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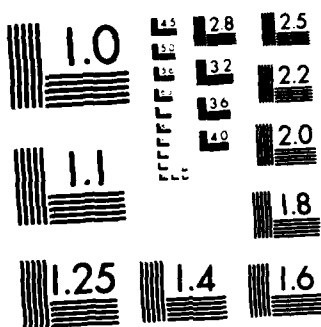
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Soldier Dimension in Battle
Final Report
Volume 1

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US Army Soldier Support Center
Fort Benjamin Harrison, Indiana 46216

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recommendations as to leadership, personnel, training and modelling actions that could be undertaken to improve soldier performance.

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EXECUTIVE SUMMARY

The U.S. Army has been systematically preparing for a modern battlefield of unparalleled lethality and fluidity that has required a fundamental re-evaluation and re-organization of its resources in meeting its primary operational mission. It is timely that the U.S. Army Training and Doctrine Command (TRADOC) should seek to further define the modern soldier in terms of capabilities and limitations individually and as tactical groups. The pivot for combat success is with the individual soldier who acts cohesively with his basic operational unit and leaders to overcome a more numerous enemy.

Managing the soldier dimensions is imperative. It is our fundamental concept that such management is achievable. We acknowledge that there is a technique gap that exists between the scientific-technical literature, its quantification, and its implementation. The problem is that this body of information must be organized, distilled, evaluated, and translated into workable, usable tools that predict systems performance accurately. We believe that our study, "Soldier Dimension in Battle," has provided methodology for synthesizing these data. Our reports have been submitted to the U.S. Army Soldier Support Center, Fort Benjamin Harrison, Indiana and in addition to this final report include:

- Volume 2, Systems Performance Measurement
- Volume 3, Individual and Group Characteristics
- Volume 4, Leader/Manager Actions

All four of these volumes actively support one or more of the U.S. Army Human Goals.

System Performance Measures

We are concerned with studying current and potential measures of system performance for their possible usefulness as dependent and independent variables in the combat equation, as a means of testing doctrinal concepts, as components in wargame formulations, and as measures of readiness useful to the work of trainers and training managers. Performance assessment and appraisal of individuals and systems is nothing new to the Army. It has extensively pursued mechanisms to achieve these objectives. We studied several of these mechanisms and their processes that are available in various sources of doctrine such as Army regulations, manuals, ARTEPS, training circulars, and related research documents.

Methodology

We then looked closely at 11 of the procedures and programs described or studied in a variety of unclassified Army sources, that we believe were worthwhile to pursue in depth, and treated each of these individually in our analyses. In addition, we also considered measures of

system performance in general from the civilian literature, and other types of such measurement used in the Army (e.g., Marine Corps Combat Readiness Evaluation System).

We analyzed our findings of the 11 programs and procedures in terms of aspects of the two major uses with which we are concerned:

- Data utility--usefulness in terms of types of data to research goals in general, Volume 2, Table 2-1.
- Military utility--usefulness to a company commander as a means to take actions which will enhance combat readiness, and usefulness to military researchers as dependent and independent variables in predicting system performance relevant to a combat equation, Volume 2, Table 2-2.

ARTEPs is the Best Measure of Systems Performance

From our study of sources and our treatment of the data as exhibited in these two tables, we have concluded that the best measures of systems performance for the purpose of this study are unit ARTEPs. The results of ARTEPs are meant to tell trainers/leaders what their strengths and weaknesses are in terms of their units' readiness to perform in combat. It also is a diagnostic instrument at the unit level that inherently requires performance at the level of the individual soldier. This fact obviates the need of military researchers to estimate combat effectiveness by aggregating soldier data individually.

SQTs are similar evaluations of MOS/soldier skills and remain important to the company commander in achieving and appraising unit effectiveness. Field Training Exercises, especially those that are not closely derived from ARTEPs, can provide additional sources of data as dependent variables in the combat equation, but they generally would not add appreciable information as independent variables because of their relative infrequency, special purpose nature, redundancy of information provided by ARTEPs or the expense of conducting them. We have concluded that unit ARTEPs are the best measures of system performance for use as dependent and independent variables in a combat equation.

Our study has focused on doctrine related to ARTEPs and other measures. A problem can exist because much can be lost in the translation of doctrine into action. How ARTEPs are actually carried out under various conditions of terrain, weather, and material availability can both diminish or enhance their useability in predicting combat effectiveness generally or in terms of specific scenarios. We also see a minor problem in applying ARTEPs data as it now stands. The formative purposes of ARTEPs are adequately served by their division into three levels of difficulty, on the one hand, and the after action critique, on the other. In terms of a combat equation the former result may be too crude and the latter results may be too specific. We are convinced that they do provide the most economic opportunity for obtaining the necessary types of data.

We believe ARTEPs data systematically accumulated at the National Training Center will be most advantageous in fundamental and developmental stages of combat effectiveness analyses.

Individual and Group Characteristics

The study of individuals and groups in the form of the Soldier Dimension represents a continuation of social science and systems science applications in the history of Army research. It also represents a shift in emphasis that is taking place in business and industry as well. Productivity is the goal and, for the Army, productivity is defined as force readiness and ultimately combat effectiveness in the form of the imposition of combat power. Part of this shift in emphasis is due to cultural and technical advances by which:

"...the mechanics of energy have been displaced from the center of our attention by the problems of information and control: how do you manage the thing once you have it running (Bruner, 1982, p. 42)."

The place where business and industry are searching for the answer to this question is exemplified by a series of articles on productivity in Fortune magazine:

"...the epicenter of change lies in the way people work together, the area of management richest in potential payoff (Burck, 1981, p. 68)."

It is not surprising to us that the Army, whose mission is characterized by life-and death decisions, also sees the key optimization issue in terms of the Soldier Dimension but with an additional sense of urgency:

"The human side of the combat equation, which is made up of such things as incentives, values, attitudes, will, cohesion, and commitment, offers the greatest order of magnitude potential for increases in combat power and force readiness (SOW, 1981, p. C3)."

Implicit in this statement is a recognition by the Army of the critical importance of anticipatory organizational design. The lethality and mobility of modern weapons technology are so out of proportion to history that they demand systematic, comprehensive preparation. The most probable lessons of combat must be learned in advance since there will be no time to effectively adapt within the framework of an actual conflict. Its technology is making the Army somewhat like a very low flying air force, and the Army's efforts to redesign structure, strategy and tactics are mirrored in this analogy. So too does this Soldier Dimension research have its eye on the future as well as the present.

We sought to relate the Soldier Dimension to the broader context of scientific theory at a number of points in Volume 3. For example, we

viewed soldier effectiveness in terms of adaptability and survival under stress in terms of survival of the "fitted". We have also emphasized the importance of cognitive-behaviorism, situational analysis, and systems theory because of our focus on human performance, interactionism, and the dynamics of individual and group adaptation.

The productivity quests of civilian business and industry on the one hand and the Army on the other are for survival. They share ground that most scientists will recognize as the objectives of any of their disciplines, namely to describe and understand the part of the universe one's specialty focuses on so that one can better predict and control one's future. In dealing with the many complexities of the universe, science has found it necessary to partition itself into a number of subspecialties because it is a human endeavor and humans have their limitations. These subspecialties have given rise to an immense amount of information whose impact ignores the analytic boundaries of science which gave rise to it. Our task has been in the integration of this information, all of which is rapidly developing in separate scientific areas so that the impacts can be described and effective adaptation can be realized.

Taxonomy and Classification Systems

We devised a system of taxonomy and classification in order to deal with the wealth of information from the scientific specialties in biology, psychology, sociology, and anthropology. This system allows us to analyze and integrate the diverse, and sometimes conflicting data, in a new and useful way because it is premised on observable and measurable actions that individuals and groups take in real situations. Our system of data organization was designed not only to comprehend existing data, but also to be useful ten years from now for an Army leader/researcher faced with the problem of estimating how some piece of research on brain chemicals, motivation, or bystander apathy can be applied in terms of enhancing combat effectiveness. The comprehensiveness of the system is unique. The most important assumptions that underline the taxonomy and classification system are summarized:

1. Humans are complex organisms.
2. Humans are built to engage their environments in all four dimensions of environmental information and must do so in an integrated way to survive.
3. Humans use their experience of engagements with their environment to enhance their survival. They are self-correcting organisms.
4. Humans use social groups to enhance their survival.
5. Humans and their groups are resources for their own survival in encounters with other features of the environment.

6. Soldiers and soldier groups are resources which societies use to enhance their survival.
7. Societies will survive to the extent that they can prepare soldiers through individual and group experiences to survive combat engagements in warfare at the expense of their opponents.

The taxonomy and classification system for individual transactions relative to salient features of the environment is summarized in Volume 3, Table 3-2 and the supporting text. An analogous system is used for the presentation of group factors. In addition, this method permits the realistic treatment of individuals and groups not in a vacuum or as abstractable units but as participants in engagements with the levels of an environment which determine their survivability. We also present examples of analogies between individuals and different kinds of groups (Volume 3, Tables 3-5 and 3-6) that follow from the methodology.

The system not only allows us to arrange the variety, diversity, and complexity of data on human functioning in an integrated manner, but it allows us to reconcile a wealth of conflicting research both within and across the disciplines we have encountered. For example, we demonstrate how opposing information from studies of personality, cognition, emotion, and social motives, on the one hand; and information from learning theory and situational analysis, on the other; can be made to coincide for useful purposes. Both types of data, individual and environmental, determine performance but they have their short-and long term effects in substantially different ways. Our system is comprehensive to the degree that it encompasses not only traditional research and logic, but also new research emphasizing the cybernetic nature of human biosocial existence. Not only does the brain affect the way people relate, but their history of social interaction changes the biological face of the brain according to recent cross-cultural neurological studies.

Our system provides an insight into the criticality of how environmental transactions determine the way the brain thinks, and how this fact is important to organizational success. Manipulation of the environment is the only way that leaders/managers can bring about changes in individual performance and thinking consistent with the goals of the organization. They, along with organizational policies/programs/procedures, are the transmitters of culture. They are the most important way in which organization-relevant performance becomes part of the individual. Volume 3 expresses the need for leaders to approach their soldiers through the systematic application of the principles of learning theory to achieve the soldier identity, cohesion, and commitment. The taxonomy and classification system has also proven useful by providing new perspectives and new frameworks for analyzing, synthesizing, and using scientific and military information for the enhancement of combat effectiveness. As a perspective that systematically ties human and group functioning to a

dynamic reality, it promotes multilevel analysis and integrated comprehensive action that optimizes the complementary and interactive nature of the factors we have defined.

Individual and Group Factors

We concluded that four major interdependent factors are important in the effective functioning of soldiers: physical health, job/task skills, interpersonal skills, and integrity/mental health. Examples of characteristics pertinent to each factor and components are shown in Volume 3, Table 3-7. Each of these factors has from 5 to 11 aspects or features that are of particular importance to soldier effectiveness. Examples of these individual/characteristics include: maintenance reliability, adaptability to stressors, persistence under stress, and skill variety.

Similarly, we identified four major interdependent factors important in the effective functioning of soldier groups: maintenance functions, mission competence, deterrence competence, and unit integrity. Examples of characteristics pertinent to each factor and relevant measures are shown in Volume 3, Table 3-8. Each of these factors has from 5 to 12 aspects that are of particular importance to the effectiveness of soldier groups and these are similar to those listed for soldier factors.

Leader-Management Actions

This study recognizes that good leadership is essential to good soldier performance and these leadership issues are examined:

- Definitions of Leadership
- Theories of Leadership
- Leader Evaluation
- Leader Controlled Elements
- Leadership Goals
- Leader Training

Definitions of Leadership

There is no generally accepted definition of leadership. There are nearly as many definitions as there are writers in the field of leadership. Even major dictionaries say little more than leadership is what leaders do. In any study, however, there is a need to define the problem and basic terms. This is needed to maintain perspective and focus. This study has used a definition taken from Leadership of the 1970s, a document produced by the Army:

"Military Leadership is the process of influencing human behavior so as to accomplish the mission of the organization (Clement and Zeirdt, 1975)."

Leadership is one aspect of the broader term, management. Management involves many matters which must be dealt with by those in leadership

positions which are not clearly part of the leadership function itself. Management is defined in this study as:

"Management is a social and technical process that utilizes resources, influences human action, and facilitates changes in order to accomplish an organization's goals."

Theories of Leadership

There has been a clearly recognizable pattern in the development of leadership theories. Early theories emphasized leader traits. Some of these theories were called "Great Man" theories. They relied heavily on biographical information in attempting to isolate those factors believed to make leaders great. Though such theories continue to be popular among the lay public, they were replaced in the professional literature with theories which emphasized situations. Situations were thought to have the power to create the needed qualities of leadership.

By World War II, there was a growing recognition of leadership as one element in a dynamic interaction between the leader, the situation, and followers. The important elements of the early theories were incorporated in the more comprehensive, newer views. Each of the theoretical views examined in this study contributes to the study in its own unique way.

- Trait Theory - Though leadership cannot be conceptualized solely in terms of traits, there are some qualities which seem to contribute to the effectiveness of leaders in most situations.
- Situational Theory - The qualities and procedures needed for effective leadership will be dictated, in part, by the demands of the situation.
- Decision Theory - The decision making procedure can be described in a way that improves decision-making effectiveness.
- Path-Goal Theory - Path-goal theory emphasizes the need for the leader to know subordinates well and to use this knowledge to effectively influence the subordinate along a goal fulfillment path.
- Fiedler's Contingency Theory - Fiedler's theory focuses attention on leader-follower relations, task structure and difficulty, leader position power, and how the interaction of these three factors determines whether a task-oriented or a relationship oriented leadership style will be most effective.

- Transactional Theory - Transactional theory points out the dynamic interaction that takes place between the leader, followers, and the situation and recognizes that each affects the other continuously.
- Power Theory - Power theory describes the five basic types of influence available to a leader and explains how each type of influence affects various kinds of outcomes of leader-follower relationships.

Leader Behavior

Studies of leader behavior have resulted in the identification of 14 categories of behaviors which incorporate all of the essential elements of leadership. This study found that the Army's procedure for assessing leaders, using the 17 categories on DA Form 2166-6 Oct. 81, touches on all of these 14 essential elements. It was also found that the Army has identified a number of leader behaviors which it teaches to its officers. These behaviors have been grouped into the categories used on DA Form 2166-6 Oct. 81, in this study. These behavioral statements operationalize the categories in which leaders are evaluated and provide a basis for the use of more objective measurement procedures.

Leader Evaluation

The grouping of behavioral statements into the categories of leader behavior already used to evaluate officer behavior provides the means for going beyond evaluation based mainly on subjective professional judgment to more precisely quantifiable behavioral statements. This can be done through the use of a variety of measurement tools and procedures. The rating given in each category is based on the measurement of those behaviors which make up each category. In order to fully implement a program of assessment which is based mainly on objective measurement of behaviors rather than subjective evaluation of categories of behavior, it will be necessary to develop and incorporate in the rating system such procedures as self-reports, inputs from subordinates, naturalistic observation, critical incident reports, rating scales, semantic differentials, interviews, questionnaires, criterion referenced evaluations, tests, and data from records.

