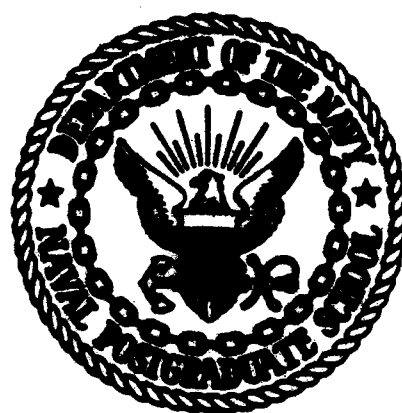


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A STUDY OF HUMAN FACTORS THAT AFFECT
COMBAT EFFECTIVENESS ON THE BATTLEFIELD

by

Charles D. Marashian

June 1982

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**A Study of Human Factors That Affect
Combat Effectiveness on the Battlefield**

by

**Charles D. Marashian
Captain, United States Army
B.A., University of California at Los Angeles, 1975**

**Submitted in partial fulfillment of the
requirements for the degree of**

MASTER OF SCIENCE IN MANAGEMENT

**from the
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ABSTRACT

This study was designed to provide empirical data which would show what relationship existed among nine human factors and combat effectiveness of soldiers on the battlefield. These human factors were: leadership, training, combat experience, perception of survival possibility, acceptance by the unit, fatigue, hunger, the ability to withstand fire, and a soldier's belief in what he was doing was right. The study focused upon a sample of fifty Army infantry battalion commanders within the continental United States who had served as small-unit combat leaders in Vietnam. Data was obtained by the use of a mailed survey. The respondents tended to agree that among all of the human factors, leadership was strongly related to combat effectiveness. Among the nine human factors, respondents felt that leadership and training were the most important human factors relating to combat effectiveness. The respondents commented extensively that cohesion, training, belief in what they were doing, and leadership were the main motivators behind the soldier's willingness to fight.

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I. INTRODUCTION

The purpose of this study was to determine to what degree various human factors affected combat effectiveness and the soldier's will to fight on the battlefield. Hopefully, by providing empirical data showing to what extent different human factors were relevant or irrelevant in battle, combat effectiveness would be better understood.

Since the end of World War I, immense efforts have been invested by individuals in many disciplines to try to define the criteria that would accurately define and measure combat effectiveness. Marshall (1947) presented interesting data gathered from observation of infantry units engaged in combat. Keegan (1976) did an extensive study of significant battles which provided a detailed account of the behavior of soldiers in combat. Richardson (1978) did a study on the psychological factors of combat based on his experiences as a psychiatrist in the British army during World War II.

Currently, a large amount of resources is being utilized by the Army to try to assess the combat effectiveness of units at all levels. The assessment techniques used range from the use of extensive tactical evaluation programs to the sophisticated simulation projects in the area of operations research.

Different terminology has been denoted to define the concept of combat effectiveness. For the purpose of this study,

the term combat effectiveness was used in the context described by Sarkesian (1980). He linked the terms readiness, cohesion, and effectiveness as part of the military effectiveness equation. Readiness was the level of tactical and technical proficiency of the unit and the operational state of its equipment and logistics it required to perform its mission. Cohesion referred to the attitudes and commitment of the individual soldiers to the integrity of the unit, the will to fight, and the degree to which these were in accord with societal and individual values. For a unit to be combat effective, it must have demonstrated readiness and cohesion. It is inconceivable that a unit could be or remain combat effective without being both cohesive and combat ready. This study addressed combat effectiveness as defined by Sarkesian with one exception. The area of operational readiness of equipment and logistics was not discussed in any depth. Immense work in these areas has already been done by operation researchers.

Ultimately, the only real measure of combat effectiveness is the performance of a unit in combat. Naturally, combat effectiveness must somehow be measured prior to entering battle. By accurately measuring combat effectiveness, meaningful training objectives can be defined that will adequately and realistically prepare soldiers for combat.

The measurement of combat effectiveness and the will to fight has been a complex and difficult task. Researchers have been quite successful in simulating and measuring

factors of combat effectiveness such as optimal firepower ratios and logistical support. But it is much more difficult to quantify and measure intangible factors of combat effectiveness such as leadership or fear or combat experience. These intangible factors (or human factors) are basic to the understanding of combat effectiveness and the soldier's will to fight. The fact that combat units have substantial logistical support or superior firepower does not necessarily assure combat effectiveness and, ultimately, victory on the battlefield. This is clearly evident in historical battles such as the fall of Malaya to the Japanese in World War II [Manchester, 1978] and the Israeli defense of the Golan Heights in 1973 [Herzog, 1975].

To understand what makes a unit combat effective or why a soldier fights, the individual soldier and his social interactions at the squad, platoon, and company level must be studied. It could be argued that how effective a brigade or a division is depended upon the fighting ability that is manifested at the company level. The performance of front-line soldiers in the heat of battle could collectively determine the combat effectiveness of higher echelon units. It is at the company level and below that the human factors play an important role in determining how well a soldier fights. One example is leadership. The brigade and division commanders' primary mission in combat has been to command and control subordinate units in battle. This entailed moving and shifting

large units to stem an attack or to capture an objective. In contrast, the company commander and his subordinate leaders have the task of directly motivating and leading soldiers in combat.

This study concentrated on examining combat effectiveness of soldiers within a company-size unit. Hopefully, cause-and-effect relationships between subjective human factors and combat effectiveness would become clearer and less ambiguous at this level.

Presently, the criteria used in the military to judge the combat effectiveness of units have traditionally been performance on formal training exercises, availability of personnel, and operational maintenance. What is lacking was the assessment of combat effectiveness based on the human factors that were relevant on the battlefield. Sarkesian (1980) described the drawbacks of current assessment techniques. Measuring subjectivity using quantitative data in a manner similar to objective measures were at best inconclusive and not reflective of the units ability to perform in combat, nor indicative of the soldiers will to fight, his commitment to the mission of the unit, and his acceptance and commitment to the ideology that has placed him on the battlefield in the first place. Indeed, measures have been developed to try to assess these human factors, but these remain peripheral and lack serious analytical depth. It is difficult to say with certainty that a unit would become effective on the battlefield because it

performed well on its Army Training and Evaluation Program (ARTEP) or passed the annual general inspection.

Many articles and books have been written that focus on the subjective factors of combat. Most have been written by historians or social scientists who have based their writings on historical research. These accounts of battle tended to not capture all of the reality of war due to the authors' superficial understanding of combat and lack of background in military theory.

Perhaps the best method to establish the criteria that could better help to understand and to predict combat effectiveness was to ask the men who actually led soldiers into combat. S.L.A. Marshall (1947) felt that nobody knew more about combat than the small-unit leader. He wrote:

One of the deterrents to the adoption of new concepts is that company officers and non-coms rarely write of their combat experiences. Even when they do so they are unlikely to search into the reason or nature of them, usually because their experiences are narrow and personal. Also, they have no way of gauging what things are typical or characteristic.

In consequence, most of our textbooks and commentaries on leadership and the mastery of the moral problem of battle are written by (authors) who are either wholly lacking in combat experience or have been for long periods so far removed from the reality of small arms action that they have come to forget what were once their most vital convictions and impressions.

Thus, the focus of this paper was to obtain a basic understanding of combat effectiveness through the data provided by men who have fought in combat as infantry leaders. The

data these soldiers provided was paramount in understanding why soldiers fight.

In order to clarify the problem and in an attempt to isolate a set of hypotheses, three basic assumptions were made:

1. That the human factors used in this study were experienced in Vietnam.

2. That since the majority of battles fought in Vietnam were infantry battles, the officers currently on active duty with the most combat experience were infantrymen.

3. That infantry battalion commanders currently in command have obtained combat experience as small-unit leaders in Vietnam.

Human factors, as defined for purposes of this study, were those factors that could psychologically affect a soldier's will to fight and significantly influence whether a unit is combat effective or not. Combat effectiveness of a unit was based on the sum effect of these factors on each of the soldiers within a particular unit. These human factors will be studied in more detail in Chapter II. There were a total of nine human factors that were identified and used to acquire data for this study:

1. training
2. fatigue
3. perception of survival possibility
4. the ability to withstand ponderous enemy fire

5. hunger
6. combat experience
7. competent leadership
8. acceptance and sense of belonging to unit (cohesion)
9. a soldier's belief that what he is doing is right.

The present study examined the perceptions of infantry battalion commanders of to what degree these nine human factors affect combat effectiveness. It was assumed that based on the sample's combat experience, information could be formulated that would provide some consensus on what human factors have a significant relationship to combat effectiveness. A survey addressing these nine factors were mailed to battalion commanders throughout the Army.

Based on the assumptions and the nine human factors, the specific area of study was narrowed to a single, twofold, question: Which of these human factors were important or detrimental to combat effectiveness and the enhancement of the soldier's will to fight; and, was it possible for soldiers to be trained to withstand the psychological rigors of combat.

The major hypothesis of this study was that certain human factors were significantly related to combat effectiveness, while other factors tended to be insignificantly related. Concurrently, it was also hypothesized that soldiers could be properly prepared during peacetime to withstand the psychological rigors of combat.

The procedures used in this study will be described in detail in Chapter III of this paper. Before describing these

procedures, however, it is necessary to briefly review the literature that relates to effectiveness on the battlefield.

II. REVIEW OF THE LITERATURE

A. OVERVIEW

There have been a variety of studies that have used different approaches to analyze combat effectiveness. This study reviewed the literature pertaining to combat effectiveness by looking at six different approaches--cohesion, the effects of fire, leadership, training, the effects of stress, and the motivation to fight.

