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HUMAN PERFORMANCE UNDER CONDITIONS OF COLD AND STRESS

REPORT ON UNIT EFFECTIVENESS

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ARCTIC AEROMEDICAL LABORATORY

AEROSPACE MEDICAL DIVISION
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FORT WAINWRIGHT, ALASKA

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FOREWORD

Research reported in this paper was done by the Arctic Aeromedical Laboratory, Psychology Branch, under Project 8237, Task 01005, and by Bassett Army Hospital, Fort Wainwright, Alaska, from April to July 1966. This was a special project in response to a request from the Surgeon's Office, U.S. Army, Alaska, USARAL.

The author wishes to acknowledge the assistance of the personnel of Bassett Army Hospital psychiatric section in scoring psychological tests. Special recognition is given to Capt Michael Speshock, Mental Health Section, Elmendorf Air Force Base Hospital, and to Col Joseph W. Marks and Lt Col Joseph Bailey of the 171st infantry brigade, Fort Wainwright, for their cooperation in providing support and troop information for this study.

This technical report has been reviewed and is approved.

Horace F. Drury

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Director of Research

ABSTRACT

At the request of the Surgeon's Office, U. S. Army, Alaska, USARAL, the Arctic Aeromedical Laboratory psychologist accompanied 30 Army personnel on a field exercise near Eielson Air Force Base, Alaska, to study behavior and performance under conditions of cold and stress. The men were divided into squads of 10 men each, representing three companies. Personality and attitude scales were administered before, during and after the exercise. Analysis showed the essential character of dynamic leadership, purpose and direction necessary for mission success. It also pointed up that the absence of these characteristics (variables) leads to independent and separate action with the consequent result of unit ineffectiveness. The most important factor in mission success seemed to be good leadership.

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I

INTRODUCTION

The Surgeon's Office, U. S. Army, Alaska, USARAL, requested the Arctic Aeromedical Laboratory to help support a study conducted on 30 Army personnel from the 47th Infantry, 1st Battalion, Fort Wainwright, Alaska. These personnel were engaged in a long-range reconnaissance patrol in the hills surrounding Eielson Air Force Base, Alaska. A psychologist from the Arctic Aeromedical Laboratory accompanied the medical team associated with the patrol during the field maneuvers, which were to last 15 days.

Purpose of the study by the medical team was to conduct both medical and psychological tests and to observe the behavior and behavior patterns of this small military group living and functioning under a particular set of circumstances in the field.

It has long been known that certain conditions of isolation and cold contribute toward the creation of stressful situations both medically and psychologically. When other variables such as leadership, purpose, cohesiveness, and equipment design, are introduced into the situation, stress may be enhanced or diminished. If these variables are negative, stress occurs and the unit becomes ineffective. On the other hand, if these variables are positive, stress is diminished and an atmosphere conducive to effectiveness results.

If this is kept in mind, some of these variables may be evaluated and tentative conclusions drawn on their contributions to the success or failure of missions of this nature.

II

METHODS

Thirty Army personnel from the 47th Infantry, 1st Battalion, Fort Wainwright, Alaska, were used as subjects. The men were divided into three groups called squads, representing three companies -- A, B, and C. The division of the squads was an Army tactical grouping for field exercises and not a selected grouping for study purposes.

The Minnesota Multiphasic Personality Inventory (MMPI) and the Edwards Personal Preference Schedule (EPPS) were administered to the subjects prior to the field maneuver to gain some insight into individual personalities which made up this unit. At the termination of the field exercise, another MMPI

was administered. Unfortunately, not all of the original members of the patrol were available for the second tests. A short (unstandardized) attitude scale was also given to the remaining members of the patrol, and an interview conducted.

In the field, random interviews were taken throughout the period and observations were made both in the dai ly base camp area and during several foot patrols. Generally, the foot patrols offered better observations from the standpoint of leadership, cohesiveness and behavior than did observations within the base camps.

The MMPI and the EPPS were evaluated together and profiles for each subject were drawn. When the EPPS were analyzed, any scores falling below a percentile of 5 or a T score below approximately 33 were considered "very low" for any particular dimension. Any scores exceeding a percentile of 90 or a T score value of above 65 were taken as "very high". In this report, each individual behavior is not analyzed in detail due to time and space. General statements about certain individuals are made, however.