The evaluation of Company Grade Officers should include all of the categories of leader activity and all of the behaviors suggested in this study under each category. The emphasis in these evaluations must be on improvement with experience rather than perfection from the beginning. The leader who is threatened by the potential long-range impact of an error or weakness recorded early in his career will not identify with the organization imposing that threat as readily as he will identify with an organization that views an early mistake as an opportunity for learning and rewards the ensuing growth. To whatever extent Company Grade Officers view the evaluation system as threatening rather than the basis for professional development, the Army should strive to overcome the bases for

such attitudes. Evaluation of leaders must take account of the context in which the leader is being evaluated. The evidence that leader traits and behaviors cannot be validly judged in isolation from their circumstances is overwhelming.

Leader Controlled Elements

Kind of Power Used

We have found that a leader has five types of power or influence which he may use and they are:

- Reward
- Referrent
- Coercive
- Expert
- Legitimate

Each type of power is effective under certain conditions and ineffective in others.

- Reward power works when the desired behavior already occurs with some degree of frequency, the leader has control over effective rewards and can administer them, time is available to develop the desired frequency of behavior using reward procedures, and a closer identification between leader and follower is desired. Efforts to use reward power under conditions other than these will be ineffective.
- Referrent power can be used when a strong identification exists between leader and follower. That relationship is the essence of referrent power. Where such an identification does not exist, referrent power is ineffective.
- Coercive power works effectively for a short time when task completion is the only matter of real concern. It is ineffective when satisfaction of personal goals is an important purpose to be accomplished or in any situation in which high task accomplishment over a long period of time with the supervisor absent is important.
- Expert power is effective in situations in which expertise is needed and the leader possesses such expertise. Efforts to impose expertise where it is not needed or to make a pretense at being an expert when, in fact, one is not, will have negative consequences.
- Legitimate power. When leader and follower share a tradition or cultural heritage which endows the leadership position with authority which the leader and the follower accept, legitimate power provides the leader with that might be considered the best

of all leadership situations. It has been pointed out repeatedly by numerous authorities, however, that the common heritage of leaders and followers which has included the tradition of military authority seems to have been lost as the military services have attracted increasing numbers of young people from diverse cultural backgrounds. Leader actions which depend on legitimate authority are not presently highly effective.

Leadership Style

Many factors contribute to leadership style. Manner and bearing, intelligence, knowledge, rank, persuasiveness, and experience are among the factors which contribute to style. Each of these probably contributes to the effectiveness of the leader's actions to some extent in some situations. Only two factors, however, seem to consistently impact in an important way on leader effectiveness. These two factors are:

- (1) Consideration
- (2) Task Orientation

Consideration refers to a leadership style that emphasizes achievement of the personal goals of followers. Task orientation characterizes the leader who tends to give first priority to task accomplishment. Leaders whose style is balanced between consideration and task orientation tend to be rated highest by followers. Most leaders, however, tend to emphasize one style or the other making them effective only in those circumstances in which their preferred style is especially effective. Fiedler believes that a leader's tendency to one style or the other comes from deep-seated aspects of personality and is relatively unchangeable (1967). We have no evidence to counter Fiedler's view, but we do believe that the leader who knows his own tendencies in this regard, who attempts to develop abilities indicative of the alternate style, and who learns to recognize situations in which each style is most effective can develop a leadership style which is more balanced and effective in a wider range of circumstances.

Consideration oriented leadership tends to be more effective than task oriented leadership when:

- The task is moderately structured
- Leader-follower relations are good
- Follower satisfaction is a major goal

Task oriented leadership tends to be more effective than consideration leadership when:

- The task is highly structured or quite unstructured
- Leader-follower relations are not good
- Task accomplishment, productivity is paramount

A review of the literature on leadership style and cohesion indicates that group cohesiveness is about equally related to the two

leadership styles. The style of the leader is then, an important factor in determining whether a leader action will be effective. Style and the kind of power used are the two most critical elements within the leader's control that determine whether or not a leader behavior will produce the desired results.

Leadership Goals

Goals of leadership fall into two major categories: (1) Organizational goals and (2) Personal goals. Both of these types of goals are present in all groups. They relate to one another in one of four possible arrangements:

- Organizational and personal goals are virtually the same
- Organizational and personal goals overlap but are not identical
- One type of goal precedes the other and contributes to the accomplishment of the second goal
- The two types of goals are incompatible with one another

The successful leader must be aware of both types of goals and their relationships to each other as well as the most effective ways of accomplishing them. The Company Grade Officer is in a particularly critical position. His is the front line operation in the fulfillment of the organization's mission and in meeting the needs of the individuals who make up the organization. The Company Grade Officer clearly fills the role described by Likert as the "Linking Pin." This is the leadership role most crucial in bringing together the purposes of the Army and its people.

It is our observation that while the Army is quite concerned with increasing cohesion, it has failed to recognize the critical role of its Company Grade Officers in this regard and has, therefore, not utilized these leaders to the fullest extent possible to accomplish this end. To enhance the development of cohesion among members of a group, the leader must use reward power to encourage the development of referent power. In order to accomplish this, the leader must be close enough to followers to regularly deliver appropriate rewards and to meet personal needs. This tends to happen in combat or during transitional periods more readily than in peacetime. The Company Grade Officer should devote more time and energy to leadership and less to administration and management duties in peacetime if cohesion is to be developed.

Leader Training

People who assume leader roles in the Army tend to be task oriented, consideration oriented, or balanced regarding these tendencies. Each of these styles may be effective in certain instances, but not in all. Leadership training should be developed to help the new leader:

- Recognize his own pattern of leadership style

- Learn which approaches to leadership are most effective under which types of conditions
- Use both styles of leadership in appropriate circumstances rather than relying on one preferred style just because it seems more natural

Leadership training cannot be limited to courses and special activities. The Company Grade Officer can be considered a leader in training at all times. Opportunities to evaluate all aspects of his work and under various circumstances can be developed and these evaluations may be used to help the leader develop necessary skills. It is especially critical that the new leader be provided opportunities to express initiative and creativity in problem solving without fear of criticism or reprisal if he is not always correct or successful. Leaders can be trained to broaden and improve their skills. This can be best accomplished in a supportive climate which rewards growth and improvement.

DETERMINING ALTERNATIVE COURSES OF ACTION

Introduction

We have analyzed and discussed the construction of the Soldier Dimension of the combat equation. Our analysis has contained an understanding of the interactions and interdependencies of these factors. Our purpose is to develop a formulation that describes the relationships among:

- Individual Characteristics
- Group Characteristics
- Leader-manager Actions
- System Performance

These relationships are to be considered in the context of the conditions: peace, transition to combat, and combat. The resulting formulation will address the problem of differentially predicting performance in these conditions. Each alternative will identify the advantages and disadvantages along with the resources required for each alternative as well as our recommended course of action.

Quantification issues are central to the problem of developing a formulation for simple interactions and become much more complex when interactions with interdependencies discussed in Volumes 2 through 4 are considered. Each volume has identified how the various elements making up each factor are quantified as well as their caveats. Volume 2, Table 2-1 illustrates the difficulty of finding a common denominator for system performance measurement among the eleven evaluation techniques. Only two of the eleven, SQT and ARTEP have levels that are measurable as scales that may be related. The other techniques are framed in units that are appropriate for each technique, but are not easily related to any other. Volumes 3 and 4 provide many other more complex quantification problems.

Quantification Issues

Operations research analysis and systems analysis have a common basis in the history of World War II and current weapon system development. They also share an approach structure that has five levels:

- Problem formulation
- Information and data collection
- Model selection and construction
- Model validation and use
- Model implementation

The initial step of problem formulation involves a studied understanding of the problem. The problem context is described, objectives and criteria are identified, and hypotheses are stated. The assembly of facts involves a disciplined work plan, collection and evaluation of data, and the

organization of those data. This process makes possible a seeking out of possibilities, alternatives, and costs. Analysis is an application of data to the problem using selected models, approximations, computations, algorithms, and results. The conclusions and recommendations are based upon the results of these mathematical techniques. Implied throughout this entire process is that the data to be acquired will be quantified data. Qualitative data are relegated to the analyst's desire to interpret the effects of nonquantifiable elements and their uncertainties. Our current contract and study covers the first two levels, problem formulation and assembly of data. The results of our study will assist in acquiring objective data that can be quantified and is meaningful to the Soldier Dimension in a combat equation. The first two levels are broadly defined requiring a far ranging methodology in order to sweep up all available inputs to a system analysis. The last three levels are narrowly defined in mathematical terms that fit existing models or algorithms of the external world without regard for the values, attitudes, and beliefs of the individuals, groups, and organizations involved.

Models and Modeling

The process at each of these levels, merits additional, succinct comments:

Problem identification. "It is important to emphasize that careful definition of the questions which a study is to answer is an analytical step in itself" (Lynn, 1969, p. 226).

Information and data collection. "As long as model builders do not question the environment set for them by those soliciting the work, any point of view can be supported by selecting appropriate guesstimates about the environment (Shubick and Brewer, 1972).

Model selection and construction. All the quantification techniques for modeling such as linear programming, CPM, Decision Models, Markov Chains, Graph theory, and Stochastic processes must be considered as well as scenario writing for those problems where it may be impossible to build really quantitative models.

Model validation and use. "Without increased and definitive operational testing and empirical studies, the use of detailed studies to treat larger force aggregations is probably of limited value in the analysis of conventional wars. Overall, we are left with faulty concepts...and an abundance of unverified, or only partially verified, detailed models" (Dupuy, 1979, p. 143).

Model implementation. "Many studies result in models that are mathematically elegant, computationally feasible, but never used because they have ignored the psychological and organizational problems of the people who must implement them. The implementation process must be a part of the model" (Gaves and Thompson, 1973, p. xii).

Systems analysis and operations research make use of the scientific method on an interactive basis if one is to be successful. This view is clearly shared by a number of authors.

"The key to successful analysis is a continuous cycle of formulating the problem, selecting objectives, designing alternatives, collecting data, building models, weighing cost against performance, testing for sensitivity, questioning assumptions and data, re-examining the objectives, opening new alternatives, building better models, and so on until satisfaction is obtained or time or money force a cut off" (Quade, 1969, p. 147).

This cycle is particularly evident in the development of weapon system simulations or war games.

War games can be classified into four categories (Schubik and Brewer, 1972, p. 5)

1. Analytic Models. Usually restricted to solve an actual operational problem directly, but because it is clean and clear, it can warn of potential difficulties and identify omissions.
2. Machine Simulations. Simulations and simulators are difficult to control - fewer scientific standards are available to aid in evaluating a computer simulation than a mathematical model.
3. Man-Machine Games. These games involve computers and people who are used to introduce human judgement. They may be slanted toward social psychology by emphasizing human factors and studying the human participants. The alternative is a bias towards systems engineering. The humans are there because they are cheaper than software and can provide interactive, complex judgements about the situation as it unfolds.
4. Free-form Gaming. Involves teams and a referee. Computation may be relegated to simple bookkeeping. Least amenable to tight technical control and it is most likely to produce new insight into complex problems.

Table 1-1 summarizes in a single conceptual matrix the parameters of current war games. Management-strategy free form games that develop national policy and analyze political-economic-military threat have civilian counterparts which include land use planning games (CITY and METRO) popularized by IBM and air pollution exercises (APEX). These games can accommodate a large group of players, more than ten, and require complex decision-making compounded by the interdependencies of all system variables at several different levels. DIVWAG is an example of an Army division war game that provides a method for evaluating force effectiveness and an analytical methodology for comparing alternative forces. A

Table 1-1. War Game Conceptual Matrix

Requirement Level	Participant Level	Decision Level	Game Level	Game Type	Game Output
Joint Staff	Large Group	Compound Complex	Strategic	Management Strategy Free Form	Global Policy
Army	Large Group	Compound Complex	Strategic	Management Strategy Free Form	Threat Analysis
Corps	Large Groups	Complex	Strategic	Full Scale Man-Machine	War Plan Analysis
Brigade/ Division	Medium Group	Complex	Strategic/ Tactical	Full Scale Man-Machine	Contingency Plan Analysis
Regiment/ Battalion	Medium Group	Compound	Tactical	Full Scale Man-Machine	Mission Analysis
Company	Small Group	Correlational	Tactical	Machine Simulation	Performance Analysis
Platoon/ Section/ Crew	Individual	Parametric	Tactical	Machine Simulation/ Analytic Model	Performance Analysis

single individual participant, e.g. helicopter pilot, using current tactics, may fly the machine simulation of an advanced helicopter design in a combat mission as a means of evaluating its tactical performance. Model builders have attempted simulations with a wide range of capability and diversity based on analytic principles (Armstrong, 1978) that are characterized as:

"Model builders are creative carpenters, artful designers and synthesizers who select their instruments of construction from any of several tool boxes we call modeling methodologies. A modeler typically has his own favorite methodology" (Greenberger et al, 1976, p. 85).

The emphasis of a model, Figure 1-1, is on quantitative data. A person is placed in the simulation loop to provide input, as in the case of the helicopter pilot, for performance analysis of a proposed design. This inclusion is a practical trade-off because weapon system models have not found a way to model pilot behavior with any fidelity.

There is a singular lack of agreement among operations research analyst members of the Military Operations Research Society (MORS) and Operations Research Society of America (ORSA) as to how best to apply analytic principles. There are confrontations between purists and those favoring applied technological applications as to the degree and type of required quantification. There are differences also in the acceptance of a single large model vs multiple models that are intergrated to solve a practical problem, Figure 1-1. Technological advances in modeling capability assist in making application problems more flexible, but often complicate the scientific understanding of these apparent successes.