B. COHESION

Tactical cohesion is defined by Hauser (1980) as the ability of a military unit to hold together and to sustain mission effectiveness despite extreme combat stress. Marshall (1947) feels that tactical cohesion is that which enables a group of soldiers to make the most of their united strength and to deal effectively with life-threatening crisis situations. Tactical cohesion comes from the growth of unit confidence which, in turn, derives from a soldier's increased awareness and utilization of his own resources under conditions which at first seem extraordinary but gradually become familiar.

Shils and Janowitz (1948) wrote extensively on cohesion within the German Army during World War II. They attributed the excellent fighting ability exhibited by the Germans as a direct result of the intense cohesion within the primary group (squad or section).

The primary group provided the individual soldier with basic organic needs, affection, esteem from both peers and superiors, and a definition of his purpose in battle. In return, the primary group expected fierce loyalty to the group and adherence to its functioning procedures.

Shils and Janowitz hypothesized that a soldier's ability to resist is directly related to the ability of his immediate primary group to avoid social disintegration. It was only when social disintegration occurred that German units became combat ineffective. Group cohesion was weakened by both spatial and physical variables. Isolation, the institution of an individual replacement system, and the reduction of food and medical services contributed to the collapse of most German units at the end of the war.

The German Army realized the value of small-group dynamics that affected front-line soldiers. Commanders saw that solidarity was fostered by the recollection of jointly experienced gratifications and that the units who experienced victory together should not be dissolved but should be maintained as a cohesive group. Thus, their replacement system operated by this concept during most of the war. The entire composition of the division would be withdrawn from the front simultaneously and refitted as a unit with replacements. New members were given the opportunity to be assimilated into the group in a less stressful environment. Eventually, the unit would be sent back to the front as a whole.

Schein (1961) discussed the importance of primary groups to survival. Primary group loyalties among the Korean prisoners-of-war (POWs) constituted their chief hope of survival and success in an extremely hostile environment. To the extent that the captors were able to isolate the individual POW from the support of his fellow prisoners physically and psychologically, they were better able to exhort cooperation and collaboration from him. Conversely, to the extent that the POWs could cleave together in close primary groups, they were better able to frustrate the efforts of their captors to dominate them completely. The strength of the POW was drawn from the same fundamental source as that of the fighting man under fire--from the individual's faith in and sense of responsibility for his fellow comrades in his primary combat group.

Coates and Pellegrin (1965) viewed primary groups to be dynamic in nature. Discharges, casualties, and replacements may radically alter the composition of the group as time passes. As new members learn the ways of the existing group, they also contribute to and change the sub-culture, bringing in new ideas and causing realignments of the inter-personal relationships among the group members. The longer the group's history and the more stable the social climate within which it operates, the more stable and resistant to change it is likely to become.

Experimental studies have drawn similar conclusions on the effects of small-group dynamics. According to Janiss

[Hellreigel and Slocum, 1979], a phenomenon called "groupthink" has occurred in decision-making groups. In small groups there was an illusion of invulnerability which created optimism and encourages members to take extreme risks. Collective rationalization prevented members of the group to hesitate or reconsider their assumptions. Stereotyped views of the enemy developed which portrayed it as evil. There was direct pressure on an individual who expressed disagreement with group goals and tasks to conform. An important phenomenon that occurred was self-censorship of an individual's deviated views or opinions. This reflected the inclination of members to minimize to themselves the importance of their doubts. This characteristic was partly the result of self-censorship. Finally, there was the characteristic of self-appointed "mindguards". These certain members protected the group from adverse information that could shelter the complacency about the effectiveness or morality of the group tasks.

After an exhaustive literature review, Stein (1976) concluded that conflict definitely affected cohesion within a group. He found that external conflict did increase internal cohesion under certain conditions. These conditions acted as intervening variables and involved the nature of the external conflict and the nature of the group. The external conflict needed to involve some threat, affected the entire group and all its members equally and involved a solution in alleviating the threat. The group needed to have been an ongoing conflict

with some apparent preexisting cohesion and have leadership that could authoritatively enforce cohesion. Finally, the group must have been able to deal with the external conflict and to provide emotional comfort and support to its members.

Cohesion and morale have been shown to be intertwined and have significant influence on each other. Chester, Van Steenberg, and Bruencke (1955) conducted a study to determine the effect on morale of infantry team replacement and individual replacement systems. The teams in the study consisted of four men each. On the basis of the findings, the researchers concluded that the system of sending team replacements for infantry units based overseas would result in higher morale and higher combat efficiency. Currently, studies on reconstitution of combat units have been undertaken to better understand the dynamics of the issue [Etheridge and Anderson, 1981].

Morale has been identified to be an important element of cohesiveness [Heymbeeck, 1968]. Marshall (1947) wrote that morale was the essence of an army. It was morale that comprised the total complex body of army thought.

Richardson (1978) identified three elements of morale. The first element was the soldier's personal or individual morale. It was sustained by both physical and mental factors. The physical factors that sustained personal morale were good health, good food, and rest. Mental factors were much more involved and are considered by Richardson to have been more vital in preserving morale. These mental factors were:

1. Possessed an understanding of the cause he was fighting for.
2. Have self-confidence in his ability as a soldier and a belief he was a better soldier than the enemy.
3. Sound religious belief and moral principle.
4. A sense of responsibility for others.

Morale of the small group was basically sustained by three factors. These factors were:

1. Membership was contented and had confidence in its leaders.
2. Confidence in and respect for fellow soldiers.
2. An intense determination not to disappoint comrades or the unit.

Richardson felt that the small group factors helped the trained soldier to react to danger as a member of a group rather than as an individual. These sustainment factors balanced his personal instincts of self-preservation against the group instincts that are directed to a common resolution to overcome fear and danger for the good of the unit.

Finally, there was unit morale. Richardson believed that unit morale did not grow automatically but must have been deliberately fostered and nurtured. If unit morale was lost, it could take a long time to rebuild. Unit morale is evident by the esprit de corps that permeates throughout the organization as a whole.

C. THE EFFECTS OF FIRE

The indirect and direct fire firepower an infantry soldier would face in the next war would probably be more massive and devastating than ever seen before. Threat armies have built their ground forces and tactics around the doctrine of ponderous and massive artillery fire. The fire a front-line soldier will experience will most likely have an adverse effect to his combat effectiveness. An example of how massively artillery can be employed is the siege of Berlin by Soviet Army in 1945. It was estimated that the Soviets assigned the firepower of one artillery piece for every thirteen feet of frontage during their final offensive. The results were devastating and the German Army collapsed a few days later [Ryan, 1966].

When lethal weapons are used in combat, there are two types of effects that occur. The first type of effect is injury or physical damage to the target. This is the primary task of the weapon. The second type of effect is psychological. The psychological effect of artillery is a secondary task and in the vast majority of the time weapons are not designed for this particular type of task. Yet, the psychological effect may be the most detrimental factor to combat effectiveness.

Although the weapon was not primarily designed for its psychological impact, the employment of artillery as suppressive fire was directed to the psychology of the soldier.

Fear was the most common reaction of soldiers under indirect fire attack. Fear could lead to behavior that could compromise his assigned individual task as well as the mission of the unit as a whole [Swann, 1972].

The most extreme psychological effect was when a soldier became so highly stressed because of artillery bombardment that he psychologically departed from reality. According to Naylor (1964), the battle ingredient most apt to "break" a soldier was the explosion of a shell in the immediate vicinity. One study [Watson, 1978] of 115 consecutive patients diagnosed as blast-concussed showed that 105 were suffering mainly from a form of acute anxiety resulting from exposure to a nearby explosion. These cases were diagnosed as battle fatigue and will be discussed in more detail later.

A less severe effect of indirect fire that occurred on the battlefield more frequently. An example was given by Swann of how behavior that did not relate to the real situation could happen. There have been numerous cases where soldiers have fallen asleep at their positions during an intense battle. These men have become so highly stressed that their behavior was not purposeful to the situation. Because of this nonproductive behavior these soldiers have degraded their unit's effectiveness.

According to Swann, the most detrimental effect of suppression that lead to combat ineffectiveness was the inhibition of behavior. A soldier has been trained to respond to

threatening fire by taking protective cover and by avoiding exposure. Consequently, if his response was to take cover, he was prevented from carrying out his assigned mission. The degree to which he was inhibited depended upon how stressed the individual is by the bombardment.

Experimental studies conducted by Swann (1971) provided some data that defined the characteristics of a defender rendered ineffective by artillery suppression. The soldier did not observe and fire into his fields of fire at the enemy thirty percent of the time, he stayed under protective cover for periods longer than one minute, and he failed to meet the assault phase of the enemy attack with fire. A squad member was temporarily reduced to performance as an individual because he could not effectively communicate with the other members of his unit. If the soldier was attacking, he was eliminated from being an effective team player on his squad if he failed to respond to communication in less than thirty seconds. If the soldier was manning a defensive position, he would cease to be an effective soldier if he fails to respond to communication within ninety seconds.

Marshall (1947) found that when an advancing infantry line encountered intense enemy fire and the soldiers sought cover which physically prevented them from seeing one another, moral disintegration occurred. All organizational unity vanished temporarily and the unit ceased to be effective. What was a combat force now became a scattering of individuals.

The effect of suppression could be so severe that soldiers would be more concerned in finding cover and not employing their own weapon systems. Marshall surprisingly found that not more than twenty-five percent of men engaged in battle would fire their weapons and actively fight. This fact alone greatly diminished a unit's combat effectiveness in terms of ratio of firepower with the enemy. Swann (1971) found that a soldier spent less than ten percent of his time firing at the enemy, or he failed to be aware of the location and action of the nearby friendlies, or for periods greater than four minutes he did not fire or look at the enemy.