III

RESULTS

A detailed analysis of the data was not attempted because of certain uncontrollable aspects of the testing program. First, the field exercise was terminated after 10 days, thereby falling short of the scheduled 15 days. Several other events occurred which reduced the reliability of data analysis, especially on the original patrol. Such events included withdrawal of personnel from the field for duty elsewhere and withdrawal of personnel to compete in the Soldier of the Month program. Dental and medical reasons also took some subjects from the field.

The medical and dental reasons were checked and found to be genuine -- apparently there were no psychological implications. Dental problems involved abcesses and tooth repair. The medical problems included one case of frostbite and another of severe burn. Two cases of VD were also present.

An analysis of the parameters seemed to indicate that of the three participating companies, the squad from Company B would perform more effectively than the other two squads from Company A and Company C. This indication was strengthened from observation in terms of group cohesiveness leading to a team effort. In addition, a certain esprit de corps existed in which the personnel of Company B squad "thought" they were the best.

The MMPI taken on 9 of 10 subjects from Company B showed 5 men as fairly well-balanced individuals who would be expected to do well in a field situation. Two others indicated they could do reasonably well under good leadership even though one showed some passive resistance to authority and the other was defensive and fairly rigid in his behavior. One of the remaining three subjects showed concern with health and he probably would be ineffective in a situation which exposed him to certain health hazards. He would be a poor risk in the field. One MMPI profile was invalid, probably because of the subject's carelessness in taking the inventory. A profile on the last subject was not obtained.

An EPPS administered to the same group from Company B showed no gross dimensional deviations although some single dimensions did show up as very low or very high. Consistency scores on the EPPS for all subjects was 9 or above. (A consistency score for 15 items on the basis of chance is 7.5; 9 yields a probability value of .40, 10 yields a probability of .15, and 11 yields a .06 probability.) Six of the nine subjects from Company B had consistency scores of 11 or more, making the instrument quite reliable for this group.

The assistant squad leader of Company B had very high aggression and dominance scores and low deference and abasement scores. On the surface this seems paradoxical since the assistant squad leader was considered a competent man by his superiors and subordinates. The paradox was resolved, however, during observations (see Conclusions). There seemed to be no dimension which yielded consistently high or low scores in this group. High and low points were scattered among all dimensions. The questionnaire given to the Company B subjects turned up some interesting statistics on selected items. One of these items was the question "...how could the patrol be improved?" All members of B squad (100%) answered with some constructive criticism. No other company did this (Table I). In the criticism the improvements listed as paramount centered around need for adequate information, especially at the NCO level, and good leadership.

TABLE I

Percent Personnel Giving Constructive and Destructive Criticism

Company	Destructive (%)	Constructive (%)
A	66.6	33.3
B	0.0	100.0
C	43.0	57.0

The percentages for Company C in Table I represent seven subjects, four of whom are from the original patrol. Complete records were obtained on these four subjects only. The squad leader was replaced because of a new duty assignment. Three other members of the original group did not show up for final testing, negating the collection of complete records on at least seven members of the original patrol (see Conclusions). One of these three subjects went AWOL after he was returned from the field with VD, and two simply did not show up.

An MMPI was taken on the four subjects with complete records throughout the study indicated that none of them would be expected to do well in any regimented capacity. One of the subjects showed a character disorder leading to difficulty in team association. Even the assistant squad leader showed difficulty with associations on the MMPI and perhaps overconcern with his own welfare. His profile indicates that he would be of little help in solving problems which might develop in the field.

Two MMPI profiles were invalid because of the extreme lie (L) scores. Another MMPI profile showed that the subject had signs of slight depression and emotional distance. He would not, however, be incapacitated for duty in the field.

All the squad members tested on the EPPS showed lower than average achievement scores. Three subjects scored very low on deference and interest scales. These scores alone are not indicative of anything, but taken with the MMPI profile they become significant.

An interesting finding is contained in Table II. General Training (GT) scores were obtained from all subjects of the original patrol. It can be seen that Company C (the average of eight subjects) shows a higher GT score than do the other two companies. The difference in average scores is barely significant at the 05% level of confidence. If, on the other hand, the scores of the four original team members of Company C are averaged, an even higher score of 93.2 is evident. The difference of this mean score from the mean GT scores of 87.2 and 89.0 is significant between the 1% and 5% level of confidence. This presents some interesting speculations which will be discussed in the conclusions section.