Quantitative Data

There are similar divisions within the behavioral sciences regarding quantification requirements or the acceptability of the use of qualitative data. These are not simply differences of opinion. Frequently they reflect disciplinary differences due to the scope of the problems faced by research investigators such as those in individual differences (psychology) and group characteristics (sociology). There are also dimensional problems associated with operationally defining and measuring concepts within each discipline. These problems are magnified when one attempts to relate factors across disciplinary lines. Our Taxonomy and Classification System seems to have resolved some of these theoretical issues because we are able to relate individual process to group processes, Figure 3-2:

- Psychobehavioral exchanges are linked to sociobehavioral exchanges
- Psychosocial exchanges are linked to sociosocial exchanges

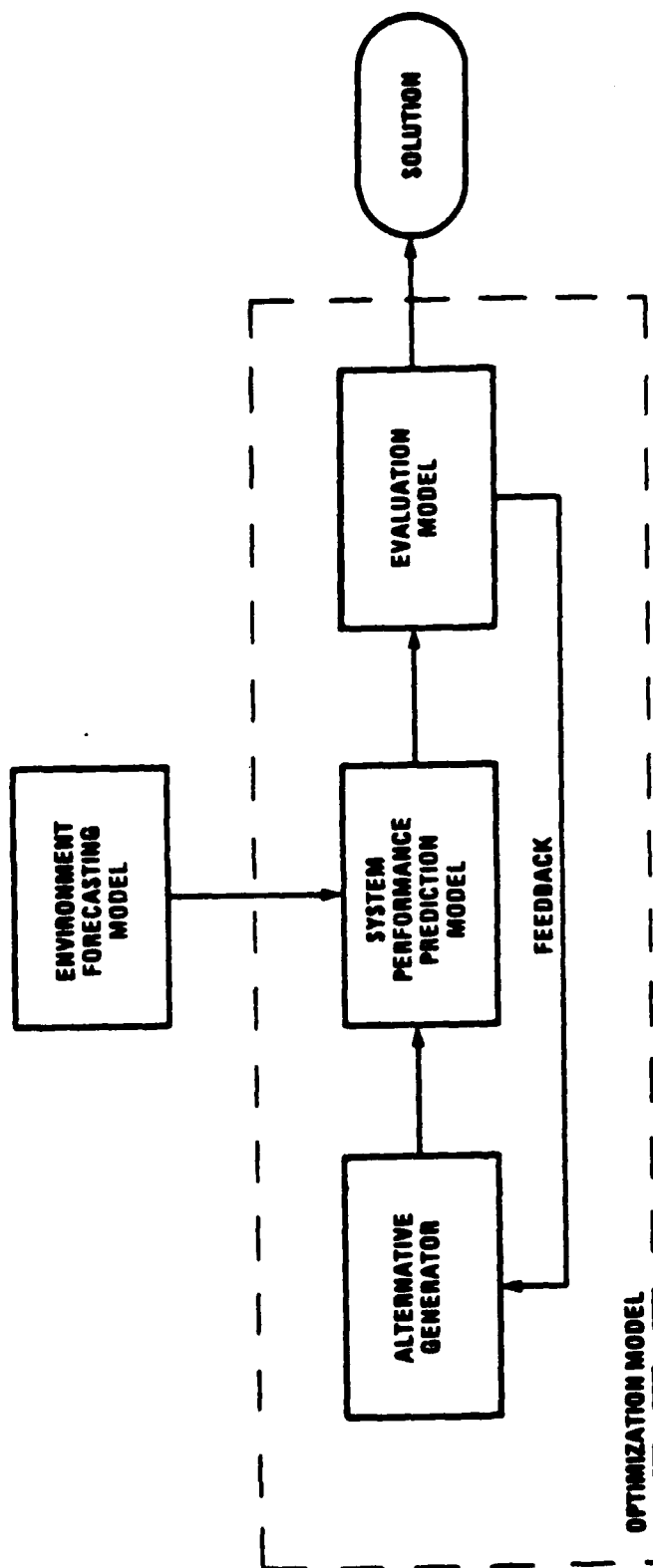


FIGURE 1-1. OPTIMIZATION MODEL

- Psychointegrative exchanges are linked to sociointegrative exchanges

These linkages represent a theoretical contribution to behavioral science and may assist in solving the practical problem of how these exchanges might be measured. These measurement problems will persist until the qualitative data from these interactions can be operationally defined, measurements agreed to, and correlations leading to understanding causation are established. This is not to say that one must wait until this quantification process is completed before attempting to use these relationships in understanding human behavior from the several perspectives of this study.

There are some qualitative data that have been used in behavioral analysis for many years that have not been fully quantified, but that state has not impaired their use. For example, in Volume 4, Table 4-8, we summarized our suggestions for quantifying leader behaviors. Each behavior may be identified or measured by one or more quantifying procedures. These quantifying procedures may not fully satisfy the bounds of quantification required by man-machine modelers. The resulting qualitative data remain useful nevertheless:

- Observation
- Critical incident procedure
- Rating scales
- Pencil and paper tests
- Interviews
- Self reports
- Records
- Semantic differential
- Criterion referenced evaluation
- Professional judgment

Few of the resulting data can be associated with statistical correlation and probabilities. This state of affairs has been the case in leadership research for over 20 years.

Behavioral science is constantly seeking new methodology and measurement techniques with which to more fully quantify qualitative data. Any gain in measurement should be reflected in progress in its application to the Soldier Dimension/ Equation. Greater allowance for human interaction in computer war games/simulations will increase the fidelity found in the real world. Any decrease in the use of human interactions in these training simulations will degrade further the understanding of how one might increase soldier commitment to his cohesive fighting organization.

Soldier Dimensions of the Combat Equation

Our review of the scientific-technical literature has enabled us to propose a paradigm of the soldier dimensions, Figure 1-2. This paradigm has been constructed according to system analytic principles. Such a

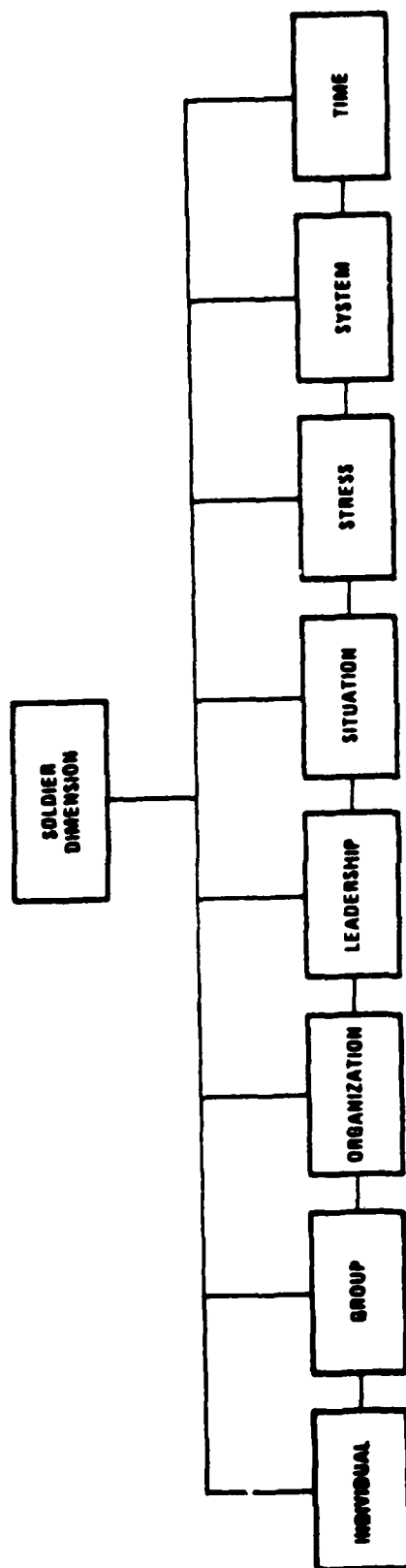


FIGURE 1-2. SOLDIER DIMENSION FACTORS

construction is based upon several interacting levels descending from the initial or system level. In this case, there are three interrelated levels below the system level. Each level consists of several interrelated factors and subfactors. Figure 1-2 shows the major factors or subsystems making up our understanding of the Soldier Dimension. These major factors were derived from our analysis of salient scientific-technology literature. Figures 1-3 through 1-10 contain the structure of each major factor with its interrelated units and components. The goal of this paradigm is to allow the several major interrelated factors found in each military soldier-leader situation to portray the dynamics of their situationally based interactions. Each dynamic snapshot of these behaviors will permit one to understand and more accurately assess the behavioral outcomes.

Individual Factor

The Individual Factor, Figure 1-3, consists of the four units derived from the detailed analysis of Volume 3:

- Physical health
- Skilled task performance
- Skilled interpersonal performance
- Integrity/mental health

The components of these units have been stated in behavioral terms that would enable one to verify each component by observation. Their measurement, however, may not be possible using shared dimensions.

We believe that it is possible, however, for one to obtain valid indication of many of these components by checklists or behavior rating scales made while observing performance oriented training sessions. Additional information may be obtained from existing individual records for such components as:

- Attains accurate entrance physical standards.
- Maintains health to standards reliably
- Applies remedies to health problems using appropriate treatment or training procedures.
- Attains accurate task performance standards.
- Maintains task performance to standards reliably.
- Develops a variety of performance skills.

Hence, the Individual Factor is operationally defined by its units and components, which are behaviorally based and are amenable to gross behavioral measurement.

Group Factor

The group contributions to an understanding of the Soldier Dimension are shown in Figure 1-4. These group characteristics are associated with

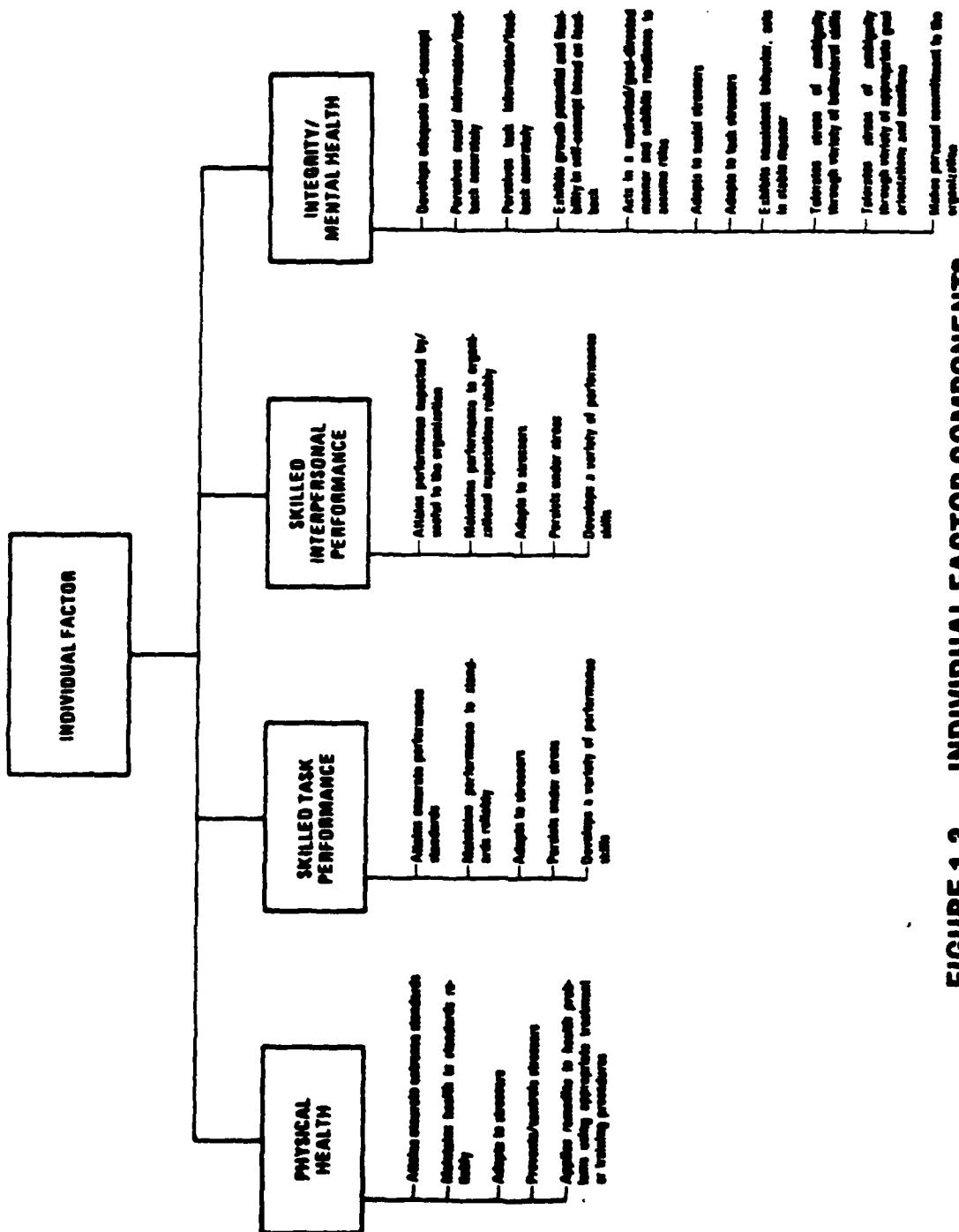


FIGURE 1-3. INDIVIDUAL FACTOR COMPONENTS

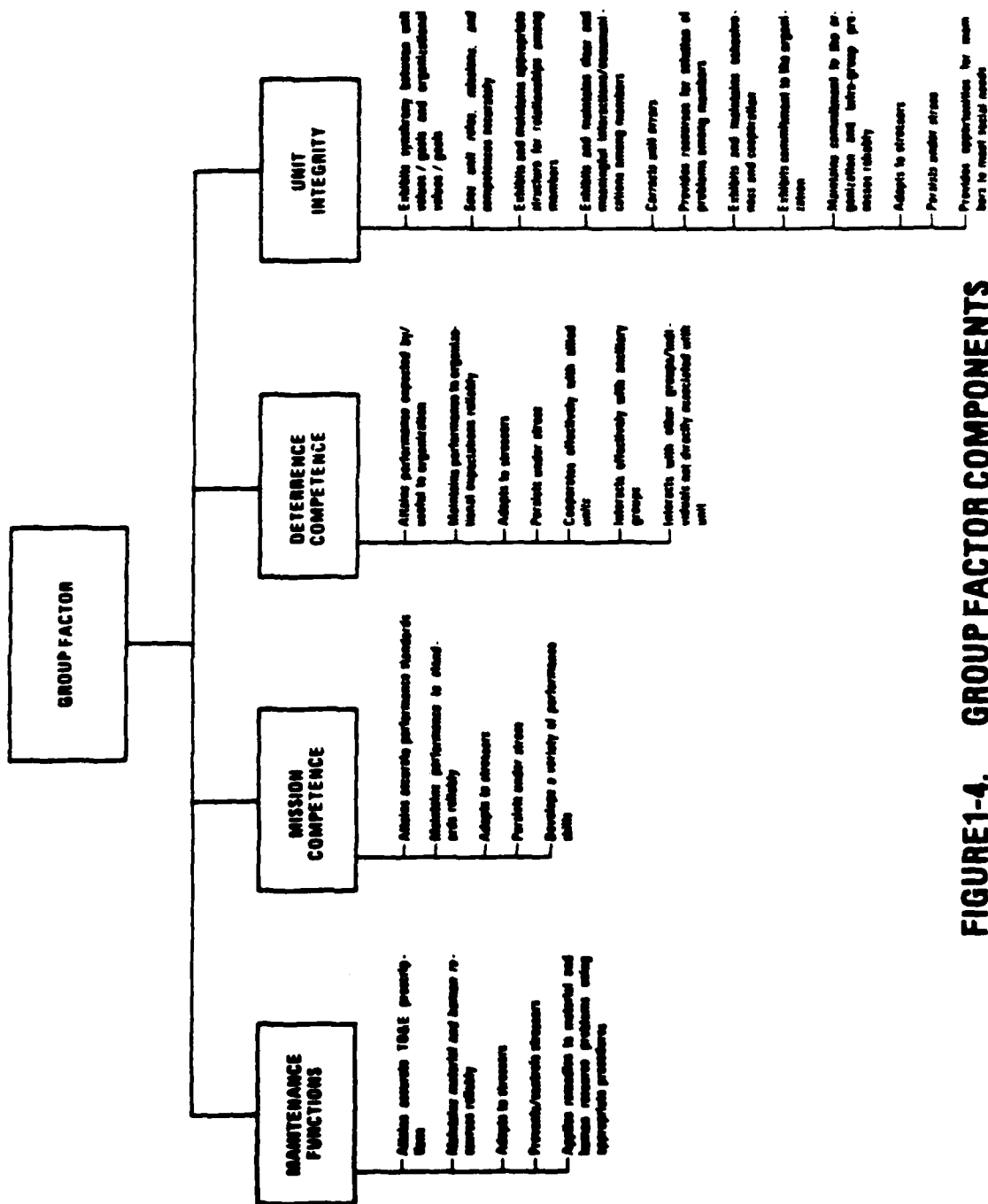


FIGURE1-4. GROUP FACTOR COMPONENTS

organizational membership as described in our analysis in Volume 3. The four units that make up the Group Factor are:

- Maintenance functions
- Mission competence
- Deterrence competence
- Unit integrity

These group units are more complex than the individual ones and are harder to measure. Nevertheless, the Soldier Dimension would be incomplete without these very meaningful interrelationships. Adapting to situational stressors and persisting under stress is a shared component among these four units.