In some cases it was not the physical casualties that rendered a unit combat ineffective. Mills and Yale [Watson, 1978] undertook a study of human reactions to fragmentation weapons. They were interested in the distances over which various weapons would cause soldiers to keep their heads down and prevent them from effectively returning fire. The study tried to determine at what non-lethal ranges was artillery affecting them. They found that the soldiers were affected by incoming artillery that impacted at ranges forty percent more than lethal range.

D. LEADERSHIP

Etzioni (1965) defined leadership as the ability to elicit the follower's response in a broad range of matters. This ability was based on the personal qualities of the leader. It was this definition of leadership that most typified a

small-unit leader's role in combat. It was considered the leader's sole responsibility to accomplish the assigned mission of his unit, to motivate men to follow him into battle, and to control fear among his troops.

There were at least two aspects of leadership--the quality that enabled a man to confidently formulate a plan of action and his ability to persuade others to carry out the planned action. Success was the bridge between these two aspects. Once men were satisfied that their leader "had it in him" to lead successfully, they no more questioned his ability but gladly committed their lives to his keeping [Moran, 1967].

The impact of leadership on group behavior could be powerful. The results of a study completed by Bey (1972) showed how organizational stress significantly increased with the departure of the commander. These units had commanders who were effective as leaders, idolized by their men, and established informal ties with their subordinates. Some units did not become effective again until months later. Heymbeeck (1968) found that confusing and contradictory orders issued by leaders significantly increased the stress level of his soldiers.

Based on his observations, Marshall (1947) listed the characteristics a leader should possess to successfully prepare and lead his men into combat. These were:

1. Emphasis on the care of soldiers.
2. The administration of strict discipline and justice in all matters.

3. Military bearing.
4. A basic understanding of the simple fact that soldiers wished to think of themselves as soldiers and that all military information was nourishing for their morale.
5. Courage, innovation, and physical fitness.
6. An innate respect for the dignity of the position and the work of other men.

Field Marshal Erwin Rommel, one of the most competent tacticians in World War II, was an avid student of the art of leadership. Based on his experiences, he wrote:

The tactical leader of the future, who will decide the battle--for the main emphasis of future battles will be on the tactical destruction of the enemy's fighting powers--will need not only mental gifts of high order, but also great strength of character if he is to be a match for his task. Because of the great variety of tactical possibilities which motorization offers, it will in the future be impossible to make more than a rough forecast of the course of the battle. This being so, the issue will be decided by flexibility of mind, eager acceptance of responsibility, a fitting mixture of caution and audacity, and the greater control over the fighting troops. [Hart, 1953]

Rommel continued to elaborate on the necessary traits of a successful leader. The leader must have been tactically and technically competent. He must have initiative and energy. A leader must have led by personal example. And, finally, the leader must have tried to establish personal contact with his men, but without weakening his authority.

Anecdotal evidence and some experimental studies have shown leadership to be an important factor in the determination

of combat effectiveness. A more in-depth discussion of the theories of leadership was beyond the scope of this study. Extensive research have provided some inconclusive data on leadership that could be applied to leader-soldier relationships [Fiedler, 1964; Hersey and Blanchard, 1969].

E. TRAINING

The purpose of training was to ingrain into the soldier the skills necessary to survive and to fight effectively on the battlefield. It has been the ultimate goal of training to teach soldiers to instinctively perform basic tasks such as marksmanship, movement and his basic assigned mission as a member of a combat unit. Training has been the essence of the learning process in the military. Koman (1971) concluded that individual performance increased proportionally to the extent to which certain activities could be automated, which in turn left more room for mental work. This could only be achieved through long training and in collaboration with weapon systems.

One of the early proponents of the belief that training was an important ingredient to combat effectiveness was General George S. Patton. In 1918, he wrote:

The object of all training is to create a Corps d'Elite, that is a body of men who are not only capable of helping to win this war, but are determined to do so. It cannot be emphasized too often that all training, at all times and at all places, must aim at the cultivation of the OFFENSIVE SPIRIT in all ranks... [Blumenson, 1972]

Patton firmly believed that soldiers must understand that the skill they gained during training would have a direct result on the battlefield. Military instruction was not a matter of getting through a definite subject or time period, but of employing time to the fullest advantage. One of Patton's fundamental principles was that "tactics are the foundation of all training, for training has as its object the preparation of the soldier for war."

Collins (1978), a former army general, had put together a working philosophy of training for leaders. He believed that the essential characteristics of a good army were that it is well trained and well disciplined. Discipline derived and flowed from training and served to emphasize the fundamental point of the all encompassing nature of training. He stated that "training permeates everything a military organization does."

Collins wrote that success in battle was dependent on the coordinated effort of a number of small combat units working together to accomplish a mission. He further elaborated:

Other things being equal, the army with the best trained small units will prevail. Even when other things are not equal, the army with skilled soldiers and determined small units will sometimes defeat bigger and better equipped armies and will often confound and outlast their adversaries.

It should be noted that training should be relevant to the type of warfare being waged. Specifically, there were major differences in a conventional war vis-a-vis an unconventional war that should be taken into account in preparing

soldiers to fight effectively. For example, a soldier fighting guerillas should be better able to identify the enemy; to psychologically deal with the hit-and-run tactics of the enemy; and; to understand that the "offensive spirit" and possession of territory won in battle was sometimes meaningless in unconventional warfare [Burchett, 1966].

Military men agreed that there was not a better way to prepare men for combat than with good training. Although the Army placed heavy emphasis on training, evaluation tools used to assess training as an indicator for combat effectiveness were far from perfect. Medlin (1979) cited five major weaknesses of the Army Training and Evaluation Program (ARTEP) used to assess combat effectiveness of tactical units. These were:

1. Lack of standardized or scientific procedures for determining the individual and unit tasks that must be performed in combat.
2. Field exercises are often unrealistic and did not provide objective data for the evaluation team. Rarely was a combat environment simulated properly.
3. The ARTEP manual provided little or no guidance to evaluators on how to design exercise, to measure unit performance, or to evaluate the observed performance.
4. Lack of guidance on how users were to deal with the partially stochastic nature of combat.
5. The ARTEP did not provide guidance in how to develop training programs that addressed the results from the ARTEP evaluation.

Taking an opposite view, Sorley (1979) felt that reliance on statistical indicators to evaluate training was debilitating and damaging to combat readiness. He viewed statistical methods as being inherently flawed, sterile, and uninformative in judging performance. Training should be based on subjective personal evaluations of commanders on unit readiness.

F. STRESS

The concept of combat effectiveness cannot be thoroughly analyzed without discussing battlefield stress and its affect on the behavior of the combatant. Of the various situations which produced stress, combat was one of the most severe; prolonged fatigue, extended wakefulness, and great physical exertion aggravated the effects of the ever-present threat to survival [Davis, et al., 1955].

Grinker and Spiegel (1963) conducted a classic study on the effects of combat stress on Air Force fliers during World War II. The authors compiled and analyzed hundreds of case studies of men suffering from different degrees of combat stress. They identified two aspects of stress--emotional and physical.

The authors described the type of emotional stress encountered by men in battle as a complex network of unusual strains inherent in the combat environment. The stress was derived from different sources which mutually reinforced each other.

Although these sources were complexed and interwoven, they could be reduced to four principle categories:

1. The threat of personal injury or death.
2. The injury or death of friends with its powerful effect on intragroup dynamics.
3. The necessity to engage in a continually hostile and destructive activity.
4. The sum effect of all the strains, both physical and emotional, on the soldier's motivation to remain in combat.

The intensity of the problems resulting from emotional and physical stress varied greatly in individual cases. Everyone seemed to react to stress somewhat differently. At times during a battle the motivation became so intense, the morale so high, that soldiers were stimulated to tremendous feats of endurance, completely disregarding their physical fatigue and their fears. At other times, the morale was so low that even the slightest stress becomes unendurable. Grinker and Spiegel concluded that, in general, there was a fixed limit of tolerance to the stress of combat. If this limit was exceeded, combat fatigue and other stress disorders could occur.

A study done by a Johns Hopkins University research team (1952) concluded that, theoretically, every man had a breaking point. The study identified three factors that predisposed combat exhaustion (an extreme case of combat stress). These were:

1. Close and prolonged contact with friends killed or seriously wounded.
2. Incoming artillery and mortar fire, as opposed to small arms fire and close combat.
3. Being alone in a position of relative security where the pressure of interdependence was eliminated.

The study also concluded that some of the most important factors in establishing combat effectiveness was the cohesiveness of the small fighting group and the interdependence of the individuals.

The effects of the stress of isolation from a group could be extremely detrimental to an individual's well-being. Studies [Haggard, 1969] have shown that isolation could result in rapid ego disintegration, withdrawal, despair, hallucinations, and violent emotional reactions such as uncontrollable rage or self-pity. The inability to cope with isolation could lead to death. Thus, normal functioning of an individual depended in part on the existence of an environment with which he was familiar and could act effectively.

Bourne (1970) found that, all things being equal, the incidence of combat stress casualties varied considerably from one unit to another. He attributed the differences to the degree of morale in each unit. In this context morale was described by Bourne as the sense of well-being enjoyed by the group, confidence in their ability to survive in combat, faith in their leadership, and cohesiveness.

Sohlberg (1976), a psychologist for the Israeli Defense Forces, identified four factors that were described by soldiers in the Yom Kippur War as extremely stressful.

These were:

1. The sudden transition from peace to a full-blown war situation.
2. The physical and psychological strain and stress related to combat in general.
3. The abrupt transition from a period of heavy fighting to a period of relative quiet after the ceasefire.
4. The loss of comrades and the problem of survival guilt.

