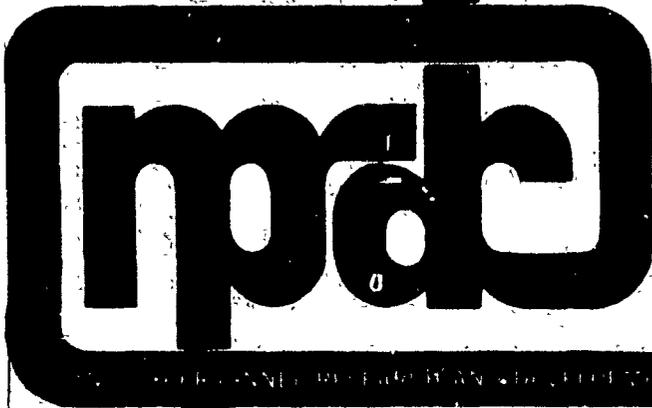


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**DEVELOPMENT OF UNIT PERFORMANCE
EFFECTIVENESS MEASURES USING DELPHI PROCEDURES**

Orvin A. Larson
Stephen I. Sander

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**DEVELOPMENT OF UNIT PERFORMANCE EFFECTIVENESS MEASURES
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FOREWORD

This research was performed under Exploratory Development Task Area PF.55.522.102 (Technique for Evaluating Marine Corps Training in Tactical Field Exercises). The research was initiated in 1972 in response to a request from the Marine Corps Development and Education Command to develop unit performance measures and criteria for use in tactical field exercises in conjunction with the Tactical Warfare Analysis and Evaluation System. Prior research in this area has been described in NPRDC TR 74-11, *Survey of Unit-Performance Effectiveness Measures* by Orvin A. Larson, Stephen I. Sander, and John H. Steinemann, January 1974.

J. J. CLARKIN
Commanding Officer

SUMMARY

OBJECTIVE

The primary objective of this research effort was to develop unit effectiveness measures and criteria for use in evaluating Marine Corps field exercises.

BACKGROUND

This report documents the second phase of an ongoing research effort in support of the Marine Corps Tactical Warfare Analysis and Evaluation System (TWAES), a computer-based system for use in field exercise environments. The previous phase was a review of the state of the art in performance evaluation systems and was documented in NPRDC TR 74-11 (January 1974). The primary existing sources of data on unit performance are checklists and the subjective experience of senior Marine Corps officers. An evaluation format which could account for the effects of contextual variables which moderate performance was deemed necessary. This led to a requirement for the development of contextual items and performance response items for use in an evaluation system.

METHOD

The DELPHI — a technique for systematically extracting expert opinion — was selected and utilized as the primary research approach to objectify the evaluation policy of senior Marine Corps officers. Infantry battalion commanders were selected to participate as subject matter experts. The DELPHI materials were distributed to participants spread over a wide geographic area, and returned by them via the mail.

RESULTS

The use of the DELPHI resulted in the development of 17 contextual variables. These were amenable to categorization in terms of situational and physical variables. Response items of two types were developed: (1) observable performance items and (2) performance items which are usually less than fully observable during an exercise but are nonetheless considered important. These items were amenable to breakdown into command, unit, and individual performance. Data were also developed on the average times needed to evaluate units of varying size ranging from squad to brigade in field exercise environments.

CONCLUSIONS AND RECOMMENDATIONS

The DELPHI technique is effective for extracting policy information from a widely dispersed group of participants. Minor changes made in the classical DELPHI format to adapt it to this application were found to be nonsignificant. Performance evaluation items relating the performance response to the context of that response and expected evaluation times were developed. It is recommended that the performance contextual and response items developed by this DELPHI research be integrated into the exercise evaluation format, and that initial reliability and validity data be gathered from the field.

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OBJECTIVES

This research was conducted in support of the Marine Corps Tactical Warfare Analyses and Evaluation System (TWAES) requirements. The primary objectives of the effort were to develop unit effectiveness measures and criteria for use in performance evaluation. More specifically, the objective of this phase of the research was to develop a scheme for evaluating unit performance as moderated by contextual or environmental factors such as mission, terrain, weather, and tactical situation.

BACKGROUND

DOCUMENTATION

This report documents the second phase of a research effort in support of the Marine Corps TWAES requirements. The TWAES is a computer-based system designed to improve the control and evaluative aspects of Marine Corps field exercises and thereby to increase the value and effectiveness of the training exercises. The initial phase of the research consisted of a review of the state of the art of existing evaluation systems and of the performance evaluation literature. That effort was documented in NPRDC TR 74-11 of January 1974, (Larson, Sander, and Steinemann, 1974) which indicated that improved performance evaluation techniques and criteria were needed to complement and fully utilize the advanced capabilities offered by the TWAES concept. It also cited the importance of contextual factors in performance evaluation, and discussed the potential applicability of DELPHI procedures to TWAES research requirements.

CRITERIA DEVELOPMENT

Organizations which exist, either by necessity or design, in a competitive arena normally evolve internal functions which serve to ensure their continued competitiveness and, thereby, their survival. Military organizations are no exception, and their past performance record is one measure of the adaptiveness of their internal evaluative processes. The long-term record of the Marine Corps indicates that its internal evaluative procedures and criteria have been adequate to ensure its continued competitiveness; and that therein lies a base of evaluative expertise. In part, this expertise has been codified in the form of various training evaluation documents and publications. An additional portion of the evaluative expertise, however, is the subjective expertise of senior officers, which is developed over an extended period of service experience and varies from individual to individual. To the extent that this expertise is codified, it is readily usable for evaluative purposes. There are difficulties, however, in accessing and utilizing noncodified expertise.

Traditionally, group processes, such as holding conferences or convening committees, have been employed to extract information involving subjective data. These group processes, however, provide, at best, opinions subject to such drawbacks as the bandwagon effect, specious persuasion, and domineering personalities. Additionally, there is the possibility that the final decision or position is formulated largely by the chairman or group leader, and does not accurately represent the combined contributions of the individual committee participants. In essence, conventional group processes often tend to stifle the contributions of participants through goal-oriented conformity. In an attempt to overcome these and related procedural problems, Helmer and Dalkey of the Rand Corporation developed the DELPHI technique in the 1950's (Dalkey and Helmer, 1963).

The DELPHI may be used as a policy-capture technique by which the internalized policy consensus of a group of experts are subjected to a series of extensive interrogations interspersed with controlled feedback from other experts. This technique ensures that all positions on an issue have been put forward for consideration, and examines the acceptability of any particular position (Turoff, 1970). This procedure encourages participants to consider factors they may have overlooked or initially considered irrelevant to the issue at hand. This approach of systematically extracting expert opinion, when complemented by existing sources of

codified evaluation materials, is relevant to TWAES requirements for the development of unit performance criteria. These criteria would be used in evaluating unit performance in field exercise environments.

EVALUATIVE FORMAT

TWAES training and evaluation requirements involve the recording and evaluation of unit and individual performance in field exercise environments. This performance evaluation requires that contextual factors which moderate performance be considered. In other words, the context in which the performance is required must be carefully specified, since environmental factors can significantly affect the range and quality of expected responses in any given situation. Currently, the Marine Corps uses trained umpire staffs to input evaluative information to TWAES. However, the subjectivity of the assessment variables makes it difficult to ensure interrater agreement. This potential interrater variability is, in part, controlled by the use of umpire schools and the assignment of umpires to evaluate within their own areas of specialization. This is particularly important when units are implicitly, if not explicitly, evaluated against each other as well as against absolute performance levels. An evaluative system which can reduce this interrater variability, provide improved criteria, and normalize ratings across units to account for contextual variables is necessary.

A system that allows the performance of all units to be evaluated on a common or normalized scale, even though these units are required to perform in dissimilar environments, is most desirable. In an ideal sense, this capability is probably not within the current state of the art. It is, however, within the realm of practical approximation. A similar effort was conducted for the Air Force Semiautomatic Ground Environment (SAGE) system (Cunningham, Sheldon, and Zagorski, 1965 and Parsons, 1972) to determine the effects of situational variables on performance. A portion of that effort (Project NORM) was designed for the express purpose of deriving "improved SAGE performance measures and the development of normative scales to assess changes in crew performance and differences between crews" (Sheldon and Zagorski, 1965). This was done by developing a scoring procedure based on relative scaling which was "independent of the difficulty of a particular mission and of inalterable sector characteristics. Crews could be compared even though they received different mission inputs and did not face equivalent environmental circumstances" (Sheldon and Zagorski, 1965). Such a system provides normalized outputs for the comparison of units across tasks/missions, while also allowing units to be compared against either absolute criteria or their own previous performance.

DEVELOPMENT SEQUENCE

The development of a context-response performance evaluation technique for TWAES first requires the following:

1. The identification of those response measures which accurately reflect unit effectiveness.
2. The identification of those contextual variables which moderate unit performance.
3. The presence of reliable observers to input these contextual and response factors.

The basic information for both the response and contextual factors was amenable to development by using the DELPHI technique to systematically extract and objectify the existing evaluative policies of senior field grade officers. This information, when complemented by data from existing literature sources on performance criteria and analyzed statistically for interactions and nonlinearities, would comprise the initial performance evaluation system. When properly formulated, these materials could be entered through the existing Digital Message Entry Device (DMED) system used by umpires, and would allow evaluative data on units and selected individuals to be accumulated over the period of an exercise. Additionally, a portion of these data would be suitable for use in the firepower calculations in much the same manner as the existing tactical effectiveness factors are now incorporated.