Like the Individual Factor, there are a few group components for which one might obtain valid information from existing records:

- Attains accurate TO & E prescriptions.
- Attains accurate mission performance standards.
- Develops a variety of mission performance skills.

Each group component has been stated in behavioral terms based on our analysis of relevant scientific literature of group dynamics. Verification of these components is currently possible although actual measurement lags their conceptual value and use. We believe that we have stated each group component in behavioral terms that approximate an operational definition for its current level of measurement.

Organization Factor

The Organization Factor, which is a very complex and dynamic factor, is described in Figure 1-5. An organization as large as an Army or as small as a company is still too complex and dynamic to conceptualize in any terms other than a slice of action or a behavioral snapshot. It is for this reason that the two units emphasize the process and performance focus at the time that the organization is observed. Such a macro-approach is scientifically sound and the components selected for the process focus and performance focus have been selected from those in the scientific-technical literature that are relatable to military organizations (Brown and Moberg, 1980; Szilagyi and Wallace, 1980). No micro-approach of the organization is contemplated because of its overlap with the individual and group factors.

Organizational climate is a product of the process and performance foci, which relates positively to situational, stress, and leadership factors. One can imagine the significance of a single shift of process focus, e.g. from stable formalization to dynamic decentralization of decisions, to understand how all of the other factors in the paradigm are affected. This is a factor that traditionally has been taken for granted as if there was only one kind of organizational climate at all levels of the military. The measurement of the dimensions of focus cannot be

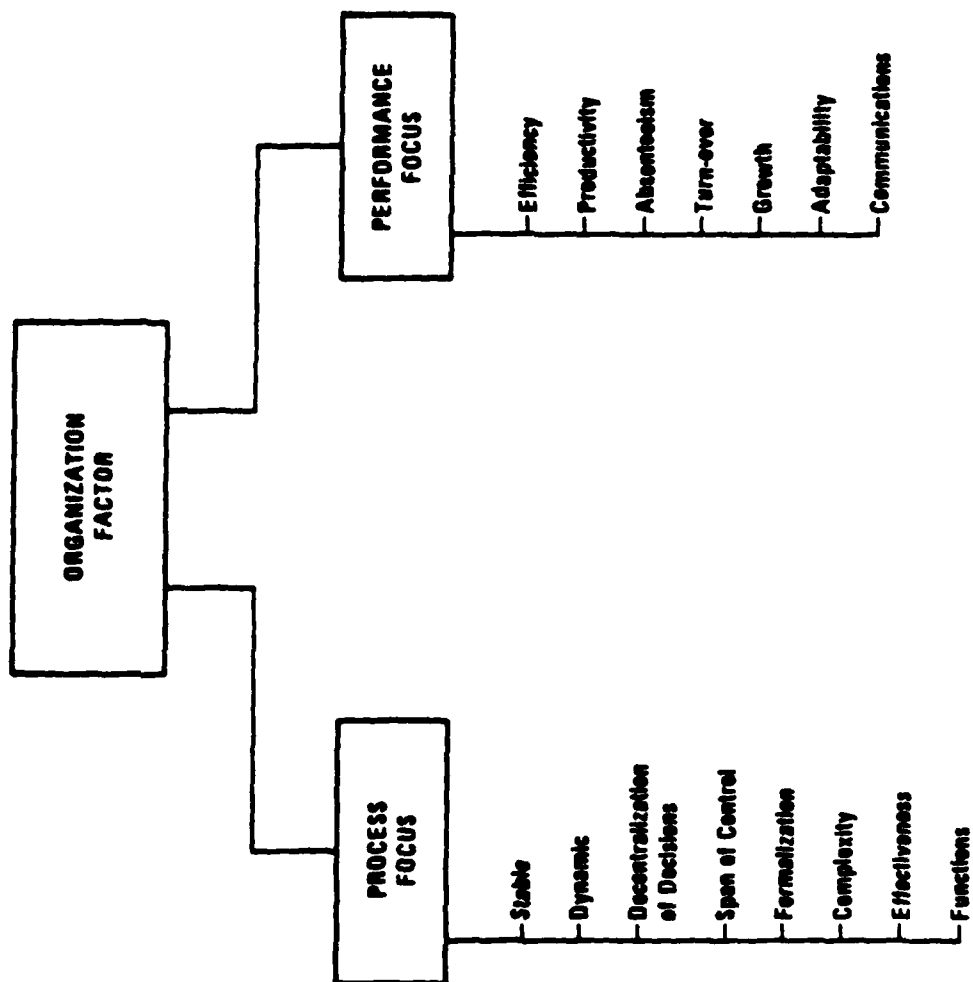


FIGURE 1-5. ORGANIZATION FACTOR COMPONENTS

assumed to be identical in both civilian and military organizations. The importance of the organizational factor to the Army of the future cannot be forecast at this time but it is sure to significantly correlate with any quality of life in the Army variables. The impact of this factor on individual and group characteristics of the Soldier Dimension has been analyzed and discussed in Volume 3. The relevance of the organization factor to leadership has been similarly treated in Volume 4.

Leadership Factor

Volume 4 identifies, describes, analyzes, and discusses the four derived units from the leadership scientific-technical literature:

- Leader goals
- Leader behaviors
- Leader power
- Leader style

The components for each of these derived units are listed in Figure 1-6. Each of these units and components exert an influence on each of the other leadership units and components. There is a broad range of instructions among these units and components that will probably accommodate a description of almost any leader in fact or fiction in a given situation. Further, one begins to appreciate leadership dynamics when all but one of these units are held constant and that one unit is allowed to vary in a specific situation. For example, holding leader behaviors, leader power and leadership style constant for a training scenario in any of the combat areas with a change in leader goals from an organizational to a personal orientation. The impact of such a change for all of the other factors in the Soldier Dimension is important if not significant. This dynamism in leadership is frequently suppressed in favor of management grid or school solutions in military leadership training. Human behavior is more complex than the simplex notions of leadership that school solutions will allow. Our paradigm allows one to speculate about solutions to leadership problems without unrealistically constraining the factors of the Soldiers Dimension such as the Company Commander's role as a linking pin in the formal organization.

Situation Factor

The catalyst in our paradigm is the Situation Factor, Figure 1-7. It is recognized in the behavioral sciences generally and in the domain of organizational research specifically as the factor that allows greater understanding of the resulting human behavior than any previous orientation. Volume 2 through 4 reinforce this notion. This factor has only two units that specify the:

- General arena of the action scenario
- Specific identifiers necessary for starting the action scenario.

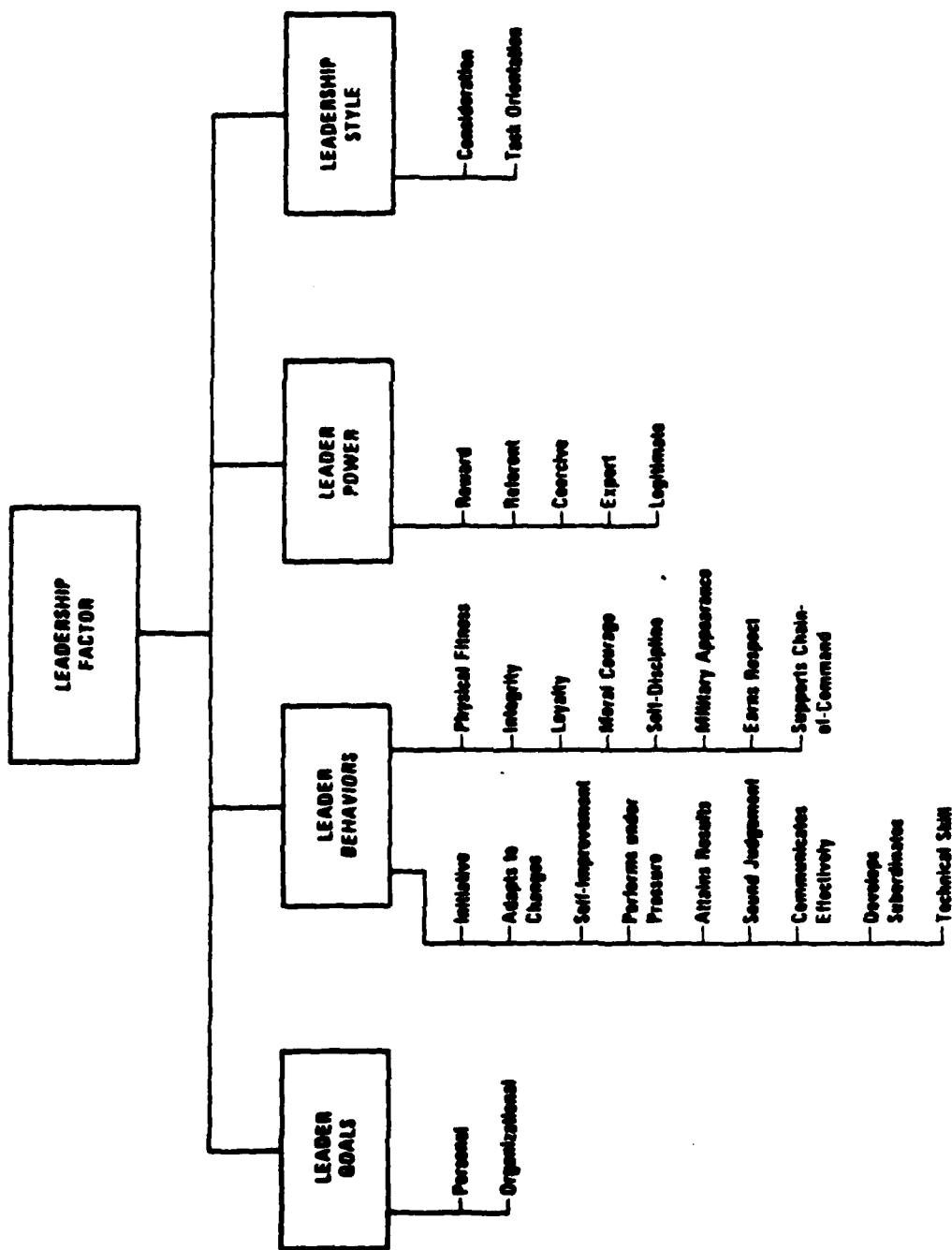


FIGURE 1-6. LEADERSHIP FACTOR COMPONENTS

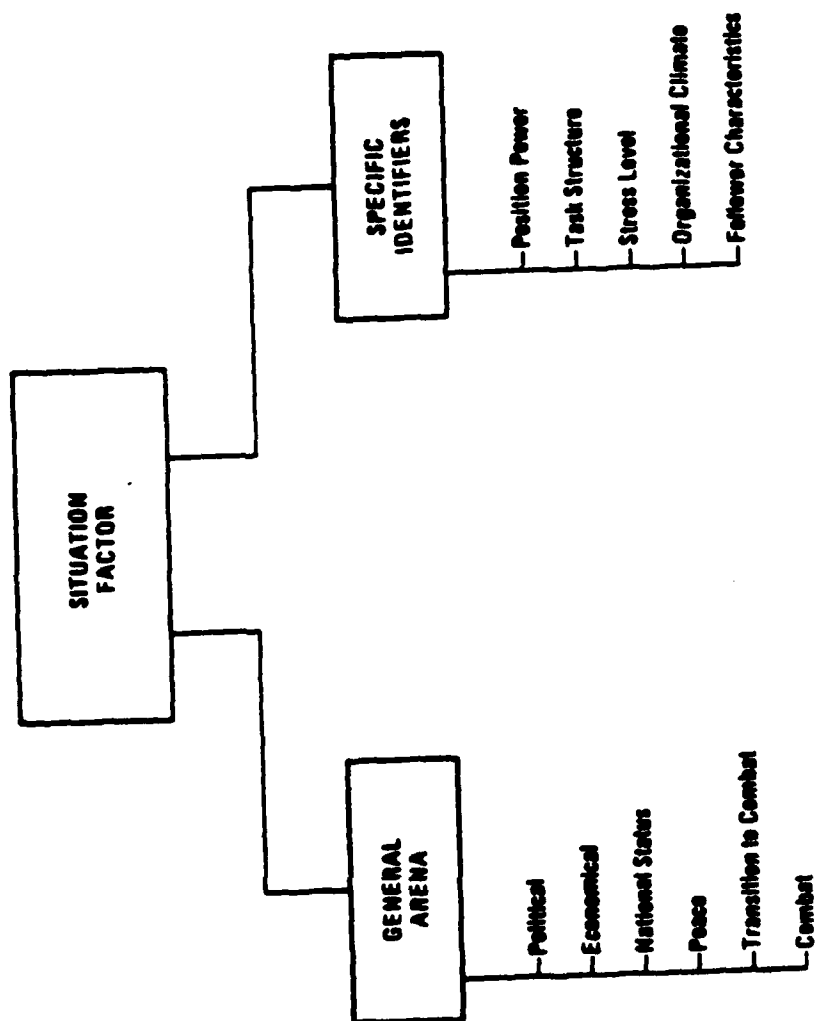


FIGURE 1-7. SITUATION FACTOR COMPONENTS

Once again it is possible to visualize the impact of these relationships by holding constant the specific identifiers, discussed in Volume 4, and merely shifting the general arena from peace to war. Such a shift will have a proportional impact for each of the other factors in the Soldier Dimension. Each scenario starts with the Situation Factor units and components being detailed. The components of the general arena provide a very broad set of arenas in which one might desire to set an interactive Army problem scenario for conceptual solution. We believe that it strengthens our formulation.

Stress/Threat Factor

We found stress or threat repeatedly interwoven in the current behavioral science literature and it appears to be measured in general terms until one considers behavioral reactions to it. This state of affairs is reflected in the units and components of the Stress/Threat Factor, Figure 1-8. The general state unit fixes stress level to which individuals, groups, and organizations being considered are reacting. The other unit portrays how the people involved in the scenario are reacting to the identified stress level. As the General State fluctuates in a situation one must also expect that the people involved also are reacting to these changing situations. The system analysis principle of inter-relationship dependency is as true for the Stress Factor as it is with any of the other factors. It must then be recognized that a change in any of the components of any single factor creates probable changes in the components/factors throughout the scenario. Further, to produce a valid scenario one must specify the interacting components in all of the factors in our paradigm. Leaving one factor out only produces an invalid scenario. In some scenarios one finds it necessary to define an indirect relationship in a factor in order to state the situation clearly. For example, an individual interacting with a leader may be supported by his group experience (family) even though they are not physically present in the Army situation.