The physical stress of combat was compounded by the effects of emotional stress previously discussed. The effects of physical stress are cumulative and could only be curtailed by the removal of the individual from combat activity. Appel (1966) produced evidence that length of time in combat was directly related to the incidence of battle fatigue. After eighty to one-hundred days of combat exposure the psychological vulnerability of the soldier increased sharply with a probability that his effectiveness would decline.

A lack of sleep and proper nutrition contributed greatly to the stress encountered by the soldier. Menninger [Bourne, 1970] identified inadequate diet, chronic physical discomfort, exhaustion, and physical illness as contributing to a high incidence of psychiatric casualties.

The literature generally agreed that fatigue was the most predominant of the factors that caused physical stress. From

a series of experimental studies, Drucker et al., (1969) found that the performance of soldiers decreased significantly after forty-eight hours of sleep deprivation. Similar studies [Haggard, 1969] on sustained operations supported these findings.

Petersen (1971) viewed fatigue as an especially degrading factor to combat effectiveness. According to Petersen, the leader had the primary responsibility of minimizing fatigue and sustaining combat effectiveness. Effective training and experience should be applied to minimize the impact of fatigue in combat. Leaders should be able to identify men who were excessively fatigued and relieve them temporarily. Commanders should take action to prevent the ill effects of rumors, panic, and discouragement. Fatigued soldiers would more likely be susceptible to these influences. Finally, effective leadership encouraged self-confidence in subordinates which is essential for coping with fatigue in combat.

Although extreme stress could possibly be devastating to combat effectiveness, measures could be taken to minimize its effects. Immense progress had been made in the psychiatric field to deal with combat fatigue cases. For example, only six percent of all medical evacuations from Vietnam were for psychiatric reasons as compared to twenty-three percent in World War II [Bourne, 1970].

Some research has been done to attempt to identify individuals who may be predisposed to combat fatigue. This type

of research is the basis of preventive psychiatry that can reduce psychiatric casualties and increase combat effectiveness.

Grinker and Spiegler (1963) found that men suffering from severe combat stress either had latent or overt neurosis, low thresholds of anxiety, or were considered non-team players. Bourne (1970) found that psychiatric casualties in Vietnam consisted mainly of soldiers who either were not assimilated in their primary group during their first few weeks in combat, had poorer military records, or had a higher rate of disciplinary actions against them. The Johns Hopkins University study (1952) characterized high-risk individuals as having a background of poor parental relationships, poor civilian occupational pattern, anxiety at both the rifle range and the infiltration course, and low intelligence.

The key to adapting to the effects of stress on the battlefield was learning to cope with the hardships and strains encountered. Dimsdale (1978) interviewed numerous former concentration camp inmates to try to determine how did they learn to cope with the extreme amount of stress placed upon them. He identified seven major styles of coping that were used during their imprisonment. These were:

1. Differential focus on the good. Camp inmates adjusted their ideas of pleasure so that these ideas were congruent with the environment.
2. Survival for some purpose. For example, to seek revenge or help a friend through the hardship.

3. Psychological removal. This involved hardening of one's feeling or denial.
4. Concept and mastery. The inmate tried to express some type of autonomy and control over his own destiny.
5. The will to live. The most fundamental element of coping.
6. The mobilization of hope. This gave the inmates something permanent to hold on to.
7. Group Affiliation. This was vital in providing support, information, and protection. It was also important in reinforcing the person's sense of individuality and self-worth.

Soldiers became "battle hardened" by becoming less aware of his surroundings and desensitized to his own feelings.

Gray (1959) wrote:

The routine of military life, the repetition, drill, and uniformity of response, works to dampen and dull any individual intensity of awareness. Even the civilian soldier who finds the military way quite alien and strange can learn to hold fast to the few simple rules, to be a proper cog in the vast machine, and to suspend thoughts that might unfit him for his appointed mission. He learns to expect orders from above and pass them along to those under his control. Thinking tends to become not only painful but more and more unnecessary.

Finally, Koranyi (1977) echoed the beliefs of many military men by stating that the two most important factors capable of preserving stress-endurance in soldiers were the quality of leadership and the quality of leadership and the thoroughness of their training.

G. THE WILL TO FIGHT

Many authors have written on the reasons why soldiers fight. The basic issue was whether a soldier fought for simply patriotic reasons or for other less glorious but basic reasons.

Hauser (1980) identified submission as a basic motivator to fight. By simply being a soldier, an individual submitted himself to legitimate authority. He was made to endure the hardships and the strains of training and combat by his superiors. Ultimately, the soldier would continue to submit to the orders of legitimate authority, even though the orders may be contrary to his fundamental instincts of self-preservation. Once the legitimacy of his superior's authority was lost, military order disintegrated. The end product could be disobedience and loss of military effectiveness.

The willingness to endure battle was contingent upon definite psychological awards in the form of continued affection, interest, support, and appreciation. An effective combat soldier lived and died for his primary group. He fought effectively to meet the perceived expectation of him by his buddies. He was rewarded by their appreciation and their own self-sacrifice for him. His motivation continued because his suffering and possible death has the greatest meaning to his friends in his combat unit. Anything which indicated indifference to the war is interpreted as to be indifference to his sacrifice [Grinker and Spiegel, 1963; Marshall, 1947].

III. METHODOLOGY

In the present study the population of interest was limited to U.S. Army infantry officers in the rank of lieutenant colonel. At the time of this study, all of these officers were in command of an infantry battalion. The assumption was made that these officers had combat experience in Vietnam either as platoon leaders or company commanders. It was also assumed that since only a select few lieutenant colonels are chosen to command a battalion, these officers were most likely the best in their profession and had an excellent combat record. The representative sample was chosen from active Army divisions in the continental United States and Hawaii. Battalion commanders of eleven of the sixteen Army divisions were represented in the study. Every infantry battalion commander within these divisions were mailed a survey. The commanders sampled represented mechanized, airborne, airmobile, and light infantry structured battalions. The return rate was seventy-six percent.

The sample fairly represented the population of infantry lieutenant colonels in the Army. It was assumed that due to a centralized command selection process, most of the population had combat experience that was similar. The sample did not include either Army infantry colonels or generals who had small-unit leadership experience in combat. Marine Corps infantry officers were not included even though many had

extensive combat experience. Lieutenant colonels who had previously commanded were not representative in the sample. It was assumed that that particular variables that occur because of the nature of the warfare (conventional vis-a-vis unconventional) affected most of the population similarly since the majority of the combat experiences was in the military today was obtained in Southeast Asia.

The survey (Appendix A) consisted of four parts. Part I consisted of four questions that asked for demographic data. No identifying data were requested in order to preserve the anonymity of the respondents. Part II consisted of forty-five statements on human factors that affect combat effectiveness. The respondents were asked to answer to what degree they agreed or disagreed with on each statement. The scale ranged from 1 to 5, strongly agree to strongly disagree. In Part III, the respondents were next asked to rank order nine human factors in order of their importance in contributing to combat effectiveness and the will to fight. The scale ranged from 1 to 9, highest to lowest. These factors were considered as either psychological or physiological variables that could possibly enhance or degrade combat effectiveness. In Part IV, the respondents were then asked to answer two open questions if they so desired. These questions were designed to give the respondents the opportunity to contribute any information on combat effectiveness that could not have been presented in Parts II and III of the survey.

Because of the complexity of the subject being studied and the number of intangible factors involved, this study employed three types of questionnaire items. Hopefully, through this instrument sufficient and mutually supporting data will be obtained to support the given hypotheses. The rating scale was chosen because it reflects both the direction and degree of opinion, and the results are more amenable to analysis by statistical methods.

The primary purpose of the ranking of the human factors was to try to determine the importance of each factor on the battlefield when compared to all factors. Also, ranking and rating techniques were generally comparable. The importance of each human factor to combat effectiveness should ideally be reflected similarly on both the rating scale and the ranking items. There were several advantages in using open-ended questions. These questions allowed for the expression of issues of concern that may not have been explicit in the closed-end items. An open-ended question allowed the respondent to express views that were important to him and how strongly he felt about a particular issue. Finally, open-ended questions provided better insight and unique information about the problem.

IV. ANALYSIS

Statistical analysis of the survey data was accomplished with the aid of the statistical package for the social sciences (SPSS). Part II was analyzed in the following manner. The data was analyzed by comparing the mean responses of each human factor. The hypothesis being tested was:

H_0 : There are no relationships among the nine human factors outlined in this study and combat effectiveness on the battlefield.

H_1 : There is a relationship among the human factors of leadership and training, with combat effectiveness on the battlefield.

Subsequently, if training was found to be a related factor to combat effectiveness, it was then assumed that soldiers could be trained to withstand the rigors of battle. The hypothesis being tested was:

H_0 : Soldiers could be adequately prepared during peacetime to withstand the psychological rigors of combat.

H_2 : Soldiers could not be adequately prepared during peacetime to withstand the psychological rigors of combat.

The hypothesis was tested by utilizing a student's t-test. This test showed whether the observed differences in the means of the significant factors ($\bar{x} \leq 2$ or $\bar{x} \geq 4$ was considered significant) were due solely to sampling error to population differences as well at the .05 level.

A t-test was also administered between the means of training factor and the other human factors to determine if

training was a significant factor that was related to combat effectiveness.

A factor analysis was conducted utilizing varimax rotation to determine if an underlying pattern of relationships existed which would allow the reduction of the 45 responses in Part II to a different, even more manageable number of factors. The factor analysis presented the true number of factors at work within the study, of what variables the factors consisted of, their degree of interaction, and the magnitude of their influence. The analysis yielded several significant factors. Only variables that loaded high (a loading of .45000 or higher was considered high) were listed as comprising the specific factor.