METHOD

GENERAL

The DELPHI technique was used as the primary research procedure in the development of the contextual and response variables. Senior Marine Corps officers participated as evaluative experts in the DELPHI. This approach not only utilized their experience but also provided them with a participatory role which will enhance the validity of the criteria, thereby increasing the acceptability of the TWAES evaluative procedures.

PARTICIPANTS

The participants selected to serve as experts in the DELPHI were the 25 infantry battalion commanders currently serving in the Marine Corps. As a group, these officers are recognized as experts within their field. Their average length of experience was 22 years. Since all of the infantry battalion commanders were contacted, they initially comprised a population of this body of experts rather than a sample. To encourage willing and frank participation, they were contacted directly and individually asked to participate rather than indirectly through their respective command chain. Each participant received a letter inviting him to participate, along with materials on the goals and scope of the project. Participants were asked, but not required, to provide their name and address (and forwarding address, if appropriate) so that contact could be maintained for the duration of the DELPHI. Although the participants were asked to refrain from discussing the issues with each other, they could use any other informational sources.

PROCEDURE

The participants received and returned their DELPHI materials by mail. They were asked to respond within 5 to 7 days. Telephone numbers of the research project personnel were provided to participants to facilitate communications in the event questions arose. They were given the option of not responding to sections of the materials if they so chose. The response materials returned from participants in each round were summarized, statistically analyzed, and reformatted to serve as feedback to participants in the succeeding round. Each round required approximately 2 months to complete, including the time required for correspondence and for analyzing the materials. A round-by-round procedural description is described below.

MATERIALS

ROUND ONE

DELPHI materials were sent to all 25 infantry battalion commanders. Each received information on the background of the project, participation instructions, the three questions listed below, and preaddressed franked envelopes for returning the materials. (Project and general information distributed to participants are contained in Appendix A).

1. Question 1

"WHEN YOU ARE ASSIGNED TO EVALUATE A UNIT IN A FIELD EXERCISE ENVIRONMENT, WHAT FACTORS OR CHARACTERISTICS DO YOU USE IN FORMING YOUR EVALUATION OF THE UNIT'S COMBAT READINESS?"

2. Question 2

"WHEN YOU ARE ASSIGNED TO EVALUATE A UNIT IN A FIELD EXERCISE ENVIRONMENT, HOW LONG DOES IT TAKE YOU TO REACH YOUR DECISION CONCERNING THE UNIT'S COMBAT READINESS? FOR EXAMPLE, DO YOU NORMALLY USE ALL OF THE TIME AVAILABLE IN THE EXERCISE OR DO YOU MAKE YOUR DECISION SOMETIME DURING THE EXERCISE AND USE THE REST OF THE EXERCISE PRIMARILY TO CONFIRM YOUR DECISION?"

3. Question 3

"WHEN YOU ARE ASSIGNED TO EVALUATE A UNIT IN A FIELD EXERCISE ENVIRONMENT, WHAT INFORMATION OR FACTORS ARE USUALLY STILL INCOMPLETE AT THE TIME YOU MAKE OR MUST MAKE YOUR DECISION CONCERNING THE UNIT'S COMBAT READINESS?"

ROUND TWO

Materials for this round were sent by "name" to those commanders who had supplied such information on the previous round, and by "unit" to those who either had not responded in the first round or had elected to do so anonymously. The materials submitted in the first round were compiled and formatted to serve as feedback for the second round. The responses submitted to Questions 1 and 3 were reformatted to facilitate scaling. General information reflecting the purposes of the second round was also provided (see Appendix A).

1. Question 1:

Participants were given a list of 48 items submitted in response to Question 1 during Round 1 (see Table 1 and Appendix B), and asked to rate these items on a rating scale (see Figure 1). Instructions provided and the original question are shown below.

a. Instructions:

"The following items were submitted in response to Question 1 during Round One of the DELPHI. You are now asked to evaluate each of the items listed as to its importance in accurately evaluating a unit, the unit level(s) at which each is most applicable, and how often or how frequently the item occurs or is observable in a field exercise. Rating scales are provided along with a restatement of the original question. Circle or check the number on the importance and frequency rating scales and fill in the appropriate number or numbers in the unit size blank. Note: Given the differences between combat and field exercises environments, the importance scale as used here refers to the importance of the item or factor as an evaluative item and as an indicator of combat readiness. An additional page is provided following the items to allow you to rephrase items and to add additional items."

b. Question:

"WHEN YOU ARE ASSIGNED TO EVALUATE A UNIT IN A FIELD EXERCISE ENVIRONMENT, WHAT FACTORS OR CHARACTERISTICS DO YOU USE IN FORMING YOUR EVALUATION OF THE UNIT'S COMBAT READINESS?"

2. Question 2:

Because of the wide range of responses and comments received in response to Question 2 during Round One, the question was reformatted for Round 2. Participants were provided with a complete listing of comments (not included in this report), and asked to respond to the revised question. Instructions provided and a restatement of the original question are shown below.

TABLE 1. SUMMARY OF DELPHI ITEMS DEVELOPED FROM QUESTION 1.

1. Coordination	26. MOS skills
2. Supporting arms	27. Mission accomplishment
3. Noise and light, discipline	28. MOS examinations
4. Casualty evacuation	29. Ability to navigate
5. Fire/maneuver	30. Offensive capability
6. Analyze mission/terrain	31. Patrolling capability
7. Discipline command post	32. Replacement status
8. Staff coordination	33. Physical condition
9. Clear and timely orders	34. Morale/motivation
10. Command pacing	35. Esprit and cohesiveness
11. Communications	36. Appearance of troops
12. Encryption and shackling	37. Develop plans and orders
13. Control of forces	38. Tactical principles
14. Effectiveness of control	39. Protective measures
15. Special situations	40. Change of billet
16. Logistics support	41. Supply economy
17. Sustain operationally	42. Reporting procedures
18. Defensive principles	43. Reaction to the unexpected
19. Organizational equipment	44. Command flexibility
20. Individual equipment	45. Team functions
21. Fire discipline	46. Crew-served weapons
22. Timeliness of fire support	47. Discipline
23. Information flow	48. Innovative SOPs
24. Intelligence gathering	49. Special equipment
25. Leader's professional skill	50. Secure communication

Notes: Item numbers refer to the complete item descriptions found in Appendix B.
Items 49 and 50 were added during Round 2.

Rating Scale for Importance

1	2	3	4	5
Never important	Sometimes important	Important about as often as not	Often important	Always important

Rating Scale for Frequency

1	2	3	4	5
Never occurs	Sometimes occurs	Occurs about as frequently as not	Often occurs	Always occurs

Unit Designations

1	2	3	4	5
Squad	Platoon	Company	Battalion	Brigade

Sample Items to be Rated:

1. Coordination with adjacent units/commander.
Imp. scale: 1 2 3 4 5 Unit: _____ Freq. scale: 1 2 3 4 5

2. Integrated utilization of supporting arms at all levels.
Imp. scale: 1 2 3 4 5 Unit: _____ Freq. scale: 1 2 3 4 5

Figure 1. Rating scale for use with items submitted in response to Question 1, Round One.

a Instructions:

“Question 2 was open to misinterpretation or at least alternative interpretations – as several of you pointed out. Despite this, the responses and particularly the comments provided information on the basic issue – can a unit be reliably evaluated in less than the total time available in a field training exercise? The responses indicate two basic positions – namely, that less than the full time is needed or that all the time is needed. This may, however, not be an accurate assessment of your position, given the inadequacy of the original question. We are, therefore, providing a complete, verbatim listing of the comments provided on the question and asking for your response on the same question based on a 96-hour field exercise involving a battalion(s) engaged in continuous operations with both offensive and defensive phases. Given this setting, how much time-out of 96 hours is normally needed to evaluate (not train) each of the units listed? The time may be assumed to be split over the offensive and defensive phases.”

b. Revised question:

“HOW MUCH TIME – OUT OF 96 HOURS – IS NORMALLY NEEDED TO EVALUATE EACH OF THE UNITS LISTED? THE TIME MAY BE ASSUMED TO BE DIVIDED BETWEEN THE OFFENSIVE AND DEFENSIVE PHASES.”

3. Question 3:

Participants were given a list of 34 items submitted in response to Question 3 during Round 1 (see Table 2 and Appendix C), and asked to rate these items on a rating scale (see Figure 2). Instructions provided and the original question are shown below.

a. Instructions:

"The following items were submitted in response to Question 3 during Round One of the DELPHI. You are asked to evaluate the items listed as to their importance in accurately evaluating a unit, the unit level(s) at which they are most applicable, and how often or how frequently the item is incomplete at the end of a field exercise. Rating scales are provided along with a restatement of the original question. Circle or check the number on the importance and frequency rating scales and fill in the appropriate number or numbers in the unit size blank. Note: Given the differences between combat and field exercises environments, the importance scale as used here refers to the importance of the item or factor as an evaluative item and as an indicator of combat readiness. An additional page is provided following the items to allow you to rephrase items and to add additional items."

b. Question:

"WHEN YOU ARE ASSIGNED TO EVALUATE A UNIT IN A FIELD EXERCISE ENVIRONMENT, WHAT INFORMATION OR FACTORS ARE USUALLY STILL INCOMPLETE AT THE TIME YOU MAKE OR MUST MAKE YOUR DECISION CONCERNING THE UNIT'S COMBAT READINESS?"

TABLE 2. SUMMARY OF DELPHI ITEMS DEVELOPED FROM QUESTION 3.