TABLE II

Average General Training (GT) Scores for Three Companies

Company	Average Score
A	87.5
B	89.0
C	91.5

From observation, Company A performed relatively well in the field, even though analysis of parameters used in testing does not indicate that this group would perform very well. Other factors were obviously at work and these will also be speculated upon in the conclusions section. Of 10 men tested, only 2 yielded a "do well" profile on the MMPI. One of these men was the squad and patrol NCO. Four other subjects showed profiles ranging from anxiety to defensiveness but three of those four could function adequately in the field with dynamic leadership. The fourth member would seem to be a handicap in situations represented in this field exercise. An MMPI on each of four remaining subjects of Company A was invalid for various reasons. Carelessness in taking the test seemed to be involved in two of the cases, and apparent manipulation seemed evident in two others.

The EPPS taken on Company A subjects revealed that the man who would be a handicap (mentioned earlier) had an extremely low score on the interest and endurance dimensions. The three subjects who indicated they could perform well with leadership scored low in achievement and deference but high in aggression and heterosexuality. One subject who seemed anxious on the MMPI scored low on dominance and aggressions. Most other scores for all the subjects fell within the average range.

Several items on the questionnaire were broken down into percentage values by Company. Tables III and IV show how the subjects rated their leadership by Officer and NCO.

TABLE III

Leadership Rating of Officers by Company

Rating of Officers	Company			Overall A, B, C
	A	B	C	
	(in %)			(%)
Excellent	44	0	14	19.3
Good	56	70	57	61.5
Poor	0	30	14	15.4
No Comment	0	0	14	3.8

TABLE IV

Leadership Rating of NCOs by Company

Rating of NCOs	Company A	Company B	Company C	Overall A, B, C (%)
	(in %)			
Excellent	44	70	43	50
Good	56	30	43	46.2
Poor	0	0	0	0
No Comment	0	0	14	3.8

Note that the highest leadership rating ("Good" for Officers, "Excellent" for NCOs) was obtained from Company B. This point is significant in itself.

Two other items which seem worthy of tabulation are those contained in Tables V and VI. Table V shows how the subjects respond to a question on quality of their own performance.

TABLE V

Self-Analysis of Performance by Company

Rating	Company A	Company B	Company C	Overall (%)
	(in %)			
Excellent	0	40	28	23.1
Good	89	60	57	69.2
Poor	11	0	14	7.7
No Comment	0	0	0	0

Table VI indicates how the subjects responded to self-appraisal on their combat effectiveness.

Note that Company C subjects rated themselves highly in combat effectiveness while Company B men rated themselves on the poorer side.

One last item which may be pertinent to this study is that of equipment rating. Six subjects from Company A rated the equipment as good but only two of these gave critical analyses. Four rated equipment as poor.

TABLE VI

Self-Appraisal of Combat Effectiveness

Rating	Company A	Company B	Company C	Overall (%)
	(in %)			
Excellent	11	10	71	7.7
Good	56	20	28	34.6
Poor	22	60	0	50.0
No Comment	11	10	0	7.2

All subjects from Company B rated their equipment as good -- 6 of the 10 gave critical reviews.

Of seven subjects from Company C on whom questionnaires could be obtained, three rated equipment as adequate, one rated it good, and three rated it poor. The predominant criticism was that M113 tracked vehicles were not heated properly and were uncomfortable. The next two most mentioned criticisms, listed equally often, were that canteen contents froze and "good" gear did not meet standards (of the subject) for conditions.

IV

CONCLUSIONS

Despite the uncontrollable factors involved in this study, some limited but valid conclusions may be drawn.

In order to have an effective maneuver involving small military units or patrols (as in this study), it is of utmost importance to start with dynamic leadership throughout the command group. This view has been stated many times, yet it seems to remain the central problem of unit effectiveness. Lack of leadership was emphasized on two particular foot patrols during the exercise. The patrol was on a five-mile march when several soldiers staggered out of line away from the patrol proper. When their squad leader asked where they were going, the personnel replied "We're taking a break," whereupon he answered "Well, ok, we might as well." The squad was from Company C. That same company, on the last 14-mile patrol of the exercise, could only retain four men on the march. All others had dropped back for various reasons, ranging from pains in the sides to ill-fitting snowshoes (which are adjustable). The latter incident occurred less than one mile into the march.