Finally, a bivariate analysis of the data from Part II of the survey was conducted. The results provided information on whether the human factors were somehow correlated.

Part III was initially analyzed using a Kolmogorov-Smirnov one-sample test. This test analyzed the goodness of fit of the reported data by determining whether the observed data could have reasonably come from a theoretically normal distribution. Thus, this test showed whether a significant difference existed between the rankings in each category. Basically, the hypothesis being tested was:

- H_0 : There are not any differences between the rankings of the factors and any observed differences are merely chanced variations to be expected in a random sample.
- H_3 : There are significant differences in the rankings of the human factors at the .05 significance level.

If the observed value of the maximum absolute deviation was such that the probability associated with its occurrence was less than or equal to .05, the hierarchy of the significant factors would be determined by calculating the frequency of each category. The importance of each human factor would be determined by how low its assigned frequency was. Again, if training was found to have a low frequency, it was interpreted that soldiers could be trained to withstand the rigors of combat.

Next, the Spearman Rank Correlation Coefficient was determined to compare the rank orders of the respondents in terms of their degree of agreement with each other. Spearman's r_s were calculated to give some measure of how the respondents' rankings of factors were similar or dissimilar with each other. In other words, how were the factors related to each other in the context of how the respondents tended to rank order them. Spearman's r_s was defined as the sum of the squared differences in the paired ranks for two variables over all cases divided by what the squared differences in ranks would have been had the sets of rankings been totally independent.

Part IV, the open-ended questions, were analyzed by simply presenting the quoted statements of the respondents. Statements were grouped in terms of a common theme and uniqueness of thought.

The next chapter will present the results of the data analysis.

V. RESULTS

A. SAMPLE PROFILE

Analysis of the demographic data yielded the following information about the sample profile. Mean time in service was 18.5 years with a range from 16 to 24 years. The mean length of combat experience was 1.84 years with a range from ten months to 3 years. The mean age of the respondents was 40.12 years with a range from 35 years to 45 years. Seven of the respondents received their commissions from USMA; twenty-eight from ROTC; thirteen from OCS, and; one from a direct commission.

B. COMPILATION OF RESPONSES

A summary of the data in Part II of the survey (responses concerning the human factors) was presented in Appendix B. The respondents tended to agree that leadership was related to combat effectiveness. This was indicated by the group mean of questions pertaining to leadership in Part II of the survey (Appendix C). The leadership factor was followed by the factors of acceptance by the unit and the ability to withstand fire, both of which had the same mean.

A t-test was conducted between the group mean of the items in the survey that represented leadership and the group mean of the items that represented the other eight human factors to determine whether there was a significant difference (Table I). Leadership was tested against the other

TABLE I

T-Test Between Leadership and Combined Human Factors

<u>VARIABLE</u>	<u>DEGREES OF FREEDOM</u>	<u>MEAN</u>	<u>T-VALUE</u>	<u>2-TAIL PROBABILITY</u>
Leadership	49	1.97	-12.21	.000
Combined human factors		2.71		

factors because it was the only factor to have $\bar{x} \leq 2$. The t-test was conducted to test the following hypothesis:

H_0 : There are no relationships among the nine human factors outlined in this study and combat effectiveness on the battlefield.

H_1 : There is a relationship among the human factor of leadership and combat effectiveness on the battlefield.

If the earlier assumptions were correct, the results of the test would have allowed the rejection of the null hypothesis and the acceptance of the alternate hypothesis. This would indicate that certain human factors affected combat effectiveness differently at the .05 significance level.

The t-test indicated a significant difference between leadership and the other human factors. The t-value of -12.21 had a probability of occurrence close to zero, well within the .05 significance value. The results allowed the rejection of the null hypothesis and the acceptance of hypothesis 1. Thus, it was deduced from these findings that there were differences between the combined human factors and leadership

in terms of their relationship to combat effectiveness and that the observed differences in the group means were not the result of chanced variations to be expected in a random sample.

To test whether training was significant in preparing soldiers for combat, a t-test was conducted in Part II of the survey between the group mean of the items that represented training and the group mean that represented the other eight items to see whether the difference between the two means were significantly different at the .05 significance level (Table II). The hypothesis being tested was:

- H_0 : There are no relationships among the nine human factors outlined in this study and combat effectiveness on the battlefield.
- H_2 : There is a relationship among the human factor of training and combat effectiveness on the battlefield.

TABLE II

T-Test Between Training and Combined Human Factors

<u>VARIABLE</u>	<u>DEGREES OF FREEDOM</u>	<u>MEAN</u>	<u>T-VALUE</u>	<u>2-TAIL PROBABILITY</u>
Training	49	2.67	1.15	.256
Combined human factors		2.56		

Based on these results, it could be implied that training was not found to be significantly different from the other

human factors. The t-value of 1.15 had a probability of occurrence .256 which was greater than the .05 significance level. This meant it could not be concluded from the data that training among the human factors was considered significantly related to combat effectiveness. Thus, the results of the t-test showed that the respondents did not consider training to be related to combat effectiveness more so than any other identified human factor. Based on these results, the null hypothesis was accepted and hypothesis 2 was rejected.

Utilizing the Kaiser Criterion, factor analysis of the data in Part II of the survey yielded twelve factors with eigenvalues of 1.0 or greater. Analysis was limited to the first seven of these factors which accounted for 76.6 percent of the total variance of the factors (Appendix D).

Utilizing the factor loadings in the varimax rotated factor matrix, only questions from Part II of the survey which loaded higher than .45000 were considered in the analysis (Appendix E). Analysis of these seven factors indicated that these factors were composed of the following types of items--six items related to leadership, five items related to training, three items related to the perception of survivability, three items related to hunger, three items related to acceptance by the unit, three items related to combat experience, one item related to fatigue, and one item related to the ability to withstand fire. Of these seven

factors, three of these factors consisted of a predominant cluster of questions that pertained to a particular human factor. These factors were Factor 1 (Training), Factor 3 (Leadership), and Factor 4 (Leadership). This led to the conclusion that of the responses to the questions in Part II of the survey, only those that pertained to leadership and training tended to cluster together in any sort of magnitude. This led to the belief that the respondents were fairly consistent in their responses to questions that addressed these two human factors.

The results of the bivariate analysis of the data from Part II of the survey did not indicate significant correlation ($> |.40|$) between the human factors (Appendix F). Although many of the correlations were far from zero, the values were not significant for a sample of this size.

C. ORDINAL RANKING

Part III of the survey (ordinal ranking) was initially analyzed by the Kolmogorov-Smirnov one-sample test to determine whether there were significant differences between the rankings of the respondents to support the assumption that the rankings of the human factors were normally distributed (Appendix G).

The hypothesis that was tested was:

H_0 : There are not any differences between the rankings of the factors and any observed differences are merely chanced variations to be expected in a random sample.

H₃: There are significant differences in the rankings of the human factors at the .05 significance level that implies that the data are normally distributed.

The results indicated there was a difference between respondents among their ratings of the human factors. The analysis determined the responses to be normally distributed. Thus, the null hypothesis was rejected and hypothesis 3 was accepted.

As a result of the normal character of the data, cumulative frequencies of scores of each of the nine human factors were calculated to determine to what extent each of the factors affected combat effectiveness (Table III). Since a rating of "1" by the respondent indicated that the particular human factor was the most important, it was assumed that the lower the frequency, the greater the importance of the particular human factor to combat effectiveness.

The results clearly indicated leadership ranked higher than any other of the nine human factors in terms of importance to combat effectiveness. In addition, training was rated second highest in importance. Based on these results, it could be safely assumed that training was an important factor that was significantly related to combat effectiveness.

Finally, Part III of the survey was analyzed using the Spearman Rank Correlation Coefficient to determine the relationships between the human factors in the context of the rank orderings (Appendix H).

TABLE III

Frequency of Ratings for Each Human Factor

<u>RANK</u>	<u>HUMAN FACTOR</u>	<u>FREQUENCY</u>	<u>RELATIVE FREQUENCY</u>	<u>CUMULATIVE FREQUENCY</u>
1	LEADERSHIP	83	.036	.036
2	TRAINING	150	.065	.101
3	ACCEPTANCE BY UNIT	202	.088	.189
4	COMBAT EXPERIENCE	215	.093	.282
5	SOLDIERS' BELIEF IN JOB	258	.112	.394
6	ABILITY TO WITHSTAND FIRE	308	.134	.528
7	FATIGUE	346	.150	.678
8	POSSIBILITY OF SURVIVAL	358	.155	.833
9	HUNGER	386	.167	1.00

Like the results of the bivariate correlation test of Part II, there seemed to be little relationship between most of the variables. However, three pairs of the variables were significantly related ($> |.40|$). These pairs of factors were:

1. Combat Experience with Soldier's Belief in Job (negatively correlated).
2. Training with Acceptance by the Unit (negatively correlated).
3. Possibility of Survival with Acceptance by the Unit (negatively correlated).

What was particularly interesting was the relationship between combat experience and a soldier's belief that what he was doing was right. This pheomenon will be discussed in more detail in Chapter VI.

D. OPEN RESPONSES

Part IV of the survey was analyzed by presenting the data in terms of general consensus and also uniqueness of thought (Tables IV and V). The data provided by the respondents was both detailed and comprehensive.

TABLE IV

Responses to Question 1, Part IV of the Survey

While leading in combat, what gave your soldiers the will to fight?

"Confidence and faith that I, their leader, knew my job..."

"Confidence in their leaders."

"Unit identity and cohesion."

"Sense of togetherness."

"The desire to survive."

"Confidence in the chain-of-command."

"Success in combat."

"Good, solid leadership by example."

"I believe that soldiers fight because they want to do what is right."