1. Ammunition	18. Combat execution
2. Armor utilization	19. Live-fire delivery
3. Close air support	20. Fire/maneuver ability
4. Knowledge of supporting arms	21. Organic weapons
5. Effectiveness of supporting arms	22. Fire discipline
6. Operability of combat-essential equipment	23. Status information
7. Reliability of combat-essential equipment	24. Sustainment ability
8. Team combat functions	25. Timely supply/resupply
9. Individual combat skills	26. Supply economy
10. Commander's care of men	27. Intelligence
11. Commander's flexibility	28. Equipment casualties
12. Commander's professional knowledge	29. Mission accomplishment
13. Ability to communicate	30. Patrolling capability
14. Defensive capability	31. Personnel stability
15. Personnel/equipment endurance	32. "Frago" effectiveness
16. Fitness	33. Expeditious reporting
17. Unit performance	34. Reporting procedures (faulty)
	35. Reporting procedures (timely)

Notes: Item numbers refer to the complete item descriptions found in Appendix C.
Item 35 added during Round Three.

<u>Rating Scale for Importance</u>				
1	2	3	4	5
Never important	Sometimes important	Important about as often as not	Often important	Always important

<u>Unit Designations</u>				
1	2	3	4	5
Squad	Platoon	Company	Battalion	Brigade

<u>Evaluative Completeness</u>				
1	2	3	4	5
Never incomplete	Sometimes incomplete	Incomplete about as frequently as not	Often incomplete	Always incomplete

Figure 2. Rating scale for use with items submitted in response to Question 3, Round One.

4. Question 4:

A fourth question was added in Round Two. It was presented in a format similar to that used in the first round:

"WHAT FACTORS INFLUENCE THE ABILITY OF A UNIT TO ACCOMPLISH ITS MISSION BUT ARE NORMALLY BEYOND THE IMMEDIATE CONTROL OF THE UNIT COMMANDER? E.G., TERRAIN, SUPPORT, ETC. . . ."

ROUND THREE

Round three materials were distributed to participants as in the second round. General information reflecting Round Three requirements was provided (see Appendix A).

1. Questions 1 and 3:

Means and standard deviations on the items derived from Questions 1 and 3 in Round Two were provided to participants as feedback, along with histograms of the unit applicability distributions. General comments submitted were used to preface the questions, and specific comments were placed with the items to which they referred.

2. Question 2:
Completed and withdrawn from further consideration.
3. Question 4:

Participants were given a list of 17 items submitted in response to Question 4 during Round Two (see Table 3 and Appendix D), and asked to rate them according to importance and unit applicability. The question was formatted similar to Questions 1 and 3 in the second round.

ROUND FOUR

Materials were sent to participants as in the previous round. Question 1 was considered completed and withdrawn from further consideration along with all but seven selected items from Question 3 (Nos. 1, 11, 17, 18, 32, 33 and 34) on the basis of a diminishing rate of change in the standard deviation from the previous round. These seven items along with the Question 4 items were formatted as in the previous round. General information provided on Round Four is found in Appendix A.

TABLE 3. SUMMARY OF DELPHI ITEMS DEVELOPED FROM QUESTION 4

1. Terrain/hydrography	10. Overcontrol
2. Weather	11. Civilians in zone
3. Time	12. Peacetime safety requirements
4. Space	13. Replacements
5. Intelligence	14. Equipment reliability
6. Support	15. Medical problems
7. Fatigue level	16. Long-range communication
8. Rules of engagement	17. Support base distance
9. Resources	

Note: Item numbers refer to the complete item descriptions contained in Appendix D.

RESULTS

The results are organized by question and round. The number of participants are as follows: Round One, 11 (44%); Round Two, 14 (56%); Round Three, 10 (40%); and Round Four, 11 (44%).

QUESTION 1

"WHEN YOU ARE ASSIGNED TO EVALUATE A UNIT IN A FIELD EXERCISE ENVIRONMENT, WHAT FACTORS OR CHARACTERISTICS DO YOU USE IN FORMING YOUR EVALUATION OF THE UNIT'S COMBAT READINESS?"

ROUND ONE

A total of 121 items was submitted in response to Question 1. This was reduced to 48 by combining redundant items and deleting those beyond the scope of TWAES project requirements (two additional items added in Round Two brought the total to 50). These items are listed in Appendix B. Item breakdown by unit level applicability is presented in Appendix E.

ROUND TWO

Data were obtained on the importance and frequency of each item, in addition to the unit levels at which each was most applicable. Means and standard deviations for the importance scale and the unit applicability graphs are presented in Appendix B.

ROUND THREE

Round Three consisted of 42 items. Low importance levels, high standard deviations, and participant comments influenced the deletion of items 7, 15, 21, 28, 30, 40, 41, and 48 from Round Three. Items 49 and 50 were submitted by a participant during Round Two. Appendix B shows the final means, standard deviations, and unit applicability graphs for each item. A number of the participants chose not to respond to Question 1 in this round. Therefore, the mean response to an item from Round Two was used for missing responses in computing Round Three means. This is in accordance with the initial instructions to the DELPHI participants providing the option of not responding to a particular question if they did not wish to revise their previous estimate.

ROUND FOUR

Completed and withdrawn from further consideration.

QUESTION 2

ROUND ONE

Question 2 as presented in the first round caused a wide range of responses along with extensive comments, indicating ambiguity in the question and response format and inadequate problem parameters. The question was reformatted for the following round.

ROUND TWO

The question and parameters were reformulated for this round as follows:

"HOW MUCH TIME – OUT OF 96 HOURS – IS NORMALLY NEEDED TO EVALUATE EACH OF THE UNITS LISTED? THE TIME MAY BE ASSUMED TO BE DIVIDED BETWEEN THE OFFENSIVE AND DEFENSIVE PHASES."

The parameters of the questions were established by the following statement:

"... based on a 96-hour field exercise involving a battalion(s) engaged in continuous operations ... how much time ... is needed to evaluate (not train) each of the units listed?"

The responses to this question for both Round One and Round Two are presented in Table 2, which includes the ranges, means, and the distributions of the responses in hours. The responses are not strictly comparable as the question was modified, but the important aspect is the improved consensus. The high degree of consensus obtained allowed this question to be withdrawn from succeeding rounds. The results supported the assumption that smaller units require the services of evaluative personnel for less time than larger units.

ROUND THREE

Completed and withdrawn from further consideration.

TABLE 4. QUESTION 2 RESPONSE SUMMARY

	ROUND ONE	ROUND TWO		
	Range	Range	Mean	Distribution
Brigade	96-168	72-96	96	.....|
Battalion	4-96	48-96	79	.....|
Company	1-48	24-67	42	.....|
Platoon	0.5-48	12-48	26	.....|
Squad	0.25-48	8-48	21	.....|

0
10-19
20-29
30-39
40-49
50-59
60-69
70-79
80-89
90-99

HOURS

Note: Responses are given in hours.

QUESTION 3

"WHEN YOU ARE ASSIGNED TO EVALUATE A UNIT IN A FIELD EXERCISE ENVIRONMENT, WHAT INFORMATION OR FACTORS ARE USUALLY STILL INCOMPLETE AT THE TIME YOU MAKE OR MUST MAKE YOUR DECISION CONCERNING THE UNIT'S COMBAT READINESS?"

ROUND ONE

Forty-three items were submitted in response to Question 3. The deletion of duplicate items and items beyond the scope of TWAES reduced this number to 34 (an additional item added in Round Three brought the total to 35). These items are listed in Appendix C.

ROUND TWO

Data were collected on each item's importance, frequency of incompleteness, and the level of unit applicability. Means and standard deviations for the importance and evaluative completeness scales are presented in Appendix C, along with unit applicability graphs.

ROUND THREE

The means and standard deviations of the reevaluated items are also shown in Appendix C. Overall, the SD of the importance scale was reduced, while the SD of the evaluative completeness scale generally increased. The histograms depicting levels of unit applicability showed little change from the previous round. An additional item – No. 35 – was submitted in this round.

ROUND FOUR

Items 1, 11, 17, 18, 32, 33, and 34, along with the new item (No. 35) submitted in the previous round, were selected for further evaluation on the basis of a considerable change in responses from the previous round. In reference to the importance scale, Appendix C shows a decrease in item variability, except for items 1 and 34. In the completeness scale for items 17 and 18, both mean responses and variability were considerably smaller.

QUESTION 4

"WHAT FACTORS INFLUENCE THE ABILITY OF A UNIT TO ACCOMPLISH ITS MISSION BUT ARE NORMALLY BEYOND THE IMMEDIATE CONTROL OF THE UNIT COMMANDER? E.G., TERRAIN, SUPPORT, ETC. . . ."

ROUND TWO

A total of 97 items was submitted in response to Question 4. Many of these items were related to personnel rather than to the requirements of the TWAES project. Appendix D lists the 17 items which were retained for evaluation after the duplicates and personnel-related items were deleted.

ROUND THREE

In contrast to Questions 1 and 3, higher levels of variability were observed on the importance ratings of the items in Question 4 (see Appendix D). Mean ratings as low as 3.30 were found, as is shown on items 15 and 16.

ROUND FOUR

A general decrease in standard deviations was observed, while mean responses tended to increase (see Appendix D). (Mean and SD data were not collected on items 13 and 14.) These statistics seem to indicate a high degree of consensus among the participants on these items. Further information on unit level was not solicited for this round. Therefore, the unit results shown are Round Three results. Item breakdown by unit level applicability is presented in Appendix E.

DISCUSSION

Items related to unit performance evaluation were developed through the use of the DELPHI. These items should, ideally, represent the key factors in the evaluative policy of the officer participants. "Ideally" is used parenthetically because it is impossible to know if this is true in an absolute sense. The DELPHI technique itself has well-established validity and the participants were well-qualified experts.