System Factor

The System Factor, Figure 1-9, consists of two units:

- Individual systems
- Crew systems

Both of these units have relevant components that assist one in identifying the type of system the individual or groups has experience with or is using in a scenario. We have found that there are scenarios where the individual is not using a given system, but is influenced by his experience with that system. This situation gives rise to certain rude remarks about "tanker logic", "grunt mentality", or "airborne simplicity." Each individual's expectations within the organization is in fact framed by the system experiences that he has accumulated or predicts will occur in a new situation. We have provided for training simulation systems for use in scenarios for completeness. We have found, in our preliminary

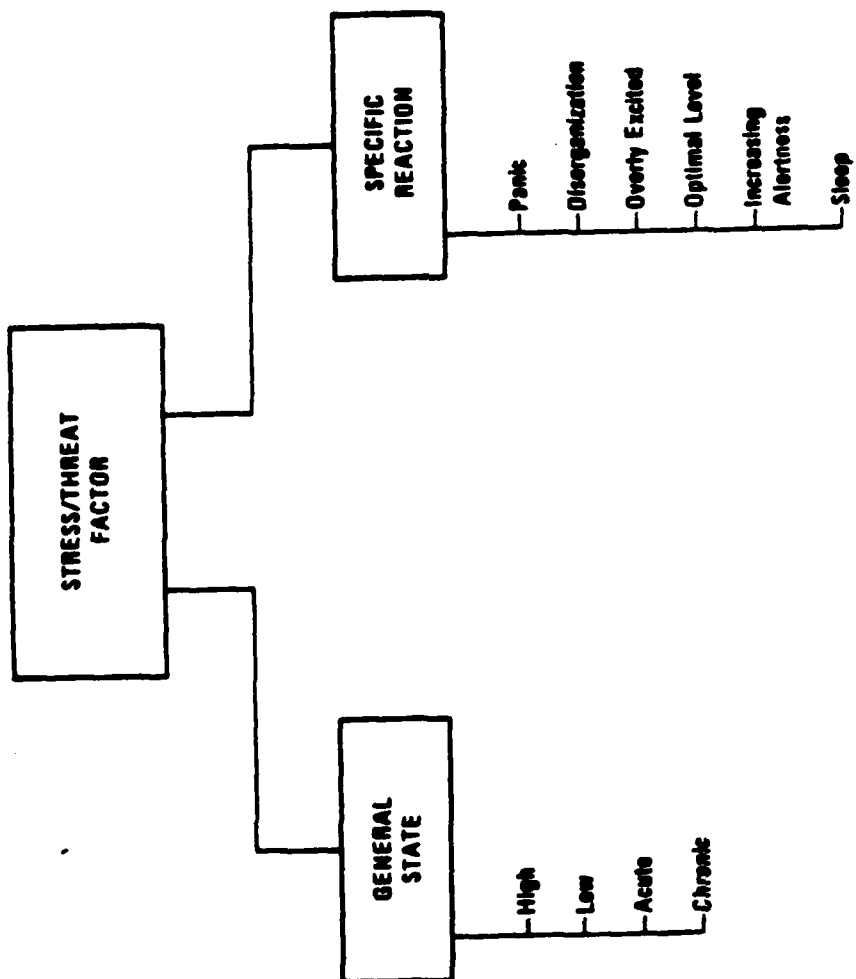


FIGURE 1-8. STRESS/THREAT FACTOR COMPONENTS

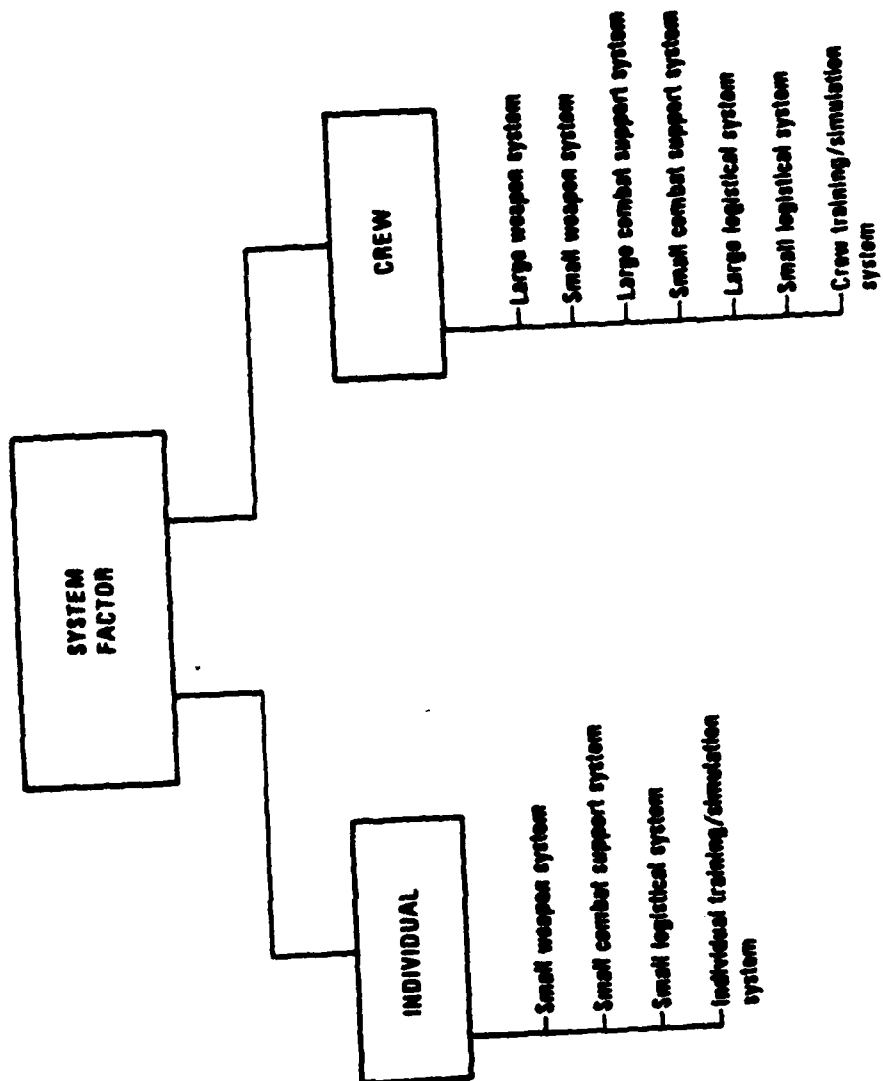


FIGURE 1-9. SYSTEM FACTOR COMPONENTS

speculations, that one may specify the System Factor in gross or detailed terms as the situation requires without overburdening the scenario dynamics.

Time Factor

The Time Factor is always present in human experience and has become an important shaper of human behavior in our high technology society. People tend to deal with time in a general or specific way; hence the two units shown in Figure 1-10. Specifically, military planners and operations are usually addressed in general terms such as short term, long term, or "it will take a generation before we can do it." Military systems require one to think in specific time units of milliseconds in computer/missile operations. On the other extreme, military historians and political scientists see the impact of military operations in month-year terms. In any scenario time continues to move forward and cannot be reclaimed as is the case of a fiction writers' flashback for dramatic effect. It is possible, however, to set up a scenario where several kinds of time coexist in relationship to an individual, group, or system. For example, one can visualize a scenario where an individual is a part of a missile crew that uses hours/minutes setting up a position, using a system computer to reach lock-on in milliseconds, firing, tracking, resetting, and refiring in terms of minutes. Time is a variable that one must consider in each scenario and it will be critical in some interactions.

Paradigm Summary

Our analyses of the scientific-technical literature covered the areas of concentration:

- Individual characteristics
- Group characteristics
- Leader-management actions
- System measures

We postulated the existence of a set of relationships among the various variables described in our System Study Schematic, Figure 1-11, which we used in our literature search. Within each of the areas of concentration, we developed lists of meaningful variables, analyzed and discussed them. We related these variables with each other to establish limits of relationships. We decided, based on this experience, that integrated lists of variables would be less valuable than a paradigm of how these variables played in dynamic situations. Our formulation or paradigm, Figure 1-2, is based on system principles and each factor, unit, and components has been shown to relate in either a direct or indirect way to all of the other factors, units, and components. Our next step is to relate these behavioral findings to each of three scenarios: peacetime, transition to combat, and combat.

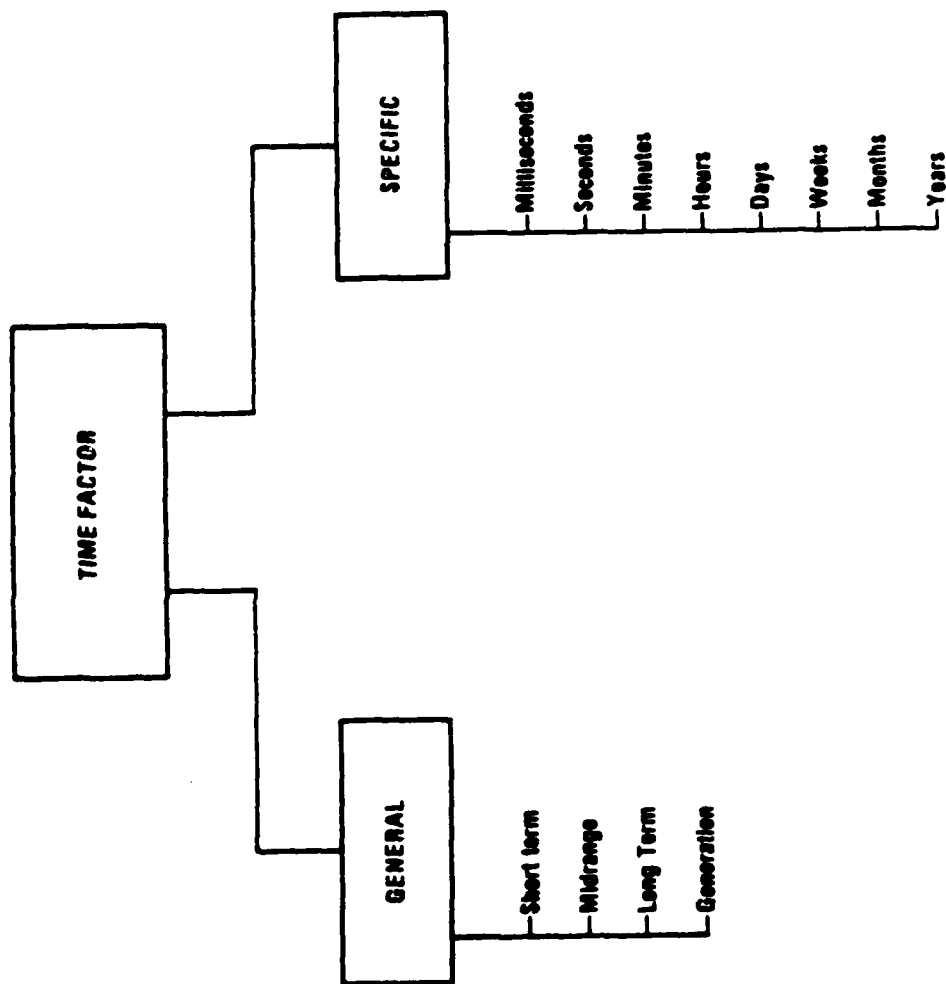


FIGURE 1-10. TIME FACTOR COMPONENTS



Predicting Effective Performance

The objective of our formulation or paradigm of how individual/group characteristics, leader-management actions, and system measures are related is to provide a basis for predicting effective behavioral performance under three specified conditions:

- Peacetime
- Transition to/from combat
- Combat

Each of our volumes has developed lists of variables, all behaviorally related, that have been derived from the scientific-technical literature. Quantification issues have been identified in each volume and may be summarized as:

- Individual and group characteristics are relatable only in the broader context of scientific theory.
- Measurement of individual characteristics vary greatly from incidence/frequency of occurrence to rating scales or questionnaires to standardized test scores that are correlated with individual performance criteria.
- Individual characteristic measurement is limited by inadequacy of self report techniques and other categorical procedures.
- How an individual has functioned previously in a given situation is probably how one can expect that individual to perform in a new, but similar situation.
- It is not possible to isolate leadership from individual characteristics, group characteristics, and a given situation.
- There is a lack of interdisciplinary tools and procedures for the quantifying of leader behaviors.

Generally, we concur with other investigators regarding the problem of converting qualitative data to quantitative data.

"The work carried out thus far has yielded no method for quantifying the impact of troop quality or capability upon weapon effectiveness on the basis of historical data and analysis, but several research tasks have been defined that offer good probability of contributing to this quantification" (Dupuy and Hammerman, 1980, p. 9).

We, as well as numerous other serious authors, find that in the behavioral areas identified in our paradigm we must deal with qualitative data at best. Our problem then is to identify behaviors, components, units, or

factors that appear to have properties that may be applied differentially in each of these situations.

Predictor Methodology

The listed behaviors from Volumes 2 through 4 are derived from a critical survey of the scientific-technical literature since World War II. Our methodology for relating these behaviors to specific scenarios with specific properties consists of:

- Defining each transition, and combat conditions.
- Projecting each behavioral item into the paradigm based upon the current condition of the literature and the condition of employment.
- The weighting of each behavioral item allows for both positive and negative impact as well as scaling the behavioral items for relationship to each condition:
 - a. Low relationship, 1.
 - b. Some relationship, 3.
 - c. High relationship, 5.
- Those items that applied equally well under all conditions are identified as constants (K).
- Those items that are critical to performance in one or more of these three conditions are identified by an accompanying letter C.
- Consensus was reached by the three senior research members of the study with some revision of the weight values for some of the behavioral items.

The conditions of the peacetime Army are dedicated to training in classrooms or in the field. Classroom instructors and instruction vary widely, but are generally experienced by an individual before receiving an assignment to an organization. Some laboratory or field work may be experienced in these schools as an adjunct to classroom work. The duty-off-duty cycles of human activities may impact individual performance whether in or away from school and for this reason are included in some scenarios. The field training associated with organized Battalion, Regiments, and Divisions are defined as having greater individual-group interactions because it is more occupationally related, intended to assist the individual to survive, and is carried out with personnel integral to the governing organization. Further, we included military on-post and

off-post interactions including such groups as families, church, neighborhood, and communities whose interactions impact on individual soldier performance.

Our definition of the transition to combat includes the transition from combat as well because the literature identified different individual, group, and leader actions for both. We defined the transition state as being one in which the organization would be carried to/from the combat area on Navy ships or Rapid Deployment Force aircraft. In this situation the organizational leadership enjoys a secondary status due to their dependence on the Navy/Air Force. Constraints may take the form of instructions to embarked personnel to oral identification of the constraints of organizational leaders.

Combat includes both active engagement and passive engagement in a war zone, e.g. demilitarized zones in Korea and Europe when provocations occur. The depth of the combat area is seen to be dependent on the forces engaged. A Corps area being a depth measured in miles while the depth of a Battalion might be measured in yards. Combat may be brief, limited to a single provocation or prolonged. It may also include a native civilian population who may be neutral or aligned with the opposing combatant group either passively or actively. Further, in acute situations that become large scale combat, dependents of our combat forces may be a part of the combat arena due to their close proximity. In the event of a global upheaval, world-wide war, home front civilians and forces in training must be considered participants.

