop an understanding of the roles necessary for effective response to crisis, communications techniques, and other factors affecting the

ability of groups to act in coordination. Some of the problems that have beset leadership research may be eliminated when leadership behaviors are conceived as differing in crisis from those in noncritical situations. Study of crisis in the arctic is convenient because the arctic is productive of a large sample of crises. This program would, however, contribute to the needs of the Army as a whole rather than only the northern forces.

Pursuit of any or all of these programs would meet current needs in the Army and contribute to an understanding of human factors in military operations.

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