The participants were Marine Corps infantry battalion commanders in the ranks of Major through Colonel. Their tenure in the Marine Corps ranged from 15 years to 28 years, with a mean of 22 years. Since not all of the officers who participated responded in all rounds, a comparison was made of the responses to Questions 1 and 3 by those who participated in both rounds one and two and those who participated initially in round two. A t-test disclosed no significant differences.

Some of the procedural details of this DELPHI varied from conventional procedures of previously reported DELPHI. These variations are described with respect to possible effects on the validity of the obtained results. In the typical DELPHI, participation by experts is constant from round to round. However, in this case, due to individual circumstances and the nature of the field, this was not achieved -- the group membership was fluid. For example, five commanders initiated their participation in the second round. Of these five, only two submitted round three data. A further deviation from conventional DELPHI was that the experts were not consulted prior to the exercise and, consequently, did not formally agree to participate. Instead, their participation was taken as evidence of agreement. This approach was seen as a tradeoff between obtaining compliance and participation and was discussed with Marine Corps project representatives prior to the exercise. The level and quality of participation achieved were probably due (1) to the inherent interest of the participants in the performance evaluation area, and (2) the fact that the TWAES is rapidly being implemented and this exercise provided one means for users to influence its final configuration. The foregoing is intended to minimize neither the exercise nor the results, but to show how the DELPHI was necessarily adapted for this particular application and some of the assumptions/compromises which were made.

A basic assumption of the DELPHI procedure is that participant responses will merge with each successive round, e.g., members will take into consideration the average group response when they submit their new responses. Support for this assumption was shown by the standard deviation measures on the items in Questions 1, 3, and 4. For the majority of these items, the standard deviations become successively smaller with each round. Question 2 variability was sharply reduced following introduction of the feedback and the more specific problem parameters.

The evaluative items submitted provide a range of application from squad level to brigade level. Somewhat more items were provided at the company and battalion levels. This may reflect the unit levels of primary importance in evaluation or, in part, the bias of the senior level officers who participated. This question will require further definition. Questions 1 and 3 provided information on evaluative items which, while important, may not always be observable for complete evaluation. Ideally, adjustments in scenarios might be made to allow more complete evaluation of such areas. If this proves impractical, the use of such items in an evaluative schema would be kept to a minimum.

The items submitted in response to Questions 1 and 4 were amenable to categorization by several strategies. Tentative categorization was achieved by determining whether the item was primarily command, team, or individual performance. Within the command category, further categorization was possible in terms of tactical decision items and administrative items. This was particularly true at the company, battalion, and brigade levels of application. This is consistent with research by Helme, Willemin, & Grafton (1971), who found that "two broad domains of officer activity were clearly differentiated - combat leadership and technical/managerial leadership." This breakdown of items also lends itself to an evaluation method developed by Cook and Baker (1968) for use with armored cavalry units. That method concentrated on evaluating the unit leader's skill in command and the unit's performance in executing those commands. A tentative breakdown of items for Questions 1 and 4 by these means is shown in Appendix E.

The environmental items submitted for Question 4 can be roughly classified into those that (1) refer to the physical environment and (2) are of a situational nature. Situational, as used here, refers to factors influencing the outcome of an engagement that resulted from previous decisions or events but which are not under the immediate control of the unit commander. Question 4 generated more comment per number of items submitted than did Questions 1 and 3. Three major areas of interest or controversy developed which concerned (1) what is under control, (2) the issue of overcontrol, and (3) personnel problems. The issue of how much is under the control of the unit commander arose in one specific case over fatigue level and also as a general response to the entire question. A minority sentiment expressed was that all factors are under control if command is adequate and that Question 4 was unnecessary. The issue of overcontrol by higher headquarters had two distinct facets. The first and most obvious was command-type overcontrol by superior officers of tasks that should have been handled at a lower level. This may have the effect of reducing flexibility at lower levels by subordinates. To the extent that this issue is a problem, it should be reflected in unit performance and be measurable by TWAES.

The second facet of overcontrol is of more interest to performance evaluation and TWAES - that is, overcontrol and oversupervision of exercises as a whole which can alter the conduct of an exercise. Close supervision can remove unwanted variability in an exercise situation and can make exercises easier to conduct. Oversupervision, however, in the interest of reducing variability, results in reducing information and response loads at all levels, which in turn reduces the authenticity of the situation and the accuracy of the performance evaluation (Arima, 1969).

The third area of controversy concerned personnel-related factors over which the commander has no control but which may reduce unit performance. Examples of the items submitted were high levels of personnel turnover prior to embarkation, drug problems, racial problems, short duration of exercise, etc. The very large number of responses of this type indicated the concern of the participants. These items were not pursued, however, because any performance degradation they cause should be measurable by the TWAES performance evaluation capability. To the extent that these factors continue to adversely affect performance, efforts should be made to ameliorate them. However, this is not within the scope of the TWAES project.

The responses to Question 2 were in accord with the expectation that small units should require less time to evaluate than large ones. The relatively short period of time needed for assessments at lower levels could permit the use of trained evaluators who could move from unit to unit during an exercise, leaving the routine control functions to less specialized individuals.

Questions 1, 3, and 4 have statistics associated with each item. Except for the unit applicability graphs, the statistics served primarily for control purposes during the conduct of the DELPHI and only secondarily for estimating the relative value of any item. For purposes of developing a performance evaluation system, all of the items are initially considered important and as basic elements to be developed and integrated. The items will be refined in later stages of the research into behaviorally-oriented items for improved observability by exercise evaluators of lesser experience than that of the participants who developed the items.

The items developed in Questions 1, 3, and 4 will be used in the next phase of the research to develop specific performance evaluation items. These items will be grouped first by the level of unit applicability and then into command decision, team performance, and individual performance areas, as is shown in Appendix E. Further breakdowns within these areas are possible, depending on the task requirements. These groups of items will be examined, statistically, from unit level to level for the effects of subsystem performance on system performance. This approach will allow some measure of the embedded performance event to be made. Embedded events, as used here, refer to events in which a subsystem (squad or platoon) mission is an important factor in the success of a larger overall mission. This approach will provide, in an ideal sense, some measure of the contribution of each unit's performance to the whole. Similarly, examining the effect of environmental variables on unit performance will provide a means of factoring out the effect of environment and thereby, ideally, allow the normalizations of unit performance scores. Data for these items must be derived, at least in part empirically, to provide validity of the relationships.

CONCLUSIONS AND RECOMMENDATION

The time requirements for exercise evaluations were established in terms of the average times needed to evaluate units varying in size from squad to brigade. The specified time requirements indicate that lower-level units can be evaluated in a relatively short time by the highly trained evaluators on a rotating basis, leaving the control function to lesser trained/experienced personnel.

Performance response items for use in evaluating tactical field exercises were developed. Additionally, data were collected on performance items which, while important, may occur too infrequently to be used in an evaluative system. Contextual factors (physical and situational) which influence performance were similarly identified.

An initial evaluation model incorporating both the contextual and the response factors has been developed. This tentative model will be further developed through the collection and statistical analyses of field performance data to establish empirically the direction and degree of relationship between the sets of context and performance variables. When sufficient empirical data have been collected, normalized unit performance indices will be derived to provide unit commanders with expected values of unit performance for given sets of contextual factors. This evaluation system, by separating the effects of environment from unit performance responses, will eventually permit the direct comparison of performance across similar types of units irrespective of mission environments.

It is recommended that the performance contextual and response items be integrated into the exercise evaluation format, and that initial reliability and validity data be gathered from the field.

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APPENDIX A

PROJECT AND GENERAL INFORMATION DISTRIBUTED TO DELPHI PARTICIPANTS

PROJECT AND GENERAL INFORMATION

PROJECT INFORMATION

The Navy Personnel Research and Development Center has been tasked by the Marine Corps Development and Education Command to develop improved unit performance measures and criteria for use in conjunction with the Marine Corps Tactical Warfare Analysis and Evaluation System (TWAES). As part of this project, an effort is being made to utilize the considerable experience of senior field grade officers for the development of these needed performance measures and criteria. There is a requirement to identify those characteristics of unit performance that distinguish a combat-ready unit from a noncombat-ready unit as observed in a field exercise environment. Some of the distinguishing characteristics or actions are largely subjective in nature and, as such, are difficult to define, observe, and quantify. To meet this problem, the DELPHI technique developed by the Rand Corporation, which provides a systematic means for extracting expert opinion, will be used in collecting and compiling the needed information on unit performance.

You, along with all other infantry battalion commanders, as experts in the practical field evaluation of combat readiness, are asked to provide and judge unit performance measures and criteria for ultimate use with the TWAES system. Your contributions of time and effort to this phase of the TWAES project will contribute to the success of this task.

DELPHI: GENERAL INFORMATION

In the DELPHI procedure, a series of questionnaires is given to a group of respondents to determine the group's views on a particular topic. As a participant, you should discard all traditional theories of surveys and questionnaires when approaching this exercise. This is not an attempt to design a short-answer, "quickie" questionnaire. Rather, we encourage you to think deeply about the questions, and to formulate new questions and explore new alternatives. We ask you, as a respondent, to spend a total of 4 or 5 one-half days distributed over approximately 4 months.

The DELPHI approach is cumulative. The first round is largely exploratory and designed to open up new areas of thought. As the second and third rounds progress, the areas of interest are narrowed and group views on certain topics begin to emerge. After each round, the reasoning of participants is fed back to all respondents for their appraisal. By the fourth or fifth round, there is a clear indication of the group's opinions and attitudes on the subject of the exercise. It should also be emphasized that, unlike the traditional one-shot survey technique, we are dealing largely with factors that can not be quantified by analysis.

All necessary steps will be taken to preserve the anonymity of the respondents, this being an essential feature of this technique.