In this instance, firm leadership was definitely needed but it was not available. As a direct result of inadequate command functioning, information that the march would take place was not passed down. Many troops were caught short and had not had a sustaining meal. Company C was unable to maintain cohesiveness in this case because of lack of leadership from both the OIC and the NCOIC.

This points up another extremely important factor which is an integral part of good leadership and mission success -- that of adequate information. A major complaint by all squads was the "lack of information" about what they were doing and why they were doing it. It may not be completely necessary or practical to give that information to all members of a squad, but it was noted that the squad leaders of this patrol were at a loss to explain what they were to accomplish. A comment by the Company B squad leader is typical. "Squad levels could have been better informed on missions." Company A squad leader suggested "...giving the men more information as to what is expected of them ...tactically." It seems that despite the knowledge that these factors are most essential they still escape personnel in command functions.

As a direct result of gaps in information, the foot patrol missions were without direction -- without purpose. Company B squad leader felt "...that the missions meant nothing to us because we walked out and then turned around and came back." He went on to say that the mission should have had some purpose such as seeking out an aggressor force or warding off prepared ambushes.

A lower echelon member commented that the mission was a foot race to see who could return first. A survey of the personnel involved in the study shows that 87% could not discern a direction or purpose in the foot patrols.

With this evidence it seems fairly obvious that a sense of purpose is also very important to mission accomplishment, even for the lowest echelon.

In terms of this patrol then, the aspects of leadership, information and purpose were very important and because they were at a minimum the squads could not become a consolidated unit. Lack of these factors fostered a "competitive" (as opposed to cooperative) atmosphere instead of encouraging interaction in a team effort. The squads very definitely operated as three separate units totally independent of each other. The comment of Company B squad leader is especially cogent here. He said "We couldn't get other companies to work with us so we tended to outdo and outperform the others --- which we did!"

The evidence from this study points to several other factors which might explain the better or worse performance of these particular squads.

Company B appeared as the most effective squad, Company A as second most effective, and Company C as least effective. It was noted in the results that Company B had the greatest number of men who would be expected to do well and Company A had the next highest percentage. This seems to indicate that a military operation of this sort would have a greater probability of success if the personnel who are selected for assignment were reasonably well-balanced individuals. At least they should have no gross personality defects. In this event, then, minimal leadership may not have the impact it would have under other conditions.

It was noted from observation that Company B had two good NCOs and their men seemed to stand by them. The assistant squad leader, it will be recalled, scored very high on the aggression and dominance dimension of the EPPS, and low on deference and abasement. This, at first glance, might seem to indicate that he was a bully-type leader who would be undisciplined. Yet under observation, he appeared as a forceful individual giving needed direction during patrols. He "talked" the personnel's language, so to speak. Under other circumstances, such as being squad leader without "immediate" supervision, he might act differently.

Table I indicates that Company B also had a positive approach toward improving the patrol on future missions, and even gave 100% constructive criticism. Of course, this does not explain Company A's low percentage on constructive criticism. It is difficult to gauge Company C in this respect simply because of the new men who had not gone through the complete maneuver. The fact that several members of Company C did not show up for final testing may be significant in itself in terms of leadership. The original squad leader, who appeared quite competent in the field, was replaced early in the exercise. He went to a new duty assignment. Had he remained, perhaps Company C would have performed differently.

Reference to the GT scores in Table II may offer a remote explanation as to Company C's poorer performance. Company C scored highest on two different averages. It may be advisable to select men with a slightly lower intellectual level, since a group at a higher level may require more details of operation - more information and more purpose. There is not enough evidence here to support that view and additional study would be necessary. The possibility of selecting individuals with a lower level GT who are well-balanced might be difficult.

In summary, the most important factor in mission success is strong and firm leadership especially at the command level. Passing on information to lower command levels is most essential and of necessity would follow from good leadership. Lack of information leads to lack of confidence by all concerned, down to the lowest member of the operation.

The mission must have direction. The purpose should be known and understood. This does not imply that an explanation of exact tactics must be given to each soldier, but the personnel should understand a purpose of the mission even though they do not understand its full meaning. That should be left to those in command.

It is increasingly evident that small military units operate in and of themselves under unique circumstances simply because of the fact that they are small. Interpersonal relationships tend to reach a critical point, whether good or bad, more quickly and more forcefully in these groups. One factor seems to stand out above all others in the molding of a good unit -- good leadership. All else seems to flow from it.

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