Individual Characteristics

Each of the units and components of the Individual Factor were considered in accordance with our methodology in relation to each of the conditions:

- Peace
- Transition to/from combat
- Combat

The value judgments for each component are shown in Table 1-2. Of the 26 components making up the Individual Factor, 11 are constants that apply across the board. The 11 critical components are related to the individual in combat and are split between the constants and variables. When developing a scenario for any of these three conditions, one should ensure that these critical and constant features of these components are included. The constants, such as maintains health to standards reliably, may be included as an indirect individual specification while "persists under stress" is a direct identifier in all conditions and critical in combat. Our expectations of these components, to be differentially related to these three environments, are based on the current status of

Table 1-2. Individual Characteristics in Peace, Transition to Combat, and Combat

Individual Characteristics	Peace	Transition	Combat
PHYSICAL HEALTH			
Attains accurate entrance standards	3K	3K	3K
Maintains health to standards reliability	3K	3K	3K
Adapts to stressors	3	5	5
Prevents or controls stressors	3K	3K	3K
Applies remedies to health problems using appropriate treatment or training procedures	3	5	5
SKILLED TASK PERFORMANCE			
Attains accurate performance standards	5	3	5C
Maintains performance to standards reliably	5	3	5
Adapts to stressors	3	3	5
Persists under stress	5K	5K	5C
Develops a variety of performance skills	5K	5K	5C
SKILLED INTERPERSONAL PERFORMANCE			
Attains performance expected by and useful to the organization	5	3	5
Maintains performance to organizational expectations reliably	5K	5K	5K
Adapts to stressors	3	5	5C
Persists under stress	3	5	5C
Develops a variety of performance skills	5K	5K	5C
INTEGRITY/MENTAL HEALTH			
Develops adequate self-concept	3	5	5
Perceives social information/feedback accurately	5K	5K	5K
Perceives task information/feedback accurately	5K	5K	5K
Exhibits potential for growth and flexibility in self-concept based on information/feedback	5K	5K	5K
Acts in a motivated/goal directed manner and exhibits a readiness to assume roles	3	3	5C
Adapts to social stressors	5K	5K	5C
Adapts to task stressors	3	3	5C
Exhibits consistent behavior, can be depended upon to act in a predictable/stable manner	3	3	5
Tolerates the stress of ambiguity through a variety of cognitive/behavioral skills	1	3	5C
Tolerates the stress of ambiguity through a variety of motivational/goal orientations with appropriate emotional intensity	3	3	5C
Makes a personal commitment to the organization	3	3	5

the scientific-technical literature for each component and consensus of expert judgment.

Group Characteristics

The Group Factor, with its units and components, is listed in Table 1-3. The weights in this table are all positive, as in the case of the Individual Factor. There are constant weightings for 11 of these group components. There are more critical behaviors and they are found in all three conditions. Most of the weightings follow current expectancies for group dynamics.

A few are at first surprising, but with some speculation fit the current understanding of group dynamics very well. For example, the component of Unit Integrity, "Exhibits, develops, and maintains clear and meaningful interactions and communications among members", is rated as a critical constant in all three conditions. Behavioral science research supports the component and its weights as described in civilian and military reports as one that is critical to developing and maintaining unit integrity. It is not seen universally as a critical constant in military policies nor in doctrinal applications. Yet it surfaces repeatedly in management and leadership comparisons of highly successful vs unsuccessful groups. One of the variables in the Deterrence Competence Unit, "interacts effectively with ancillary groups", is weighted with a high positive and critical rating because of the need for developing very strong family ties while in garrison so that these associations will assist in sustaining individual members in crisis or uncertainty. When the group transitions to combat aboard Navy ships it is important to interact effectively with Navy crew members, who are also members of ancillary groups. In combat there is less need for this effective interaction although one can use World War II literature to support the notion that if partisans are an ancillary group in a given combat area then by working effectively with them the group may be more likely to achieve its mission objectives sooner.

Leader Behaviors

Specific leader behaviors were derived from the scientific-technical literature, analyzed, and discussed in Volume 4 among other important leader-management actions. These behaviors, Table 1-4, are the components that fall under specific units within the Leadership Factor of our paradigm. There are some negative weightings for the first time, which may be due to an inappropriateness of a behavior within a specific condition such as combat. For example, a combat leader that is engaged in a planned program of professional and personal development meaning a correspondence course, would probably find such activity inappropriate. This rationale generally accounts for these negative ratings. There are about the same proportion of constants, but less critical behaviors than found in Table 1-2 and 1-3. This state of affairs may be due to the paucity of combat studies within the behavioral sciences. There is only one negative rating for an across-the-board behavior that includes a peacetime condition. That

Table 1-3. Group Characteristics in Peace, Transition to Combat, and Combat

Group Characteristics	Peace	Transition	Combat
MAINTENANCE FUNCTIONS			
Attains accurate TO&E prescriptions and logistical support	3	5	5C
Maintains materiel and human resources reliably	5K	5K	5K
Adapts to stressors	3	3	5C
Prevents or controls stressors	5K	5K	5K
Applies remedies to materiel and human resource problems using appropriate treatment or repair procedures	5	3	3
MISSION COMPETENCE			
Attains accurate performance standards	5	3	5
Maintains performance to standards reliably	5K	5K	5C
Adapts to stressors	3	3	5C
Persists under stress	3	3	5C
Develops a variety of performance skills	5	3	5C
DETERRENCE COMPETENCE			
Attains performance expected by/useful to the organization regarding deterrence	5C	5K	5K
Maintains performance to organizational expectations reliably	5C	5C	5K
Adapts to stressors	3	3	5
Persists under stress	3	3	5
Cooperates effectively with allied units	3	5	5C
Interacts effectively with ancillary groups	5C	5	3
Interacts with other groups and individuals not directly associated with the unit	5	3	5
UNIT INTEGRITY			
Exhibits synchrony between unit values/goals and values/goals of the organization	3	3	5
Perceives unit roles, missions, and competence reliably	5	3	3
Exhibits, develops, and maintains appropriate structures for relationships among members	5	3	5
Exhibits, develops, and maintains clear and meaningful interactions and communications among members	5C	5C	5C
Corrects unit errors	5C	5C	5K
Provides resources for solution of problems among members	5C	5	3
Exhibits, develops, and maintains cohesiveness and cooperation	5K	5K	5K
Exhibits commitment to the organization	5	3	3
Maintains commitment to organization and intra-group processes reliably	5K	5K	5K
Adapts to stress	5K	5K	5C
Persists under stress	5K	5K	5C
Provides opportunities for members to meet social needs	5C	3	1

Table 1-4. Leader Behaviors in Peace, Transition to Combat and Combat

Leader Behavior	Peace	Transition	Combat
DEMONSTRATES INITIATIVE			
Recognizes tasks that must be done	3	3	5
Defines own role and roles of subordinates clearly	5	1	5
In the absence of instructions, takes action to fulfill mission and accepts responsibility for own behavior and outcome of mission	5	3	5C
Accurately anticipates situations, missions, and availability of resources and predicts outcomes accurately	3K	3K	3K
Offers new and improved solutions to problems involving present and future missions	5	3	3
Actively seeks additional and more important responsibilities	3	1	-3
ADAPTS TO CHANGE			
Insists on demonstrations of effectiveness of proposed changes	-3	-3	-5
Effectively implements change	5K	5K	5C
SEEKS SELF-IMPROVEMENT			
Is engaged in a planned program of professional and personal development	5	-3	-5
Responds constructively to constructive criticism	5K	5K	5K
PERFORMS UNDER PRESSURE			
Efficiency of behavior does not diminish as stress increases	3	3	5C
ATTAINS RESULTS			
Emphasizes mission accomplishment	5K	5K	5K
Schedules training needed to improve unit effectiveness	5	3	-5
Supervises work closely to insure adherence to standards	5	5	-1
Imposes appropriate disciplinary measures where needed to maintain standards and productivity	5	5	3
Uses capabilities of unit and individuals to best advantage	5K	5K	5K
DISPLAYS SOUND JUDGEMENT			
Employs and can describe a sound, decision-making procedure	5	3	3
Regularly and systematically obtains relevant information and advice from subordinates, peers, and seniors	5K	5K	5K
COMMUNICATES EFFECTIVELY			
Uses persuasion and argument effectively, orally and in writing	5	5	3
Exhibits strong convictions	5	1	5
Maintains cordial relationships with superiors	3K	3K	3K
Makes accurate reports to supervisors	3K	3K	3K
Knows capabilities of subordinates for understanding communications and communicates within these limits	5	3	5

Table 1-4. Leader Behavior in Peace, Transition to Combat, and Combat Continued

Leader Behavior	Peace	Transition	Combat
Lets members of his unit know what is expected of them, missions, tasks, and procedures to be carried out	5	3	5C
Uses positive communications	3K	3K	3K
DEVELOPS SUBORDINATES			
Allows followers scope for initiative, decision, and action	5	3	5
Makes provisions for the comfort and well-being of followers	3	3	5
Knows capabilities of subordinates and assigns personnel to tasks commensurate with grade, experience and abilities	5K	5K	5K
Is accessible to followers for personal and professional counsel and advice	5	1	5
Depersonalize interactions with subordinates	5	3	3
Constructively criticizes behavior rather than individual	5	3	3
Expresses appreciation when a subordinate does a good job	5K	5K	5K
Delegates authority when appropriate	5K	5K	5K
Employs incentives, rank, and structure to effectively challenge and motivate subordinates	5	3	5
DEMONSTRATES TECHNICAL SKILL			
Demonstrates technical competencies required in his assignment	5K	5K	5K
Demonstrates tactical proficiency	5K	5K	5K
PHYSICAL FITNESS			
Participates regularly in a program of physical fitness	3	3	1
Participates regularly in a comprehensive preventive health program	3	5	5
Meets physical standards prescribed by the Army	3	3	1
INTEGRITY			
Does not betray confidence	3K	3K	3K
Is honest	3	3	1
Is reliable	3K	3K	3K
Demonstrates behavior consistent with professed value system	3K	3K	3K
LOYALTY			
Respects and believes in system of authority of which he is a part including responsibilities assigned to his role and to those above and below him in the system	3	3	5
Subordinates personal interests to military requirements	5K	5K	5K
MORAL COURAGE			
Accepts consequences of decisions and actions and admits errors	5K	5K	5K
Stands up for moral principles in face of popular disfavor	3K	3K	3K

Table 1-4. Leader Behaviors in Peace, Transition to Combat, and Combat Continued

Leader Behaviors	Peace	Transition	Combat
SELF DISCIPLINE WHEN UNDER STRESS			
Neither looks nor acts worried	1	3	5
Controls voice and gestures	1	3	5
Maintains dignity	3K	3K	3K
Understands and controls own fears	3	5	5
MILITARY APPEARANCES			
States decisions in a clear, forceful manner	1	3	3
Maintains exemplary appearance	5	3	5
Maintains clothing and equipment in excellent condition	5K	5K	5K
Manner reflects alertness, energy, competence, and confidence	5K	5K	5K
Carries self upright	3	1	1
Optimistic and cheerful	5	3	1
EARLY RESPECT			
Speaks and acts as unit representative	5K	5K	5K
Demonstrates concern for the comfort, well-being, status, and contributions of followers	5K	5K	5K
Sets example for subordinates	5K	5K	5K
Is thoughtful, considerate, impartial, fair, and prompt in dealings with others	5	3	3
Places self last in priority and shares hardships with followers	1	5	5
SUPPORTS EO/EEO			
Willingly and voluntarily supports policies and orders of chain of command	5	3	5

one is, "Insists on demonstrations of effectiveness of proposal changes". That behavior relates to a personality trait of rigidity in behavioral science research and makes adapting to change generally more difficult in which the leader is a part of a problem rather than a solution. Those behaviors that are rated as constant and/or critical in a given condition should be reflected in any scenario or situational speculation about leadership style or leader power.

Scenario Development

The predictor methodology included the development of scenarios because our System Study Schematic, Figure 1-11, is difficult to group in dynamic terms. The paradigm, Figure 1-2 through 1-10, is based on a system analysis, which show components with their interrelationships. These figures do not show dynamic interactions, although these are implied by the various levels indicated and are presumed to interact. Operational Sequence Diagrams (OSD) have been used over the past 30 years by System Engineering Design teams to make system analytic interrelationships more obvious; particularly when man is in the system loop as a participant (Kurke, 1961). OSD's have continued to be refined for these reasons in many design situations ranging from defense systems to industrial processing system to commercial telecommunications and design of man-system dialogue for computer aided instruction (CAI) and computer aided design (CAD). We have assisted in advancing the state of the art for OSD in these dialogues by advocating the use of structured OSD's in systems development (McMichael, 1980). The structured OSD shows interactions for each level in a top-down order. This permits one to view the interactions knowing that a more detailed version lies at the next level down until one is at the lowest level. Ordinarily there are five levels below the system level with the last level reserved for training dialogue in Instructional System Design (ISD) applications or output products.

Our study produced a wide array of interactive individual and group characteristics and leader behavior that mix in varied situations. Not all of these are capable of contributing equally to situations in peacetime training, transition to combat, and combat (see Tables 1-2 through 1-4). A refined listing of these behaviors is contained in Tables 1-5 through 1-7 that contain the constants and critical behaviors for each of the three scenarios. These refined listings identify the minimum number of behaviors to be considered for our scenarios. Any of the other behaviors listed in earlier tables may be included in one or more scenarios as needed in demonstrating situational dynamics. Our goal in setting the scenarios is to show how the units and components of our paradigm permit one to view the dynamic situational interrelationships. After one understands how these interrelationships affect the outcome of the situation, one may speculate about how changing one factor, unit, or component creates a significantly different outcome. OSD's help one to intelligently speculate about dynamic relationships on paper without the high cost of producing the situation in reality.