"Believing in what they were doing."

"Fear of letting their buddies and leaders down..."

"Leadership."

"Confidence in their professional training."

"Outrage toward the enemy."

"Dynamic leaders of the 'down to earth', practical type."

"Peer pressure--image enhancement."

"Self-confidence."

"The belief that superior headquarters were concerned and able to provide medical assistance, rations, and backup forces."

TABLE IV (Cont.)

"The belief that if our forces did not kill, destroy, or capture the enemy, the enemy would kill, destroy, and capture us."

"Excellent small-unit leadership."

"Confidence that immediate leaders were knowledgeable and were not foolhardy."

"Discipline."

"Fear of letting their buddies down."

"Their buddies and then their leaders."

"Survival."

TABLE V

Responses to Question 2, Part IV of the Survey

Are there are viable ways leaders can prepare soldiers for combat?

"A leader in combat must have earned the respect of his men."

"Not within the current restraints. Prohibitions to hazardous training environments precludes effective realism which is needed to place stress on soldiers."

"Physical conditioning."

"Establish and maintain discipline in all the little areas."

"Train commanders to communicate with their soldiers."

"Make training hard and realistic."

"Live fire exercises which include overhead fire, close artillery, and mortar fire."

"Foster a sense of cohesion and mutual confidence based on shared experiences."

"Tough and realistic training."

"Nothing can replace the din, the confusion, the moaning, the death, the knowledge to control fear..."

"Mental toughness training."

"Develop and demand immediate reaction to orders."

"Discuss the realities of war with junior leader."

"Present combat film footage and discuss it with leaders and soldiers."

TABLE V (Cont.)

"Be concerned with soldiers and let it show."

"Lead by example."

"Focus on the use of weapon systems and physical training."

"Teach them to kill."

"Convince the soldiers you are competent and will not needlessly endanger their lives."

"Stability in leaders procedures, SOPs, and crews."

"Let them see and hear competent leaders up front with them."

"To be successful, we must learn to improvise and to do without in training since we'll never have all we need in combat."

"To be effective in combat we must focus upon sustainability."

VI. CONCLUSION

A. SUMMARY

The study of combat effectiveness was characterized by a host of complex and intertwined factors which made empirical research difficult. A complete study of combat effectiveness on the battlefield required the basic understanding of the psychology of the individual soldier--namely, identifying the motivators which gave the soldier the will to fight. The difficulty of this task was illustrated by a study undertaken by Tyagi et al., (1976). This study on courage found that anxiety, leadership, personality make-up, morale, and job efficiency individually did not determine courage.

This study attempted to provide empirical data which would show what, if any, human factors were significantly related to the combat effectiveness of the individual soldier on the battlefield. This study focused on a sample of fifty infantry battalion commanders who all had experience as small-unit leaders in combat. Data was collected by administering a survey in which responses would be based on the personal experiences of the respondents in combat. The survey was designed around nine human factors that could affect the combat effectiveness of soldiers in battle. These human factors were leadership, training, acceptance by the unit (cohesion), a soldier's belief in what he was doing, combat experience, the ability to withstand fire, perception of survival possibility,

hunger, and fatigue. Three different forms of responses were requested in the survey. The first method used was an interval scale to determine to what degree the respondents agreed or disagreed whether certain human factors affected combat effectiveness. The second method was an ordinal scale. The respondents were asked to rank order the nine human factors in terms of the item's importance to combat effectiveness. Finally, the third method consisted of two open-ended questions. These questions were designed to provide additional and in-depth information in two areas of inquiry--what motivated soldiers to fight and what could be done to prepare soldiers for the shock of combat. Two alternate hypotheses were developed regarding the data: (H_1) There was a significant relationship among the nine human factors and combat effectiveness on the battlefield, and (H_2) that a soldier could be prepared to withstand the rigors of combat.

The results of this study fully supported hypothesis one and partially supported hypothesis two. The results of Part II of the survey indicated that among the nine human factors, leadership was the most significantly related. This conclusion was based on two phenomena. First, leadership had, by far, the lowest group mean. Second, the statistical analysis between leadership and the other human factors indicated that leadership was significantly different from the other factors. Thus, the respondents tended to agree that leadership was an important factor that influenced combat effectiveness.

The group mean of the training factor was not shown to be significantly different from the combined means of the other eight factors. Relative to the other factors, statistical analysis determined that the training factor was not significantly related to combat effectiveness. But the factor analysis with varimax rotation of the data in Part II resulted in Factor 1 consisting of six items, in which four of these items pertained to training. Thus, it could be assumed that since Factor 1 accounted for more variance than the other factors, training was an important variable which accounted for much of the variance in this factor. Although the results in Part II of the survey were inconclusive in demonstrating the importance of training to combat effectiveness, the training factor could not be completely disregarded.

Further analysis of the data in Part II led to the conclusion that the human factors were generally independent of each other. The results of the bivariate correlation test failed to show any significant correlation between the human factors. This led to the assumption that respondents tended to agree or disagree about the importance of a human factor irrespective of its relationship to the other factors.

The analysis of the data in Part III of the survey substantiated the results of Part II. Due to the results of the Kolmogorov-Smirnov one-sample test, the distribution of rankings were assumed to be normal. Subsequently, the frequency of the rating scores for each factor were used to

determine the hierarchy of factors in terms of importance. Leadership tended to be rated as the most important factor that affected combat effectiveness. This conclusion was based on the fact that leadership had the lowest frequency of total rating scores.

The training factor received rating scores that had a combined frequency second only to leadership. Although the frequency of rating scores were not as low as those of leadership, the scores were significantly lower than the scores produced by the third most important factor (combat experience). The results were interpreted to mean that the respondents tended to consider training to be an important factor to prepare soldiers to be combat effective on the battlefield.

In terms of importance, the human factors of acceptance by the unit and combat experience was considered fairly important in determining combat effectiveness. A soldier's belief in what he was doing was right and the ability to withstand fire was generally rated toward the middle in importance. Perception of survival possibility, hunger, and fatigue were generally rated low in importance to combat effectiveness.

Unlike the results in Part II of the survey, three pairs of the human factors were found to be significantly correlated. The Spearman rank correlation coefficient analysis indicated acceptance by the unit was significantly correlated with training and the perception of survivability. What was especially noteworthy was the correlation between combat experience and

a soldier's belief in what he was doing was right. The relationship between these two factors could possibly be explained by the "desensitization" process a soldier could undergo during his tour in combat. The longer a soldier was exposed to the realities of war, the less important beliefs, values, and justification for his actions become.

Part IV of the survey provided results that generally supported the findings in Parts II and III. Even though the data in Part IV did not allow for any type of statistical analysis, valuable information was obtained. The general consensus among the respondents indicated that there were certain human factors that were important to combat effectiveness. Invariably, the respondents agreed that realistic training was key to preparing soldiers for combat. There were numerous responses which indicated that leadership and cohesion were very important factors that motivated soldiers to fight. The respondents indicated that a soldier's faith in his leaders was vital to combat effectiveness. Additionally, the respondents generally felt that soldiers fought for their "buddies." He was motivated to fight by the expectations by his peers of him and the fear of letting "his buddies down." Also, the respondents indicated a sense of survival and outrage to be significant motivators.

B. DISCUSSION

It was evident why leadership, relative to the other human factors, was considered a very important factor that affected

combat effectiveness. The basic premise that defined leadership in the military was that the leader was responsible for everything his soldiers did or failed to do. The responsibility of the leader was both awesome and comprehensive. The general feeling reflected by the results of the survey was that, ultimately, the small-unit leader determined the effectiveness of soldiers in combat. It is the leader's responsibility to prepare and to motivate soldiers to fight effectively on the battlefield. The respondents overwhelmingly seemed to feel that the soldier's faith in his leadership directly affected his motivation to fight. The results of Parts II and III of the survey statistically reaffirmed the stated feelings of the respondents--leadership was the most vital ingredient to the combat effectiveness of men in battle.

Although training was not shown in Part II to be significantly different from the other human factors, the training factor was indicated to be important in Parts III and IV. The respondents generally felt that realistic training was necessary to prepare men for combat. It was implied from this response that soldiers could be prepared to withstand the psychological rigors of combat. Thus, the better trained a soldier was, the better his chances to survive and to fight effectively in combat.

Surprisingly, the respondents did not consider combat experience nor cohesion as dominating factors that affected combat effectiveness. It could be that while combat experience improved one's chances of survival, it did not necessarily

improve one's combat effectiveness. For example, over a period of time in combat a soldier might learn to avoid tasks and missions that might be hazardous to him but vital to the overall mission. This could possibly be illustrated by the example presented by Marshall previously discussed in Chapter II. Marshall found that less than thirty percent of soldiers engaged in combat fire their weapons. One explanation could be that the learning process a soldier underwent dictated that soldiers might have a better chance of survival if they did not expose themselves and place fire upon the enemy.

Although acceptance by the unit was not indicated to be a significant factor, the responses to Part IV of the survey placed much importance on cohesion as an important part of combat effectiveness. The respondents felt cohesion to be a driving factor that motivated soldiers to fight. The importance of cohesion in a war (Vietnam) characterized by short combat tours was especially noteworthy. Considering the short tours (thirteen months) and the individual replacement system, cohesion was a factor that developed quickly within units. Effective cohesion solidly established itself amidst high turnover and short-term comradeship within the small unit.

C. RECOMMENDATIONS

This section outlined two recommendations based on the results of this study.

RECOMMENDATION1: The current leadership program for junior officers should be reviewed with particular attention

to the addition of an education program on the "realities of war." This program would generally entail educating young officers on what could be expected on the battlefield in terms of soldier behavior under fire and other psychological variables.