Questionnaires in a DELPHI exercise are meant to be only a stimulus, rather than a straightjacket. As a respondent, you have the following options with respect to any particular question, subquestion or alternatives presented:

1. You may choose not to answer a question if you feel your judgment would be "risky." In this risky situation, if you feel the judgment is an important one to be made, we would hope for a comment on the type of information that would aid you or others in making the particular judgment.
2. You may choose to rewrite, as a comment, a particular question and then answer your version if you feel the original is misleading.
3. You may suggest questions you would like to see in the next questionnaire if you feel they would clarify an issue or raise a new alternative that the group should consider.
4. You may consult with associates, but not with other participants, on specific items in the questionnaire or utilize other information sources normally available to you. However, you should respond as an individual and not as a spokesman for a particular group.

5. You may, and are encouraged, to express short arguments or comments on any judgment about which you feel confident. This may include items of information that lead you to the judgment. The shorter the comment, the greater the probability that it will be included intact in the summary which is fed back to the participants on the next round.

Whenever a consensus is obtained on an issue, we will usually drop that issue from further exploration in succeeding questionnaires. When a polarization of views occurs, we will attempt to develop questions designed to highlight reasons for the polarization. The degree to which the design team chooses to explore a majority-minority type polarization will be more a function of the arguments or comments made than of the actual number of individuals taking a particular view.

INSTRUCTIONS FOR PARTICIPATION IN THE DELPHI: ROUND ONE

The study in which you are about to participate is for the purpose of investigating behavior that is characteristic of a combat-ready unit and of the evaluative decision processes of the commanding officer. Your primary task is to answer each question based on your experience and knowledge. You may choose not to respond to a particular question. Further instructions are as follows:

1. Please return the completed questionnaire within 5 days after receiving it.
2. Please do not discuss your participation in this study or the contents thereof with other participants.
3. Do not hesitate to contact members on the design team by telephone if you need clarification on the questions or instructions: (714) 225-2371, Autovon 933-2371.

You can expect this DELPHI to consist of four or five rounds. Therefore, you are requested to provide your name and address and to apprise the design team of any change of address so that we may keep in contact with you for the duration of the study. We again emphasize the fact that your name will not be identified with the materials and comments you submit nor will your name be known or released to anyone beyond the design team. Please return this page and the response pages in the enclosed envelopes.

DELPHI: ROUND TWO

The purpose of the second round of the DELPHI is to inform you of the items submitted by the other participants and to allow you the opportunity to revise, eliminate, or add items. Additionally, a fourth question is added for your consideration.

The items submitted for Question 1 are listed essentially as they were received except in those cases where more than one participant submitted similar items. In those cases, the items were combined when no change of meaning or emphasis seemed likely to result. If you see an item that no longer reflects your position, you are asked to correct it.

All of the responses submitted for Question 2 are presented to show the comments of the participants and the range and frequency of the responses submitted. As noted in the instructions for Question 2, the question has been altered to incorporate some of your suggestions.

DELPHI: ROUND THREE

The third round of the DELPHI is to inform you of the responses submitted by the other participants and to allow you the opportunity to revise, eliminate, or add items. While Questions 1, 3 and 4 have been revised for Round Three, the concluding results to Questions 2 are presented.

The responses submitted for Question 1 are summarized and presented along with any comments received. A few items were dropped because of low importance or duplication of items. Question 2 was completed with the last round and a summary of that data is provided along with space for comments you may have. Question 3 presents an interesting problem in that many of the items received widely diverse responses in terms of evaluative completeness. All of the responses submitted and the comments received are summarized. This question needs special attention and comments. Question 4 is made up of the items received on the last round.

DELPHI: ROUND FOUR

The fourth round of the DELPHI is to inform you of the responses submitted by the other participants in Round Three and to allow you to revise, eliminate, or add items. Only Questions 3 and 4 will be considered at this time. A complete summary of all questions will be sent when this round is completed and analyzed.

A few items have been selected from Question 3 for reevaluation in this round. Since a consensus was obtained on the remaining items, they will not be reconsidered. A summary of responses and comments to Question 4 is presented. All of these items will be reevaluated in this round.

For all practical purposes, this will be the last round in which you will be asked to respond to DELPHI questions. It is asked that you consider each item carefully and provide comments in support of your responses where appropriate.

APPENDIX B
PERFORMANCE RESPONSE ITEMS DEVELOPED FROM QUESTION 1

QUESTION 1 RESULTS

ITEMS			% UNIT APPLICABILITY	
			ROUND TWO	ROUND THREE
			Squad Platoon Company Battalion Brigade	Squad Platoon Company Battalion Brigade
	TWO	THREE		
1. Coordination with adjacent units/commander.				
<u>Importance</u>				
Mean	4.70	4.50		
Standard Deviation	0.79	0.42		
2. Integrated utilization of supporting arms at all levels.				
<u>Importance</u>				
Mean	4.90	4.80		
Standard Deviation	0.30	0.30		
3. Exercise of noise, light, dispersion, police, and local security discipline.				
<u>Importance</u>				
Mean	4.60	4.40		
Standard Deviation	0.70	0.65		
4. Timeliness with which casualties are evacuated.				
<u>Importance</u>				
Mean	4.00	3.80		
Standard Deviation	1.00	0.44		
5. Ability to concentrate combat power at the decisive time and place through fire, maneuver, and awareness of time/space factors.				
<u>Importance</u>				
Mean	4.40	4.30		
Standard Deviation	0.80	0.60		

QUESTION 1 RESULTS (CONT.)

ITEMS	ROUND		% UNIT APPLICABILITY	
			ROUND TWO	ROUND THREE
	TWO	THREE	Squad Platoon Company Battalion Brigade	Squad Platoon Company Battalion Brigade
6. Ability to analyze/understand mission and terrain.				
<u>Importance</u>				
Mean	4.60	4.50	.....	.....
Standard Deviation	0.70	0.64	.....	.....
*7. Ability to timely and effectively discipline command post/staff.				
<u>Importance</u>				
Mean	3.60		—	—
Standard Deviation	1.20			
8. Ability of staff to coordinate, and to respond to others/ situation in a timely manner.				
<u>Importance</u>				
Mean	4.80	4.90	.....	.....
Standard Deviation	0.50	0.11	.....	.....
9. Ability of commander to issue clear, concise, timely, and complete orders.				
<u>Importance</u>				
Mean	4.70	4.60	.....	.....
Standard Deviation	0.70	0.63	.....	.....
10. Ability of commander and staff to pace themselves.				
<u>Importance</u>				
Mean	4.00	3.88	.....	.....
Standard Deviation	0.80	0.83	.....	.....

*Deleted from Round Three

QUESTION 1 RESULTS (CONT.)

ITEMS			% UNIT APPLICABILITY	
			ROUND TWO	ROUND THREE
	ROUND		Squad Platoon Company Battalion Brigade	Squad Platoon Company Battalion Brigade
	TWO	THREE		
11. Ability to communicate by primary and alternative means in a timely, brief, accurate, and secure manner.				
<u>Importance</u>				
Mean	4.50	4.30		
Standard Deviation	0.90	0.61		
12. Effectiveness of encryption and shackling and use of authentication.				
<u>Importance</u>				
Mean	4.10	3.80		
Standard Deviation	0.90	0.69		
13. Ability to control forces and utilize proper troop leading steps at all levels.				
<u>Importance</u>				
Mean	4.60	4.30		
Standard Deviation	0.70	0.60		
14. Methods and effectiveness of control by small unit leaders.				
<u>Importance</u>				
Mean	4.50	4.50		
Standard Deviation	0.70	0.38		
*15. Knowledge of general and special situations by small unit leaders.				
<u>Importance</u>				
Mean	4.00			
Standard Deviations	1.20			

*Deleted from Round Three

QUESTION 1 RESULTS (CONT.)

ITEMS			% UNIT APPLICABILITY	
			ROUND TWO	ROUND THREE
	ROUND		Squad Platoon Company Battalion Brigade	Squad Platoon Company Battalion Brigade
	TWO	THREE		
16. Ability of unit/commander to utilize logistical and service support.				
<u>Importance</u>				
Mean	4.30	3.80		
Standard Deviation	1.00	0.79		
17. Ability of a unit to sustain itself operationally and logistically.				
<u>Importance</u>				
Mean	4.60	3.90		
Standard Deviation	0.70	0.89		
18. Knowledge/display of defensive principles (digging-in, sectors of fire, etc. . .).				
<u>Importance</u>				
Mean	4.70	4.90		
Standard Deviation	0.70	0.16		
19. Completeness and condition of organizational equipment.				
<u>Importance</u>				
Mean	4.40	4.40		
Standard Deviation	0.80	0.39		
20. Completeness and condition of individual equipment.				
<u>Importance</u>				
Mean	4.30	4.20		
Standard Deviation	1.00	0.59		

QUESTION 1 RESULTS (CONT.)

ITEMS			% UNIT APPLICABILITY	
			ROUND TWO	ROUND THREE
	ROUND		Squad Platoon Company Battalion Brigade	Squad Platoon Company Battalion Brigade
	TWO	THREE		
*21. Exercise of fire discipline.				
<u>Importance</u>				
Mean	4.00			
Standard Deviation	1.29		—	—
22. Time from request for fire support to delivery.				
<u>Importance</u>				
Mean	4.30	4.50	|||||	|||||
Standard Deviation	1.10	0.65	|||||	|||||
23. Proper flow of information between higher, adjacent, and subordinate units.				
<u>Importance</u>				
Mean	4.30	4.10	|||||	|||||
Standard Deviation	0.90	0.52	|||||	|||||
24. Manner and efficiency with which intelligence is gathered, reported, passed on, and utilized.				
<u>Importance</u>				
Mean	4.20	4.10	|||||	|||||
Standard Deviation	1.00	0.51	|||||	|||||
25. Unit leader's demonstration of professional knowledge and combat skills.				
<u>Importance</u>				
Mean	4.80	4.70	|||||	|||||
Standard Deviation	0.40	0.40	|||||	|||||

*Deleted from Round Three

QUESTION 1 RESULTS (CONT.)