Table 1-5. Constant and Critical Individual Characteristics in Peace, Transition to Combat, and Combat

Individual Characteristics	Peace	Transition	Combat
PHYSICAL HEALTH			
Attains accurate entrance standards	3K	3K	3K
Maintains health to standards reliably	3K	3K	3K
Prevents or controls stressors	3K	3K	3K
SKILLED TASK PERFORMANCE			
Attains accurate performance standards	5	3	5C
Persists under stress	5K	5K	5C
Develops a variety of performance skills	5K	5K	5C
SKILLED INTERPERSONAL PERFORMANCE			
Maintains performance to organizational expectations reliably	5K	5K	5K
Adapts to stressors	3	5	5C
Persists under stress	3	5	5C
Develops a variety of performance skills	5K	5K	5C
INTEGRITY/MENTAL HEALTH			
Perceives social information/feedback accurately	5K	5K	5K
Perceives task information/feedback accurately	5K	5K	5K
Exhibits potential for growth and flexibility in self-concept based on information/feedback	5K	5K	5K
Acts in a motivated/goal directed manner and exhibits a readiness to assume roles	3	3	5C
Adapts to social stressors	5K	5K	5C
Adapts to task stressors	3	3	5C
Tolerates the stress of ambiguity through a variety of cognitive/behavioral skills	1	3	5C
Tolerates the stress of ambiguity through a variety of motivational/goal orientation with appropriate emotional intensity	3	3	5C

Table 1-6. Constant and Critical Group Characteristics in Peace, Transition to Combat, and Combat

Group Characteristics	Peace	Transition	Combat
MAINTENANCE FUNCTIONS			
Attains accurate TO&E prescription and logistical support	3	5	5C
Maintains material and human resources reliably	5K	5K	5K
Adapts to stressors	3	3	5C
Prevents or controls stressors	5K	5K	5K
MISSION COMPETENCE			
Maintains performance to standards reliably	5K	5K	5C
Adapts to stressors	3	3	5C
Persists under stress	3	3	5C
Develops a variety of performance skills	5	3	5C
DETERRENCE COMPETENCE			
Attains performance expected by/useful to the organization regarding deterrence	5C	5K	5K
Maintains performance to organizational expectations reliably	5C	5C	5K
Cooperate effectively with allied units	3	5	5C
Interacts effectively with ancillary groups	5C	5	3
UNIT INTEGRITY			
Exhibits, develops, and maintains clear and meaningful interactions among members	5C	5C	5C
Corrects unit errors	5C	5C	5K
Provides resources for solutions of problems among members	5C	5	3
Exhibits, develops, and maintains cohesiveness and cooperation	5K	5K	5K
Maintains commitment to organization and infra-group processes reliably	5K	5K	5K
Adapts to stress	5K	5K	5C
Persists under stress	5K	5K	5C
Provides opportunities for members to meet social needs	5C	3	1

**Table 1-7. Constant and Critical Leader Behaviors in Peace,
Transition to Combat, and Combat**

Leader Behavior	Peace	Transition	Combat
DEMONSTRATES INITIATIVE			
Takes action to fulfill mission and accept responsibility for own behavior and outcome mission	5	3	5C
Accurately anticipates situation, missions, and availability of resources	3K	3X	3K
Predicts outcomes accurately	3K	3K	3K
ADAPTS TO CHANGE			
Effectively implements change	5K	5K	5C
SEEKS SELF-IMPROVEMENT			
Responds constructively to constructive criticism	5K	5K	5X
PERFORMS UNDER PRESSURE			
Efficiency of behavior does not diminish as stress increases	3	3	5C
ATTAINS RESULTS			
Emphasizes mission accomplishment	5K	5K	5K
Uses capabilities of unit and individual to best advantage	5K	5K	5K
DISPLAYS SOUND JUDGEMENT			
Regularly and systematically obtains relevant information and advice from subordinates, peers, and seniors	5K	5K	5K
COMMUNICATES EFFECTIVELY			
Maintains cordial relationships with seniors	3K	3K	3K
Makes accurate reports to superiors	3K	3K	3K
Lets members of his unit know what is expected of them, missions, tasks, and procedures to be carried out	5	3	5C
Uses positive communications	3K	3K	3K
DEVELOPS SUBORDINATES			
Knows capabilities of subordinates and assigns personnel to tasks commensurate with grade, experience, and abilities	5K	5K	5K
Expresses appreciation when a subordinate does a good job	5K	5K	5K
Delegates authority when appropriate	5K	5K	5K
DEMONSTRATES TECHNICAL SKILL			
Demonstrates technical competencies required in his assignment	5K	5K	5K
Demonstrates tactical proficiency	5K	5K	5K
INTEGRITY			
Does not betray confidences	3K	3K	3K
Is reliable	3K	3K	3K
Demonstrates behavior consistent with professed value system	3K	3K	3K

Table 1-7. Constant and Critical Leader Behaviors in Peace, Transition to Combat, and Combat Continued

Leader Behavior	Peace	Transition	Combat
LOYALTY			
Subordinates personal interests to military requirements	5K	5K	5K
MORAL COURAGE			
Accepts consequences of decisions, actions, and admits errors	5K	5K	5K
Stands up for moral principles in face of popular disfavor	3K	3K	3K
SELF DISCIPLINE WHEN UNDER STRESS			
Maintains dignity	3K	3K	3K
MILITARY APPEARANCE			
Maintains clothing and equipment in excellent condition	5K	5K	5K
Manner reflects alertness, energy, competence, and confidence	5K	5K	5K
EARNs RESPECT			
Speaks and acts as unit representative	5K	5K	5K
Demonstrates concern for the comfort, well-being, status, and contributions of followers	5K	5K	5K
Sets example for subordinates	5K	5K	5K

The first scenario is one that is placed in a common peacetime training situation involving a Sergeant Instructor, an individual student and accompanying class that are in organizational small arms training. The unit level OSD, Figure 1-12, sets up the situation according to the terms of our paradigm, Figure 1-2. This figure extends over three pages so alphabetical connectors are provided for proper sequencing. The items to be specified or expanded upon at the next more detailed level are indicated in the Notes section on each page of Figure 1-12. The Unit Level interactions set up the structure of the situation and readies one for the Component Level. Figure 1-13 provides the detailed dynamics of the situation structured previously. The peacetime training scenario covered in these two figures is one in which all but one of the behaviors present are portrayed at their optimal level. That one being the individual student's inability to prevent or control the stressor of firing small arms. Such a scenario may be described as a beginning or best case. A number of variants of this simple scenario could be successfully explored by allowing other suboptimal behaviors into the situation one at a time. For example, change the Sergeant Instructor's power use from legitimate to coercive and add it to this scenario's acute Individual Student distress. Further, one might speculate how the situation might be resolved if the class members were not supportive or the Infantry Company were not stable and cohesive. These additional practical considerations would lengthen and complicate this scenario, but our methodology would greatly assist one in conceptualizing its resolution. It also provides a means to insure that a relevant factor, unit, or component is not unintentionally omitted.

Similar scenarios can be drawn for the transition to/from combat as well as combat. In each case, however, one should use the behavior weights shown in the transition and combat columns in Tables 1-5 through 1-7 as guidance for structuring the Unit Level/Component Level interactions. The ensuing OSDs can accommodate a wide range of situations that one might desire to explore. It would be worthwhile to see the impact of one, two, and more suboptimal changes at the Component Level to assess the descriptive impact of the individual soldier on weapon system performance. It is recommended that an external source for the initial combat scenario such as Pyles' Brave Men be used. Then one could vary the interactive parameters for a further exploration of the situational dynamics.

Alternative Analysis

In the study of the Soldier Dimension in Battle we identified:

- System Performance Measures, Volume 2
- Individual and Group Characteristics, Volume 3
- Leader-Manager Actions, Volume 4

Our conceptual paradigm identified the factors, units, and components from each of these volumes. We weighted these for relevance in peacetime, transition to/from combat, and combat based on the scientific-technical literature. Further, we explored the situational dynamics of our