The small-unit leader must have become aware of how vital his role as leader was to the survival of his subordinates and to the successful accomplishment of the mission. He must have become as educated as he possibly could in a peacetime environment on how soldiers would be expected to behave while under fire. The leader must somehow have become aware of the initial shock and din of high intensity warfare that could encounter on the battlefield. Hopefully, by preparing the leader for the psychological realities of battle beforehand, casualties and the initial decrease of combat effectiveness would be minimized.

The training requirements for this program would be minimal. It would be pertinent that this program be presented by seasoned combat veterans. Realism could be enhanced by the extensive use of combat film footage.

RECOMMENDATION 2: Ensure training is made as realistic as possible at all levels of command. This should include increased emphasis on live-fire maneuver exercises and sustained combat operations.

The establishment of the National Training Center was definitely a step toward the right direction. Here, battalion-size units have the opportunity to maneuver and to employ all of their weapon systems in a very realistic combat

environment. The problem was that battalions have the opportunity to undergo this training once a year, at best. More of this type of training should be made more available to all levels of command much more frequently.

The effectiveness of combat units could be better evaluated by field training exercises that lasted several weeks at a time and that increased the stress level of soldiers. The stress factor could be induced by sleep deprivation due to sustained physical and mental activity and by meager and infrequent food rations. It was very evident during short term tactical evaluations (similar to the ARTEP) that most leaders performed at a very high activity level with little or no sleep. It was questionable whether these leaders could maintain this activity during long periods of combat operations. In turn, this would question the combat effectiveness of units in sustained operations.

C. FURTHER RESEARCH

Added research was definitely needed in the area of the study of the psychological aspects of combat effectiveness. There were two basic areas that research similar to this study could be applied to increase the understanding of this complicated subject.

First, data on the relationship between human factors and combat effectiveness should be obtained from individuals with combat experience other than Vietnam. It was possible that the results obtained from this study did not truly reflect

the importance of human factors such as fatigue, hunger, reconstitution, and the ability to sustain intense fire. The following reasons could possibly explain the potential discrepancies that could occur:

1. Combat soldiers in Vietnam did not, as a rule, experience ponderous indirect fire attacks as would be expected from an attack from the Warsaw Pact nations.
2. Generally, soldiers were not kept in the combat zone longer than thirteen months at a time during the Vietnam War. This period was much shorter than World War II or the Korean Conflict.
3. Soldiers did not experience the debilitating effects of severe cold weather which could decisively influence combat effectiveness.
4. As a rule, there was never a serious resupply problem to units in combat in terms of food and the basic supplies.
5. Units generally rotated to rear areas for rest regularly.

Second, the sample in this study consisted of all officers. The possibility existed where the opinions expressed by the sample might differ quite significantly from a sample consisting of non-commissioned officers (NCOs) with combat experience. A study should be undertaken to compare the results between officers and NCOs. Hopefully, the results could provide some groundwork in clarifying and resolving differences between

the two groups which, ultimately, should enhance the overall effectiveness of combat units.

APPENDIX A

HUMAN FACTORS SURVEY

NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA - 93940

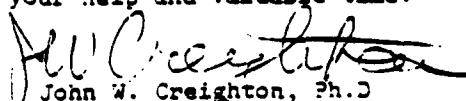
IN REPLY REFER TO:
NC4 (54C2)/cdm
15 January 1982

To: Questionnaire Recipient

This questionnaire is part of a study to determine to what degree various human factors affect combat effectiveness and the soldier's will to fight on the battlefield. Some of the factors being studied are fatigue, hunger, combat experience, training, and the ability to withstand the shock of battle. We believe that the best way to understand what factors affect the combat effectiveness of the individual soldier is to ask infantry leaders with extensive combat experience at the small unit level. Thus we would deeply appreciate your cooperation in completing this questionnaire.

Specific instructions on completing the questionnaire can be found on the inside cover. Note that there are four parts to the survey. Part I consists of basic demographic questions. Part II asks to what extent do you agree or disagree with certain statements that pertain to combat effectiveness. Part III consists of nine factors that affect combat effectiveness and the will to fight. This part asks you to rank order these factors according to importance. Part IV are open ended questions. Please feel free to add any comments on combat effectiveness and the soldier's will to fight that may not have been touched upon in this questionnaire. The questionnaires are completely confidential. The individual identity of respondents will not be recorded. Please return the questionnaire as soon as possible.

Thank you very much for your help and valuable time.


John W. Creighton, Ph.D.
Professor of Management

Instructions

The questionnaire is self-explanatory. If there is any difficulty in interpreting the questions, try to give the most reasonable answer possible. When you are through, put the entire questionnaire in the accompanying envelope and mail. It will probably take 30-35 minutes to complete the questionnaire.

All responses will be kept strictly confidential. There is not a record of which individuals participate in the study. Complete frankness will greatly enhance the value of the study.

Part I: Demographic Data

For each of the following questions please check the box or fill in the appropriate information which most accurately indicates your answer to the question.

1. Age: _____

2. How many years do you have of combat experience?

- ☐ 1. 0-1 years
- ☐ 2. 2-3 years
- ☐ 3. other (specify) _____

3. What is your source of commission?

- ☐ 1. USMA
- ☐ 2. ROTC
- ☐ 3. OCS
- ☐ 4. Direct Commission

4. Years of service: _____

Part II: Human Factors That Affect Combat Effectiveness

The following are 45 statements on factors which may affect combat effectiveness and the will to fight of front line soldiers in a high intensity combat environment. We are interested in knowing, based on your combat experience, to what extent do you agree or disagree with each statement.

Note: Read these answer choices over carefully.

Then answer each of the following questions by placing an X in the box under the answer you want to give.

	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
1. Soldiers will continue to fight effectively as long as there is any hope for survival.	☐	☐	☐	☐	☐
2. A combat unit should be able to fight indefinitely without relief or rest.	☐	☐	☐	☐	☐
3. The main reason soldiers fight is because of their dedication and loyalty to their buddies.	☐	☐	☐	☐	☐
4. Realistic training prepares soldiers adequately for combat.	☐	☐	☐	☐	☐
5. The longer a soldier is in a combat environment, the greater his chances of survival.	☐	☐	☐	☐	☐
6. The frequency and amount of rations a soldier in combat receives significantly affects his will and ability to fight.	☐	☐	☐	☐	☐
7. The main reason soldiers fight is fear.	☐	☐	☐	☐	☐

	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
8. Current training doctrine adequately prepares soldiers for the shock of combat.	☐	☐	☐	☐	☐
9. The psychological effect of ponderous artillery attack on troops can greatly degrade combat effectiveness and the will to fight.	☐	☐	☐	☐	☐
10. Combat survival cannot really be taught but must be gained by experience.	☐	☐	☐	☐	☐
11. How successful a unit is in combat is determined by how well-fed and nourished its soldiers are.	☐	☐	☐	☐	☐
12. The individual need to survive is what motivates soldiers to fight in combat.	☐	☐	☐	☐	☐
13. The amount of rest a unit has is an important consideration in determining whether that unit is committed into a tactical combat mission.	☐	☐	☐	☐	☐
14. Newly formed squads with combat experienced soldiers are more combat effective than squads that consist of soldiers that have worked together for a long time but are not combat experienced.	☐	☐	☐	☐	☐
15. I currently have the resources to properly train soldiers to survive and fight in a high intensity combat environment.	☐	☐	☐	☐	☐

- | | Strongly Agree | Agree | No Opinion | Disagree | Strongly Disagree |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| 16. There is no practical way to prepare soldiers for the psychological shock of ponderous artillery bombardment. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 17. A unit that has been engaged in combat for three or more months is far more able to succeed in accomplishing a tactical mission than a newly committed "green" unit. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 18. Hunger diminishes a soldier's will to fight. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 19. A unit's combat effectiveness depends mainly on its leadership. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 20. A soldier's will to fight is significantly affected by his belief that what he is doing is right. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 21. A soldier will lose his will to fight as the reality of war (death and destruction) becomes more apparent. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 22. ARIEPs and other evaluation tools accurately measure how well a combat unit will survive and fight in combat. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 23. The will to fight is considerably affected by fatigue. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 24. As casualties within a soldier's squad increases, his will to fight becomes more intense. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 25. A soldier's fighting ability diminishes significantly if, because of combat losses, he is reassigned to a reconstituted unit. | ☐ | ☐ | ☐ | ☐ | ☐ |

	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
26. It can be determined how well a soldier will fight by how well he performs in training.	☐	☐	☐	☐	☐
27. The longer the period of combat experience a soldier obtains, the greater his will to fight.	☐	☐	☐	☐	☐
28. A soldier must know why a particular tactical operation is taking place if he is to be combat effective.	☐	☐	☐	☐	☐
29. A unit that is not well-fed will eventually become combat ineffective.	☐	☐	☐	☐	☐
30. A soldier's values must be congruent with the goals and objectives he is fighting for if he is to maintain his will to fight.	☐	☐	☐	☐	☐
31. Soldiers will cease to be combat effective when they perceive that there is no hope for victory.	☐	☐	☐	☐	☐
32. A soldier's initial reaction to his first battle experience is that of shock.	☐	☐	☐	☐	☐
33. A unit cannot become combat effective without good leadership.	☐	☐	☐	☐	☐
34. Morale and the will to fight is greatly enhanced by frequent and adequate rations.	☐	☐	☐	☐	☐
35. A soldier will lose his will to fight in sustained combat operations without adequate sleep.	☐	☐	☐	☐	☐
36. Soldiers obtain their will to fight from their leaders.	☐	☐	☐	☐	☐

	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
37. The clearer a soldier's understanding of the reason for a particular tactical operation, the greater his willingness to fight.	☐	☐	☐	☐	☐
38. A combat unit cannot fight effectively without cohesiveness and communication among its members.	☐	☐	☐	☐	☐
39. It is the primary responsibility of the small unit leader to motivate his soldiers to fight.	☐	☐	☐	☐	☐
40. I am confident that soldiers can be trained to withstand the psychological rigors of combat.	☐	☐	☐	☐	☐
41. A soldier's will to fight and chances of survivability depend significantly on his acceptance as a member of his squad and platoon by his peers.	☐	☐	☐	☐	☐
42. No matter what the odds are against victory, a unit will fight indefinitely if there is effective leadership.	☐	☐	☐	☐	☐
43. It is most probable that a unit will maintain its will to fight and combat effectiveness even though its leaders have become casualties.	☐	☐	☐	☐	☐
44. A unit will fight only as well as its leaders can lead.	☐	☐	☐	☐	☐
45. It is the responsibility of the leader to control fear in his soldiers.	☐	☐	☐	☐	☐

Part III: Please rank order the following human factors in order of their importance in contributing to combat effectiveness and the will to fight (1-highest, 9-lowest).