ITEMS	ROUND		% UNIT APPLICABILITY	
			ROUND TWO	ROUND THREE
	TWO	THREE	Squad Platoon Company Battalion Brigade	Squad Platoon Company Battalion Brigade
26. Individual's demonstration of combat and MOS skills.				
<u>Importance</u>				
Mean	4.70	4.50	|||||	|||||
Standard Deviation	0.50	0.65	|||||	|||||
27. Ability of unit to accomplish mission.				
<u>Importance</u>				
Mean	4.80	4.90	|||||	|||||
Standard Deviation	0.40	0.11	|||||	|||||
*28. MOS practice examinations.				
<u>Importance</u>				
Mean	3.00		—	—
Standard Deviation	1.10			
29. Ability to navigate, particularly at night.				
<u>Importance</u>				
Mean	4.50	4.60	|||||	|||||
Standard Deviation	0.80	0.63	|||||	|||||
*30. Offensive capability utilizing live ammunition.				
<u>Importance</u>				
Mean	3.70		—	—
Standard Deviation	1.20			
31. Ability to carry out ambush, security, search, and attack patrols.				
<u>Importance</u>				
Mean	4.30	4.00	|||||	|||||
Standard Deviation	0.70	0.65	|||||	|||||

*Deleted from Round Three

QUESTION 1 RESULTS (CONT.)

ITEMS	ROUND		% UNIT APPLICABILITY	
			ROUND TWO	ROUND THREE
	TWO	THREE	Squad Platoon Company Battalion Brigade	Squad Platoon Company Battalion Brigade
32. Accountability and status of personnel and requests for replacements.				
<u>Importance</u>				
Mean	4.10	3.80	.....	.....
Standard Deviation	0.80	0.47	.....	.....
33. Physical condition of troops.				
<u>Importance</u>				
Mean	4.80	4.80	.....	.....
Standard Deviation	0.40	0.32	.....	.....
34. Morale, motivational, and mental condition of troops.				
<u>Importance</u>				
Mean	4.50	4.40	.....	.....
Standard Deviation	0.50	0.39	.....	.....
35. Esprit and pride in/and cohesiveness of unit.				
<u>Importance</u>				
Mean	4.70	4.50	.....	.....
Standard Deviation	0.50	0.42	.....	.....
36. Appearance of troops, serviceability of uniforms, boots, personal weapons, and size of combat load.				
<u>Importance</u>				
Mean	4.10	3.90	.....	.....
Standard Deviation	0.70	0.35	.....	.....

QUESTION 1 RESULTS (CONT.)

ITEMS			% UNIT APPLICABILITY	
			ROUND TWO	ROUND THREE
	ROUND		Squad Platoon Company Battalion Brigade	Squad Platoon Company Battalion Brigade
	TWO	THREE		
37. Development of plans and orders - timeliness, clarity, accuracy, and adherence to doctrine.				
<u>Importance</u>				
Mean	4.80	4.50		
Standard Deviation	0.60	0.67		
38. Tactical principles: followed or ignored?				
<u>Importance</u>				
Mean	4.70	4.50		
Standard Deviation	0.50	0.42		
39. Individual protective measures taken by troops.				
<u>Importance</u>				
Mean	4.30	3.90		
Standard Deviation	0.80	0.53		
*40. How well can/could personnel accept responsibility of a more senior T/O billet?				
<u>Importance</u>				
Mean	3.70			
Standard Deviation	1.00			
*41. Supply economy and discipline.				
<u>Importance</u>				
Mean	3.80			
Standard Deviation	1.10			

*Deleted from Round Three.

QUESTION 1 RESULTS (CONT.)

ITEMS	ROUND		% UNIT APPLICABILITY	
			ROUND TWO	ROUND THREE
			Squad Platoon Company Battalion Brigade	Squad Platoon Company Battalion Brigade
	TWO	THREE		
42. Adequacy of reporting procedures.				
<u>Importance</u>				
Mean	4.40	4.30	|||||	|||||
Standard Deviation	0.50	0.33	|||||	|||||
43. Ability of a unit to react to the unexpected.				
<u>Importance</u>				
Mean	4.30	4.40	|||||	|||||
Standard Deviation'	0.90	0.63	|||||	|||||
44. Ingenuity and flexibility of commander at all levels.				
<u>Importance</u>				
Mean	4.40	4.60	|||||	|||||
Standard Deviation	0.90	0.38	|||||	|||||
45. Ability to execute team combat functions.				
<u>Importance</u>				
Mean	4.50	4.60	|||||	|||||
Standard Deviation	0.70	0.39	|||||	|||||
46. Skill and state of training of crew-served weapons.				
<u>Importance</u>				
Mean	4.80	4.80	|||||	|||||
Standard Deviation	0.40	0.32	|||||	|||||

QUESTION 1 RESULTS (CONT.)

ITEMS	ROUND		% UNIT APPLICABILITY	
			ROUND TWO	ROUND THREE
	TWO	THREE	Squad Platoon Company Battalion Brigade	Squad Platoon Company Battalion Brigade
	47. Discipline: immediate obedience to orders/incidence of misconduct.			
<u>Importance</u>				
Mean	4.70	4.20	|||||	|||||
Standard Deviation	0.70	1.00	|||||	|||||
*48. More innovative SOPs to improve professionalism.				
<u>Importance</u>				
Mean	3.30		—	—
Standard Deviation	1.10			
**49. Ability of troop to operate when burdened with special equipment, i.e. field protection mask, cold weather gear, etc.				
<u>Importance</u>				
Mean		3.83		|||||
Standard Deviation		1.24	—	|||||
**50. Ability of the command to function in a secure radio mode.				
<u>Importance</u>				
Mean		4.26		|||||
Standard Deviation		0.25	—	|||||

*Deleted from Round Three.

**Added in Round Two.

APPENDIX C
PERFORMANCE RESPONSE ITEMS DEVELOPED FROM QUESTION 3

QUESTION 3 RESULTS

ITEMS				% UNIT APPLICABILITY	
				ROUND TWO	ROUND THREE
	ROUND			Squad Platoon Company Battalion Brigade	Squad Platoon Company Battalion Brigade
	TWO	THREE	FOUR		
1. Ammunition: (Class V) Do troops have all they are calling for?					
<u>Importance</u>					
Mean	4.20	3.60	3.70		
Standard Deviation	0.70	1.10	1.40		
<u>Completeness</u>					
Mean	3.10	3.60	2.30	|||||	|||||
Standard Deviation	1.00	1.30	0.50	|||||	|||||
2. Proper utilization of armor.					
<u>Importance</u>					
Mean	3.80	3.70			
Standard Deviation	0.90	0.80			
<u>Completeness</u>					
Mean	3.10	2.70		|||||	|||||
Standard Deviation	0.90	0.80		|||||	|||||
3. Effectiveness of close air support in support of attack/defense.					
<u>Importance</u>					
Mean	4.70	4.60			
Standard Deviation	0.70	0.50			
<u>Completeness</u>					
Mean	3.10	3.30		|||||	|||||
Standard Deviation	1.20	1.30		|||||	|||||
4. Knowledge and use of supporting arms.					
<u>Importance</u>					
Mean	5.00	5.00			
Standard Deviation	0.00	0.00			
<u>Completeness</u>					
Mean	3.10	2.60		|||||	|||||
Standard Deviation	1.10	1.20		|||||	|||||

QUESTION 3 RESULTS (CONT.)

ITEMS				% UNIT APPLICABILITY	
				ROUND TWO	ROUND THREE
	ROUND			Squad Platoon Company Battalion Brigade	Squad Platoon Company Battalion Brigade
	TWO	THREE	FOUR		
5. Full effectiveness of supporting arms in all phases.					
<u>Importance</u>					
Mean	4.70	4.70			
Standard Deviation	0.60	0.50			
<u>Completeness</u>					
Mean	3.50	3.10			
Standard Deviation	1.00	1.20			
6. Operability of combat-essential equipment.					
<u>Importance</u>					
Mean	4.70	4.80			
Standard Deviation	0.50	0.50			
<u>Completeness</u>					
Mean	3.30	3.10			
Standard Deviation	0.90	1.00			
7. Reliability of combat-essential equipment.					
<u>Importance</u>					
Mean	4.60	4.90			
Standard Deviation	0.70	0.40			
<u>Completeness</u>					
Mean	3.50	3.00			
Standard Deviation	1.10	1.10			
8. Execution of team combat functions.					
<u>Importance</u>					
Mean	4.70	4.90			
Standard Deviation	0.70	0.40			
<u>Completeness</u>					
Mean	3.30	3.00			
Standard Deviation	1.00	1.00			

QUESTION 3 RESULTS (CONT.)

ITEMS				% UNIT APPLICABILITY	
				ROUND TWO	ROUND THREE
	TWO	THREE	FOUR	Squad Platoon Company Battalion Brigade	Squad Platoon Company Battalion Brigade
9. Execution of individual combat skills.					
<u>Importance</u>					
Mean	4.70	5.00			
Standard Deviation	0.50	0.00			
<u>Completeness</u>					
Mean	2.10	2.70			
Standard Deviation	1.00	1.10			
10. Did commanders take care of men?					
<u>Importance</u>					
Mean	4.50	4.60			
Standard Deviation	0.90	0.50			
<u>Completeness</u>					
Mean	2.90	2.60			
Standard Deviation	1.00	1.50			
11. Ingenuity and flexibility of commanders at all levels.					
<u>Importance</u>					
Mean	4.10	4.60	4.70		
Standard Deviation	1.00	0.50	0.50		
<u>Completeness</u>					
Mean	3.10	3.00	3.40		
Standard Deviation	0.90	1.10	0.80		
12. Professional knowledge of commanders and staff at all levels.					
<u>Importance</u>					
Mean	4.80	5.00			
Standard Deviation	0.40	0.00			
<u>Completeness</u>					
Mean	3.20	2.80			
Standard Deviation	1.30	1.00			

QUESTION 3 RESULTS (CONT.)

ITEMS				% UNIT APPLICABILITY				
				ROUND TWO		ROUND THREE		
	TWO	THREE	FOUR	Squad	Platoon	Company	Battalion	Brigade
13. Ability to communicate in a timely and accurate manner.								
<u>Importance</u>								
Mean	5.00	4.90						
Standard Deviation	0.00	0.40						
<u>Completeness</u>								
Mean	2.90	2.30						
Standard Deviation	1.30	1.30						
14. Defensive capability.								
<u>Importance</u>								
Mean	4.50	4.90						
Standard Deviation	0.70	0.60						
<u>Completeness</u>								
Mean	2.50	2.80						
Standard Deviation	0.70	1.00						
15. Endurance of personnel and equipment beyond the exercise period.								
<u>Importance</u>								
Mean	3.90	3.80						
Standard Deviation	1.20	1.20						
<u>Completeness</u>								
Mean	4.30	4.70						
Standard Deviation	0.80	0.50						
16. Physical, mental, and moral fitness.								
<u>Importance</u>								
Mean	4.30	4.30						
Standard Deviation	1.20	0.80						
<u>Completeness</u>								
Mean	3.90	4.10						
Standard Deviation	1.20	1.10						

QUESTION 3 RESULTS (CONT.)

ITEMS	ROUND			% UNIT APPLICABILITY	
				ROUND TWO	ROUND THREE
	TWO	THREE	FOUR	Squad Platoon Company Battalion Brigade	Squad Platoon Company Battalion Brigade
17. Unit performance in the field for an extended period.					
<u>Importance</u>					
Mean	4.50	4.20	4.40		
Standard Deviation	0.90	1.20	0.50		
<u>Completeness</u>					
Mean	3.70	4.20	3.40		
Standard Deviation	1.30	1.10	0.90		
18. Execution in a combat situation.					
<u>Importance</u>					
Mean	4.80	4.40	4.60		
Standard Deviation	0.60	1.30	0.50		
<u>Completeness</u>					
Mean	3.50	4.20	2.80		
Standard Deviation	1.40	1.30	1.10		
19. Ability to deliver live fire accurately and timely.					
<u>Importance</u>					
Mean	4.90	5.00			
Standard Deviation	0.30	0.00			
<u>Completeness</u>					
Mean	3.40	3.40			
Standard Deviation	1.20	1.10			
20. Fire and maneuver ability.					
<u>Importance</u>					
Mean	4.70	4.90			
Standard Deviation	0.70	0.40			
<u>Completeness</u>					
Mean	2.90	2.80			
Standard Deviation	1.00	1.00			

QUESTION 3 RESULTS (CONT.)

ITEMS				% UNIT APPLICABILITY	
				ROUND TWO	ROUND THREE
	TWO	THREE	FOUR	Squad Platoon Company Battalion Brigade	Squad Platoon Company Battalion Brigade
21. Employment of organic weapons.					
<u>Importance</u>					
Mean	4.90	5.00			
Standard Deviation	0.30	0.00			
<u>Completeness</u>					
Mean	2.80	2.80			
Standard Deviation	1.10	1.00			
22. Fire discipline.					
<u>Importance</u>					
Mean	4.50	4.40			
Standard Deviation	0.70	0.70			
<u>Completeness</u>					
Mean	3.00	2.80			
Standard Deviation	1.10	1.00			
23. Definitive information on supply and equipment status.					
<u>Importance</u>					
Mean	4.20	4.00			
Standard Deviation	0.70	0.80			
<u>Completeness</u>					
Mean	2.90	2.80			
Standard Deviation	0.90	1.20			
24. Ability to sustain under certain resupply conditions.					
<u>Importance</u>					
Mean	4.00	4.20			
Standard Deviation	0.80	0.80			
<u>Completeness</u>					
Mean	3.40	4.00			
Standard Deviation	0.80	1.10			

QUESTION 3 RESULTS (CONT.)

ITEMS				% UNIT APPLICABILITY	
				ROUND TWO	ROUND THREE
	ROUND			Squad Platoon Company Battalion Brigade	Squad Platoon Company Battalion Brigade
	TWO	THREE	FOUR		
25. Was supply/resupply orderly and timely?					
<u>Importance</u>					
Mean	4.50	4.30			
Standard Deviation	0.70	0.90			
<u>Completeness</u>					
Mean	3.20	3.30			
Standard Deviation	0.70	1.00			
26. Supply economy.					
<u>Importance</u>					
Mean	4.00	3.60			
Standard Deviation	1.10	1.40			
<u>Completeness</u>					
Mean	2.50	3.40			
Standard Deviation	0.80	1.30			
27. Whether or-not intelligence was received and acted upon?					
<u>Importance</u>					
Mean	4.50	4.00			
Standard Deviation	0.70	0.80			
<u>Completeness</u>					
Mean	3.30	2.90			
Standard Deviation	1.10	1.10			
28. Effectiveness of logistic support for handling equipment casualties.					
<u>Importance</u>					
Mean	4.30	4.00			
Standard Deviation	0.80	0.80			
<u>Completeness</u>					
Mean	3.40	3.40			
Standard Deviation	0.70	1.20			

QUESTION 3 RESULTS (CONT.)

ITEMS				% UNIT APPLICABILITY	
				ROUND TWO	ROUND THREE
	TWO	THREE	FOUR	Squad Platoon Company Battalion Brigade	Squad Platoon Company Battalion Brigade
29. Did mission get accomplished?					
<u>Importance</u>					
Mean	5.00	5.00			
Standard Deviation	0.00	0.00			
<u>Completeness</u>					
Mean	2.40	2.40		|||||	|||||
Standard Deviation	1.10	1.30		|||||	|||||
30. Patrolling capability.					
<u>Importance</u>					
Mean	4.70	4.50			
Standard Deviation	0.50	0.50			
<u>Completeness</u>					
Mean	2.80	2.60		|||||	|||||
Standard Deviation	0.90	1.10		|||||	|||||
31. Personnel stability – are all troops deployable?					
<u>Importance</u>					
Mean	3.70	3.70			
Standard Deviation	1.30	1.40			
<u>Completeness</u>					
Mean	3.50	4.00		|||||	|||||
Standard Deviation	1.40	0.90		|||||	|||||
32. Did a “frago” move the unit out smartly after the objective was taken?					
<u>Importance</u>					
Mean	3.60	4.40	4.70		
Standard Deviation	1.10	0.50	0.60		
<u>Completeness</u>					
Mean	2.30	2.40	3.25	|||||	|||||
Standard Deviation	1.50	1.50	1.50	|||||	|||||

QUESTION 3 RESULTS (CONT.)

ITEMS				% UNIT APPLICABILITY	
				ROUND TWO	ROUND THREE
	ROUND			Squad Platoon Company Battalion Brigade	Squad Platoon Company Battalion Brigade
	TWO	THREE	FOUR		
33. Did casualty reports, log reports, etc., go up the chain expeditiously, and was there rapid response?					
<u>Importance</u>					
Mean	4.20	3.90	4.27		
Standard Deviation	0.90	0.80	0.76		
<u>Completeness</u>					
Mean	3.10	2.90	3.14	.....	.....
Standard Deviation	1.00	1.00	1.07	.....	.....
34. Are reporting procedures faulty (S-1, S-4) because of set up of problem?					
<u>Importance</u>					
Mean	4.10	3.60	3.80		
Standard Deviation	0.70	1.30	0.84		
<u>Completeness</u>					
Mean	3.60	3.40	3.80	.....	.....
Standard Deviation	1.10	1.10	0.84	.....	.....
*35. Do reporting procedures provide accurate information in a timely manner?					
<u>Importance</u>					
Mean			4.14		
Standard Deviation			0.38		
<u>Completeness</u>					
Mean			3.29		
Standard Deviation			1.11		

*This item was added in Round Three.

APPENDIX D
CONTEXTUAL ITEMS DEVELOPED FROM QUESTION 4

QUESTION 4 RESULTS

ITEMS			% UNIT APPLICABILITY
			ROUND THREE
	THREE	FOUR	Squad Platoon Company Battalion Brigade
1. Terrain/hydrography.			
<u>Importance</u>			
Mean	4.40	4.44	|||||
Standard Deviation	1.07	0.88	|||||
2. Weather.			
<u>Importance</u>			
Mean	4.10	3.89	|||||
Standard Deviation	0.87	0.93	|||||
3. Time (Available).			
<u>Importance</u>			
Mean	4.40	4.33	|||||
Standard Deviation	0.96	1.00	|||||
4. Space (Maneuvering).			
<u>Importance</u>			
Mean	3.90	4.11	|||||
Standard Deviation	1.10	0.33	|||||
5. Intelligence (provided by higher headquarters).			
<u>Importance</u>			
Mean	4.10	4.44	|||||
Standard Deviation	0.73	0.53	|||||
6. Timeliness and quality of requested close air support, supporting arms, helo support, and logistics support.			
<u>Importance</u>			
Mean	4.90	4.89	|||||
Standard Deviation	0.31	0.33	|||||

QUESTION 4 RESULTS (CONT.)