__training

__fatigue

__perception of survival possibility

__the ability to withstand ponderous direct and indirect fire

__hunger

__combat experience

__competent leadership

__acceptance and sense of belonging to unit

__a soldier's belief that what he is doing
is right

Part IV: Open Questions

Please add any comments or opinions pertaining to the following questions which may add more insight into our study of combat effectiveness and the soldier's will to fight.

1. While leading in combat, what gave your soldiers the will to fight?

2. Are there any viable ways leaders can prepare soldiers for combat?

APPENDIX B

SUMMARY OF THE RESULTS OF THE DATA IN PART II OF THE SURVEY

<u>QUESTION</u>	<u>HUMAN FACTOR</u>	<u>MEAN</u>	<u>STANDARD DEVIATION</u>
1	Training	1.94	.867
2	Fatigue	4.36	.693
3	Acceptance by Unit	2.14	1.03
4	Training	1.94	.843
5	Combat Experience	2.26	1.08
6	Hunger	2.76	1.021
7	Perception of Survival Possibility	3.72	.904
8	Training	3.58	1.07
9	Ability to Withstand Fire	1.76	.657
10	Combat Experience	3.46	1.07
11	Hunger	3.86	.808
12	Perception of Survival Possibility	2.50	1.07
13	Fatigue	2.24	.870
14	Combat Experience	3.44	.929
15	Training	3.12	1.24
16	Ability to Withstand Fire	2.88	1.19
17	Combat Experience	1.64	.663
18	Hunger	2.84	1.04
19	Leadership	1.64	.722

20	A Soldier's Belief in the Mission	2.08	.804
21	Perception of Survival Possibility	3.78	.764
22	Training	3.42	1.11
23	Fatigue	2.06	.767
24	Acceptance by Unit	3.22	1.04
25	Acceptance by Unit	2.82	.962
26	Training	2.80	.969
27	Combat Experience	3.16	1.02
28	Soldier's Belief in Mission	3.10	1.07
29	Hunger	2.74	1.01
30	Soldier's Belief in Mission	2.66	1.10
31	Perception of Survival Possibility	3.22	1.06
32	Combat Experience	2.30	1.04
33	Leadership	1.46	.503
34	Hunger	2.22	.840
35	Fatigue	2.62	.923
36	Leadership	2.22	.887
37	Soldier's Belief in Mission	2.16	.912
38	Acceptance by Unit	1.50	.544
39	Leadership	1.70	.707
40	Training	1.88	.799
41	Acceptance by Unit	1.90	.789

42	Leadership	1.92	.778
43	Leadership	3.14	1.09
44	Leadership	1.88	.918
45	Leadership	1.86	.756

APPENDIX C

PERCEPTIONS OF COMBAT COMMANDERS AS TO THE INTENSITY OF IMPORTANCE OF INDIVIDUAL HUMAN FACTORS TO COMBAT EFFECTIVENESS

HUMAN FACTOR	RANK	MEAN	STANDARD DEVIATION	VARIANCE
Leadership	1	1.97	.487	.237
Acceptance by unit	2	2.32	.697	.485
Ability to withstand fire	2	2.32	.792	.627
A soldier's belief in his mission	3	2.50	.688	.473
Training	4	2.67	.742	.560
Combat Experience	5	2.71	.750	.562
Hunger	6	2.88	.600	.358
Fatigue	7	2.89	1.279	1.636
Perception of survival possibility	8	3.31	.592	.351

APPENDIX D
RESULTS OF THE FACTOR ANALYSIS

FACTOR	EIGENVALUE	PERCENTAGE OF VARIANCE	CUMULATIVE PERCENTAGE
1	4.822	17.9	17.9
2	4.069	15.1	33.1
3	3.075	11.4	44.5
4	2.467	9.2	52.7
5	2.251	8.4	62.1
6	2.188	8.1	70.2
7	1.718	6.4	76.6

APPENDIX E

COMPOSITION OF THE RESULTS OF THE FACTOR ANALYSIS

Major Human Factors Comprising Factor 1

RANK	QUESTION	HUMAN FACTOR	LOADING
1	24	Acceptance by the unit (casualties)	.74423
2	15	Training (resources)	.71388
3	22	Training (evaluation)	.67206
4	8	Training (doctrine)	.64942
5	1	Perception of survival (hope)	.54428
6	4	Training (realistic training)	.46563

Major Human Factors Comprising Factor 2

RANK	QUESTION	HUMAN FACTOR	LOADING
1	31	Perception of survival (hope for victory)	.79531
2	35	Fatigue (sustained combat operations)	.68377
3	21	Perception of survival (reality of war)	.59222
4	30	Belief in what he is doing (values)	.50037
5	29	Hunger (well-fed)	.48839

Major Human Factors Comprising Factor 3

RANK	QUESTION	HUMAN FACTOR	LOADING
1	18	Hunger (will to fight)	-.69154
2	39	Leadership (motivation to fight)	.58109
3	33	Leadership	.55211
4	6	Hunger	.54689

Major Human Factors Comprising Factor 4

RANK	QUESTION	HUMAN FACTOR	LOADING
1	19	Leadership	.82767
2	42	Leadership (will to fight)	.68511
3	45	Leadership (control fear)	.49828

Major Human Factors Comprising Factor 5

RANK	QUESTION	HUMAN FACTOR	LOADING
1	41	Acceptance by the unit	.65858
2	26	Training (performance in training)	.59643
3	14	Combat experience (reconstitution)	.47525

Major Human Factors Comprising Factor 6

RANK	QUESTION	HUMAN FACTOR	LOADING
1	34	Leadership	.70497
2	27	Combat experience	.53481
3	36	Acceptance by the unit	.51653

Major Human Factors Comprising Factor 7

RANK	QUESTION	HUMAN FACTOR	LOADING
1	32	Combat experience	.71129
2	16	Ability to withstand fire	.50523

APPENDIX F

BIVARIATE CORRELATION RESULTS

	CBT EXP	TNG	LDRSHP	SURV POSS	ACCP BY UNIT	HUNG	FATI	ABIL TO WITH FIRE	SOLDIERS BELIEF IN MISSION
CBT EXP	1.0	.05	.35	.37	.14	.38	.06	.14	- .29
TNG	- .05	1.0	.22	- .21	.19	- .13	- .07	- .33	.02
LDRSHP	.35	.22	1.0	.19	.21	- .18	.13	.02	- .27
SURV POSS	.37	- .21	.19	1.0	.08	.34	.32	.12	- .17
ACCP BY UNIT	.14	.19	.21	.08	1.0	.13	.23	- .31	.02
HUN	.38	- .13	- .18	.34	.13	1.0	.14	- .05	.21
FATI	.06	- .07	.13	.32	.23	.14	1.0	.01	- .10
ABIL TO WITH FIRE	.14	- .33	.02	.12	- .30	- .05	.01	1.0	- .25
SOLDI BELIEVE IN MISSION	.29	.02	- .27	- .17	.02	.21	- .10	- .24	1.0

APPENDIX G

RESULTS OF THE KOLMOGOROV-SMIRNOV ONE-SAMPLE TEST

KOLMOGOROV- SMIRNOV Z SCORE	MAXIMUM ABSOLUTE DIFFERENCE	MAXIMUM (+ DIFFERENCE)	MAXIMUM (- DIFFERENCE)	2-TAIL PROBABILITY
.429	.1430	.1025	.1430	.993

APPENDIX H

SPEARMAN r_s FOR EACH PAIR OF HUMAN FACTORS

	OBT EXP	TNG	LDRSHP	SURV POSS	ACCP BY UNIT	HUNG	FATI	ABIL TO WITH FIRE	SOLDIERS BELIEF IN MISSION
OBT EXP	1.0	.06	.18	.08	.26	.14	.04	.02	- .60
TNG	.06	1.0	.16	.06	- .43	- .18	- .04	.16	- .16
LDRSHP	.18	.16	1.0	- .03	.01	- .36	.13	- .07	- .34
SURV POSS	.08	.06	- .03	1.0	- .40	- .14	- .30	.04	- .12
ACCP BY UNIT	- .26	- .43	.01	- .40	1.0	- .13	.08	- .14	.01
HUNG	- .14	- .18	- .36	- .14	- .13	1.0	.08	- .05	.14
FATI	.04	- .04	.13	- .30	.08	.08	1.0	- .38	- .27
ABIL TO WITH FIRE	.02	.16	- .07	.04	- .14	- .05	- .38	1.0	- .26
SOLDI BELI MISSION	- .60	- .16	- .34	- .12	.01	.14	- .27	- .26	1.0

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