ITEMS	ROUND		% UNIT APPLICABILITY
			ROUND THREE
	THREE	FOUR	Squad Platoon Company Battalion Brigade
7. Fatigue level of personnel (due to extended, demanding operation).			
<u>Importance</u>			
Mean	3.77	4.33	|||||
Standard Deviation	1.09	0.52	|||||
8. Rules of engagement.			
<u>Importance</u>			
Mean	3.40	3.88	|||||
Standard Deviation	1.34	0.64	|||||
9. Resources allocated by higher headquarters.			
<u>Importance</u>			
Mean	4.00	4.29	|||||
Standard Deviation	0.75	0.49	|||||
10. Overcontrol by higher headquarters.			
<u>Importance</u>			
Mean	4.20	3.63	|||||
Standard Deviation	1.13	1.19	|||||
11. Civilians in battle zone.			
<u>Importance</u>			
Mean	3.55	3.38	|||||
Standard Deviation	1.58	1.06	|||||
12. Peacetime environmental and safety requirements.			
<u>Importance</u>			
Mean	3.80	3.75	|||||
Standard Deviation	1.58	0.46	|||||

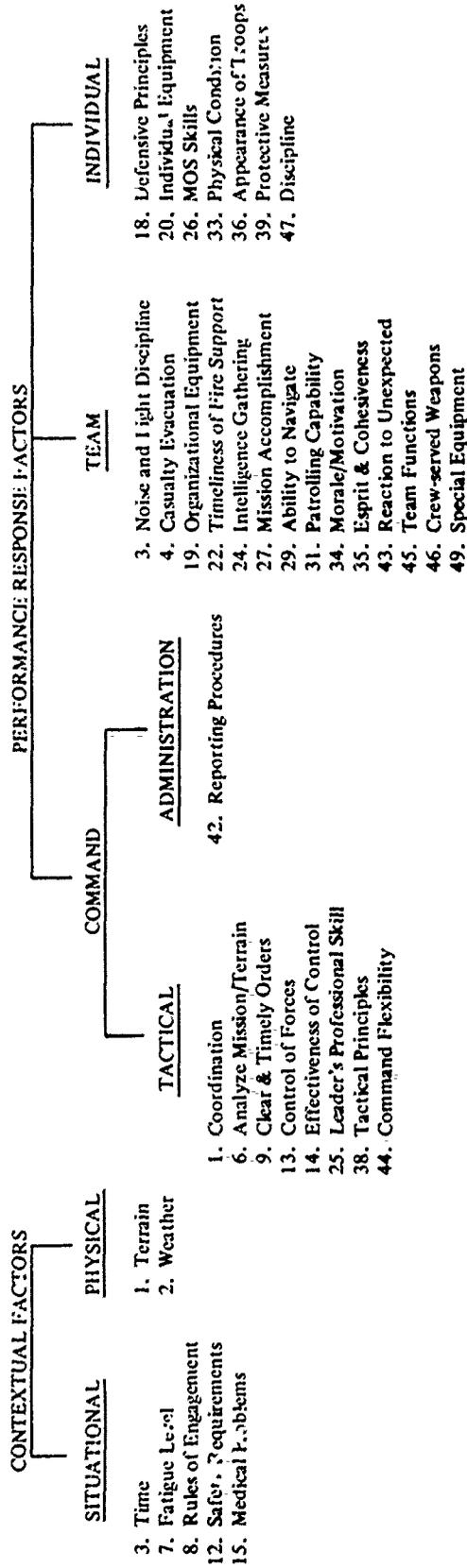
QUESTION 4 RESULTS (CONT.)

ITEMS	ROUND		% UNIT APPLICABILITY				
			ROUND THREE				
	THREE	FOUR	Squad	Platoon	Company	Battalion	Brigade
* 13. Replacements (quality, training, and availability).							
<u>Importance</u>							
Mean	3.28						
Standard Deviation	1.60						
* 14. Reliability/durability of equipment.							
<u>Importance</u>							
Mean	4.25						
Standard Deviation	0.70						
15. Unexpected medical problems in the objective area.							
<u>Importance</u>							
Mean	3.30	3.22					
Standard Deviation	1.15	0.83					
16. Long-range communications from the objective area.							
<u>Importance</u>							
Mean	3.30	3.67					
Standard Deviation	1.05	0.71					
17. Distance from the objective area to the nearest support base.							
<u>Importance</u>							
Mean	3.60	4.00					
Standard Deviation	1.17	0.87					

*Statistical data not collected in Round Four.

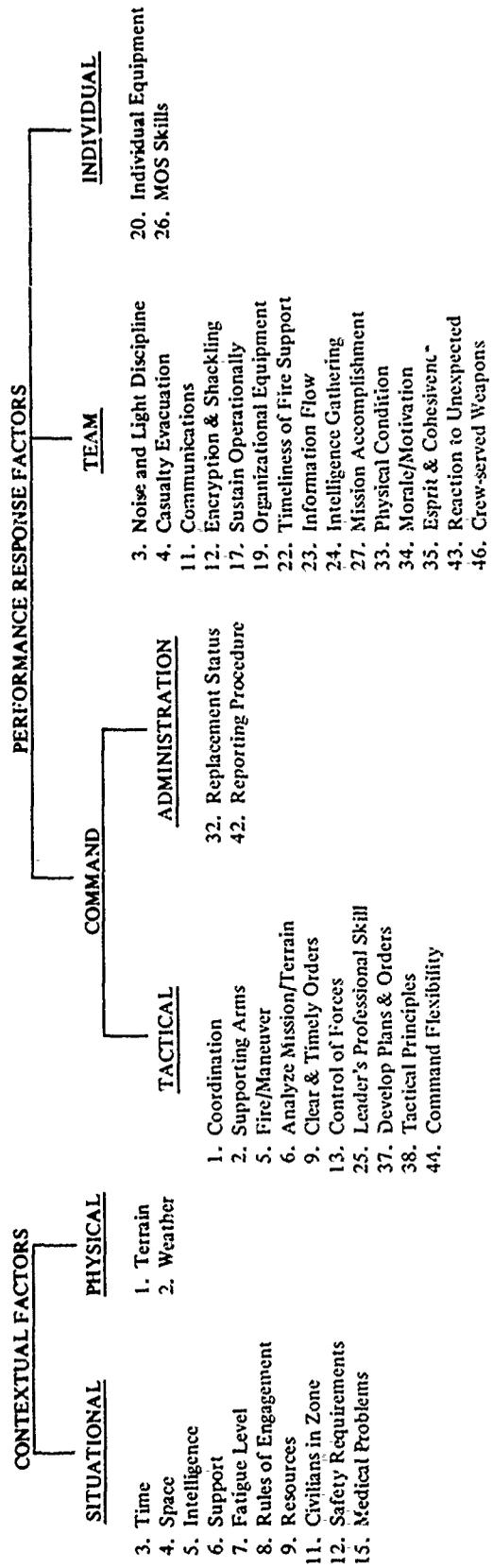
APPENDIX E
INITIAL PERFORMANCE EVALUATION FORMAT FOR
UNIT LEVELS (SQUAD THROUGH BRIGADE)

TENTATIVE SQUAD-COMPANY ITEM BREAKDOWN



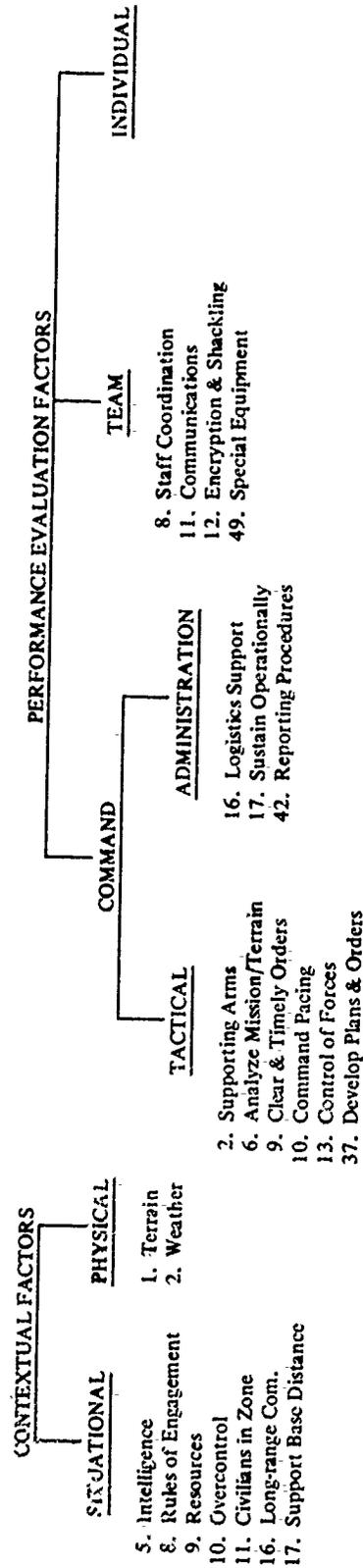
NOTE: Item numbers refer to the complete item description found in Appendices B and D.

TENTATIVE COMPANY-BATTALION ITEM BREAKDOWN



NOTE: Item numbers refer to the complete item description found in Appendices B and D.

TENTATIVE BATTALION-BRIGADE ITEM BREAKDOWN



NOTE: Item numbers refer to the complete item description found in Appendices B and D.

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