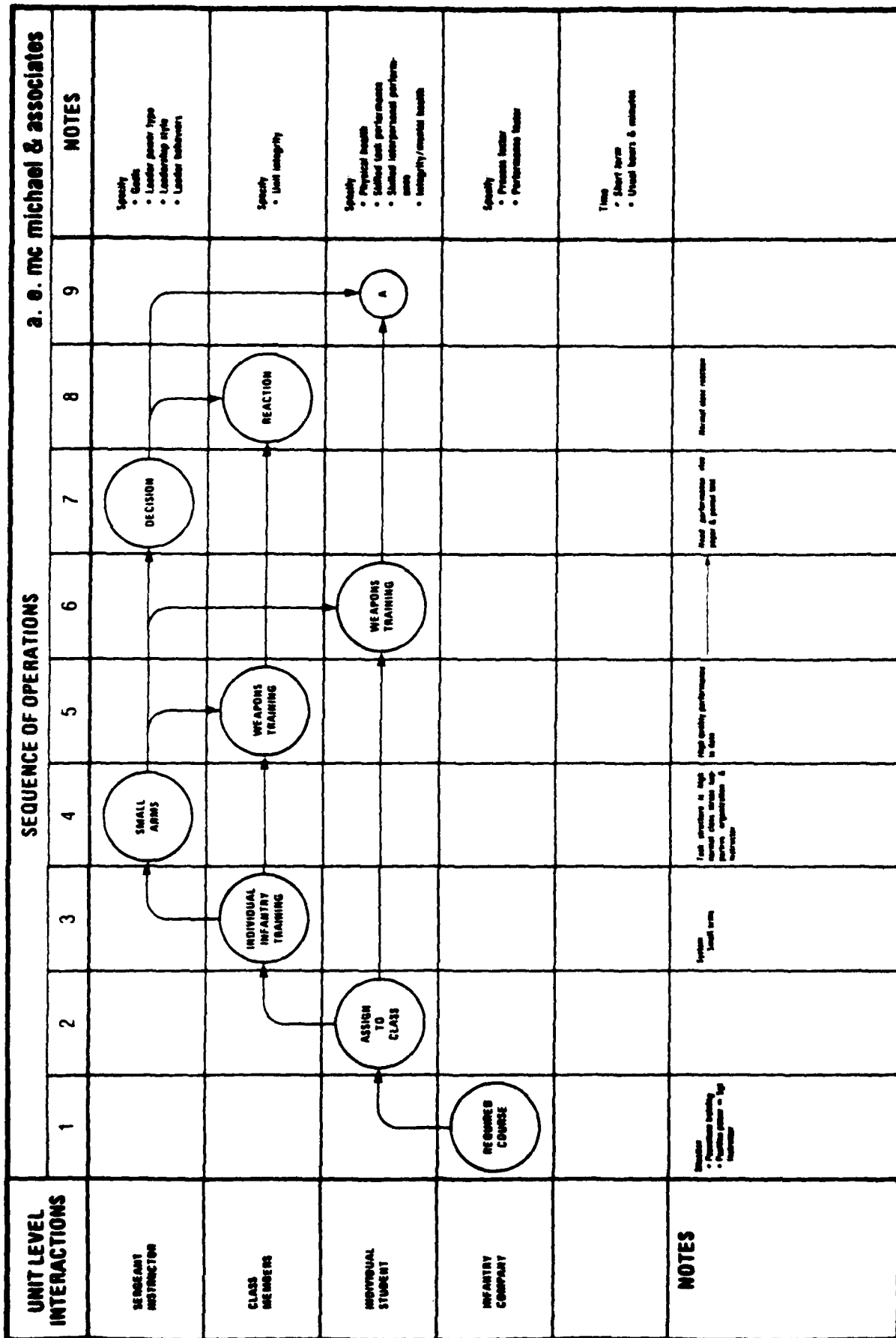


Figure 1-12. Precetime Scenario, Unit Level

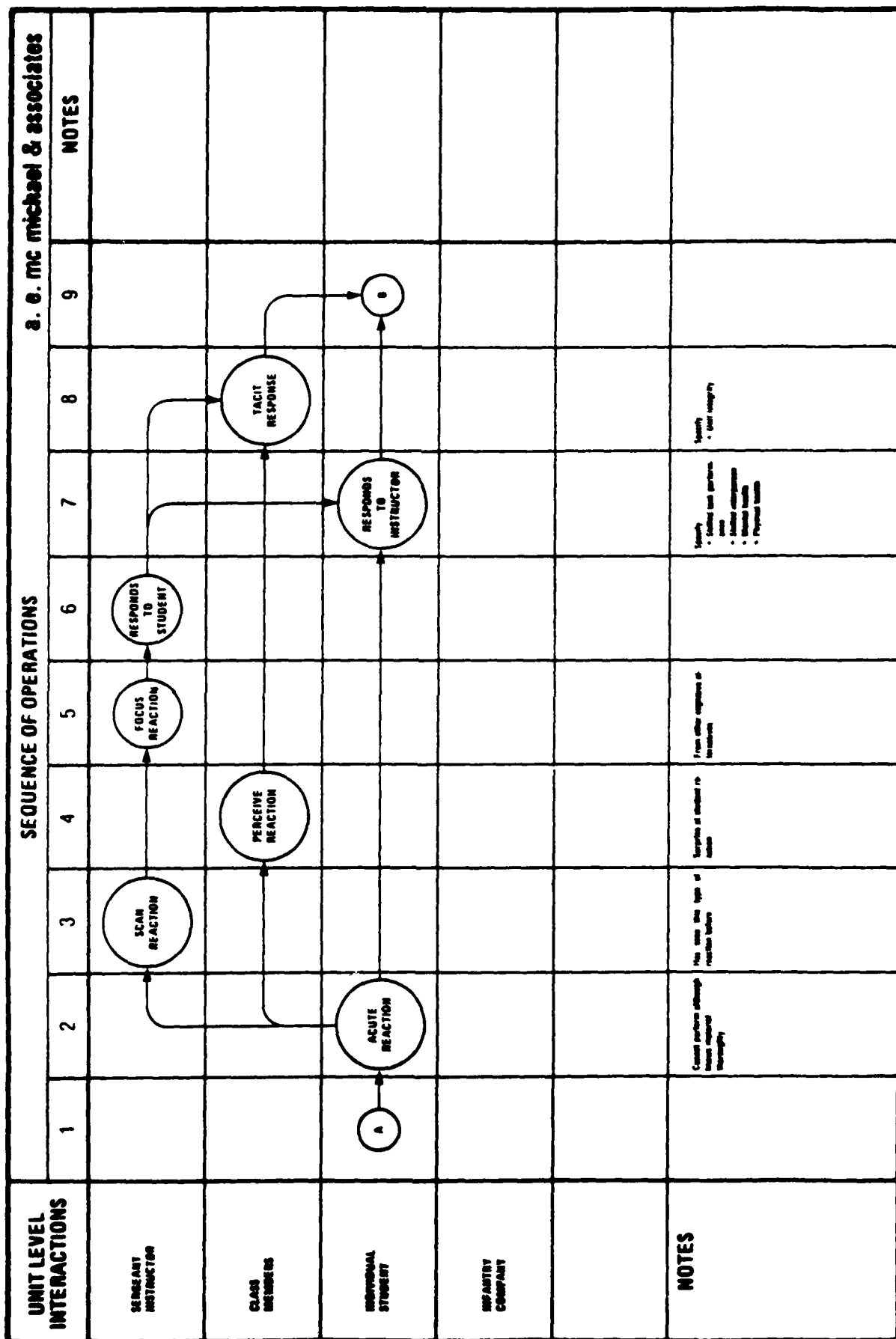


Figure 1-12. Peacetime Scenario, Unit Level

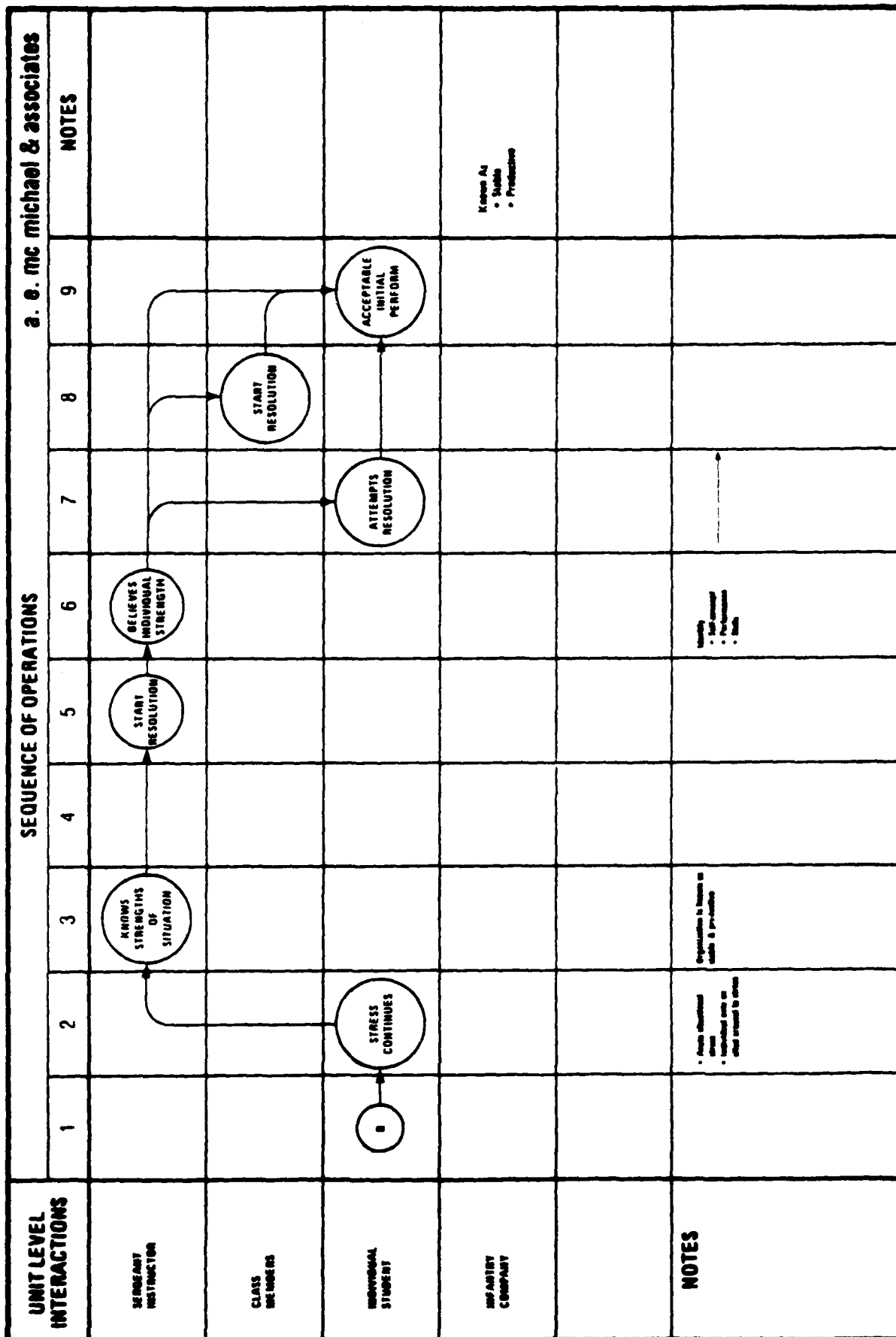


Figure 1-12. Peacetime Scenario, Unit Level

SEQUENCE OF OPERATIONS										a. o. mc michael & associates	
COMPONENT LEVEL INTERACTIONS	1	2	3	4	5	6	7	8	9	NOTES	
BARRE INSTRUCTOR											
SENIOR INSTRUCTOR											
CLASS MEMBERS											
INDIVIDUAL STUDENT											
INFANTRY COMPANY											
NOTES											

Figure 1-13. Peacetime Scenario, Component Level

SEQUENCE OF OPERATIONS										
a. o. mc michael & associates										
COMPONENT LEVEL INTERACTIONS	1	2	3	4	5	6	7	8	9	NOTES
RANGE INSTRUCTION										
SERGEANT INSTRUCTION	A	CLASSROOM TRAINING	HIGH QUALITY PERFORMANCE	HIGH QUALITY PERFORMANCE	PASSES PAPER & PENCIL TESTS	PASSES PAPER & PENCIL TESTS	STOP CLASSROOM TRAINING	PREPARE FOR FIELD TRAINING	B	
CLASS INSTRUCTIONS										Maintainance function • Strives to prevent or control situation
INDIVIDUAL STUDENT				HIGH QUALITY PERFORMANCE		PASSES PAPER & PENCIL TESTS				Integrity/Personal Goals • Persuasive model & task instruction/feedback necessary • Exhibits potential for growth & flexibility or self concept based on information/feedback
INFANTRY COMPANY										
NOTES		• Take notes to field mission • Let members know what is expected of them & procedures to be carried out	Monitor company of performance skills	Monitor team performance skills • Develop variety of performance skills	Self Integrity • Follows standards & procedures Interacts with members & with	Integrity • Adapts to new situations • Being interpreted as Interacts with members & with	• Accurately understands situation & availability of resources	• Usually provides unit support necessary • Legitimate resources (equipment/feedback)		

Figure 1-13. Peacetime Scenario, Component Level

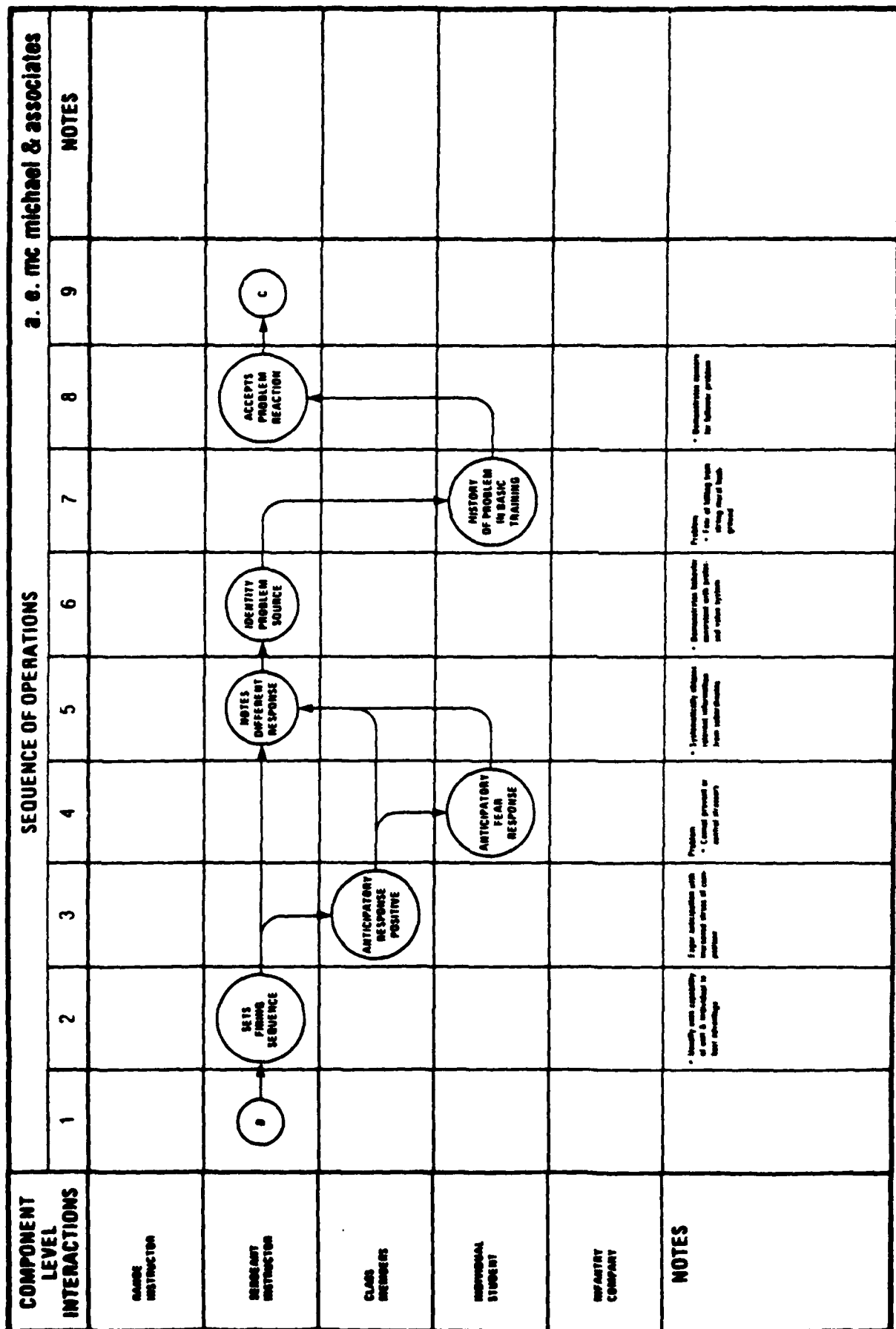


Figure 1-13. Pacetime Scenario, Component Level

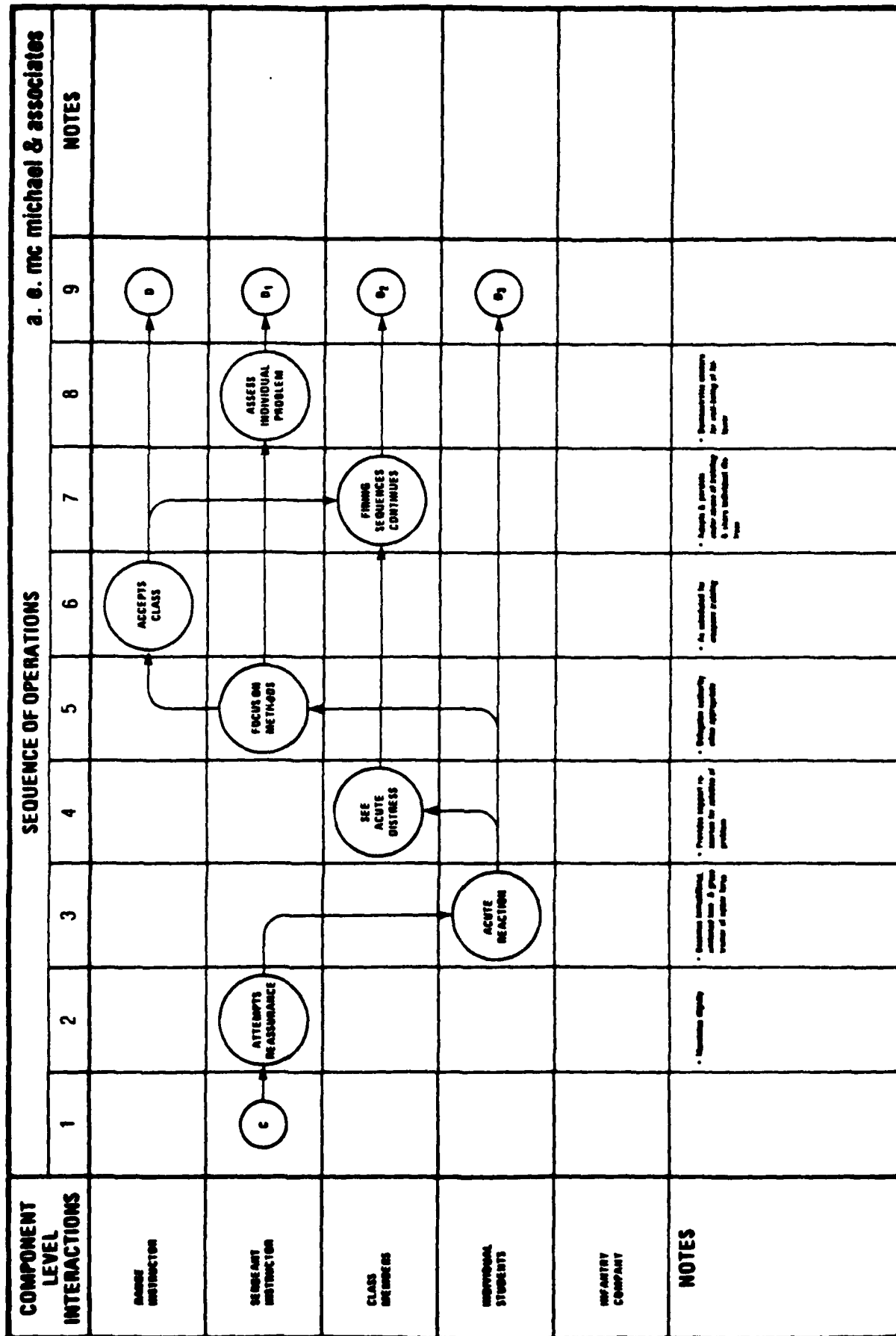


Figure 1-13. Peacetime Scenario, Component Level

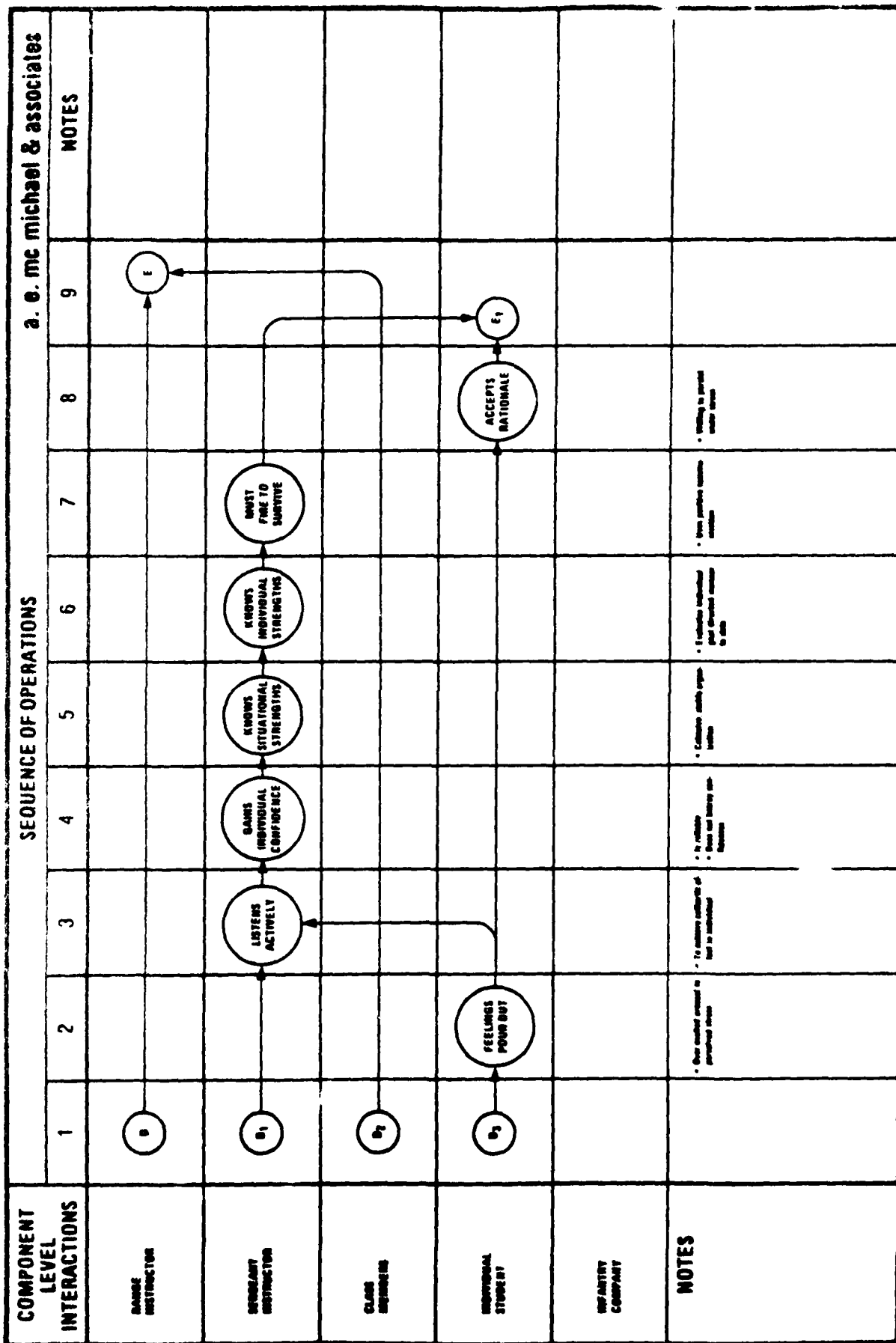


Figure 1-13. Peacetime Scenario, Component Level

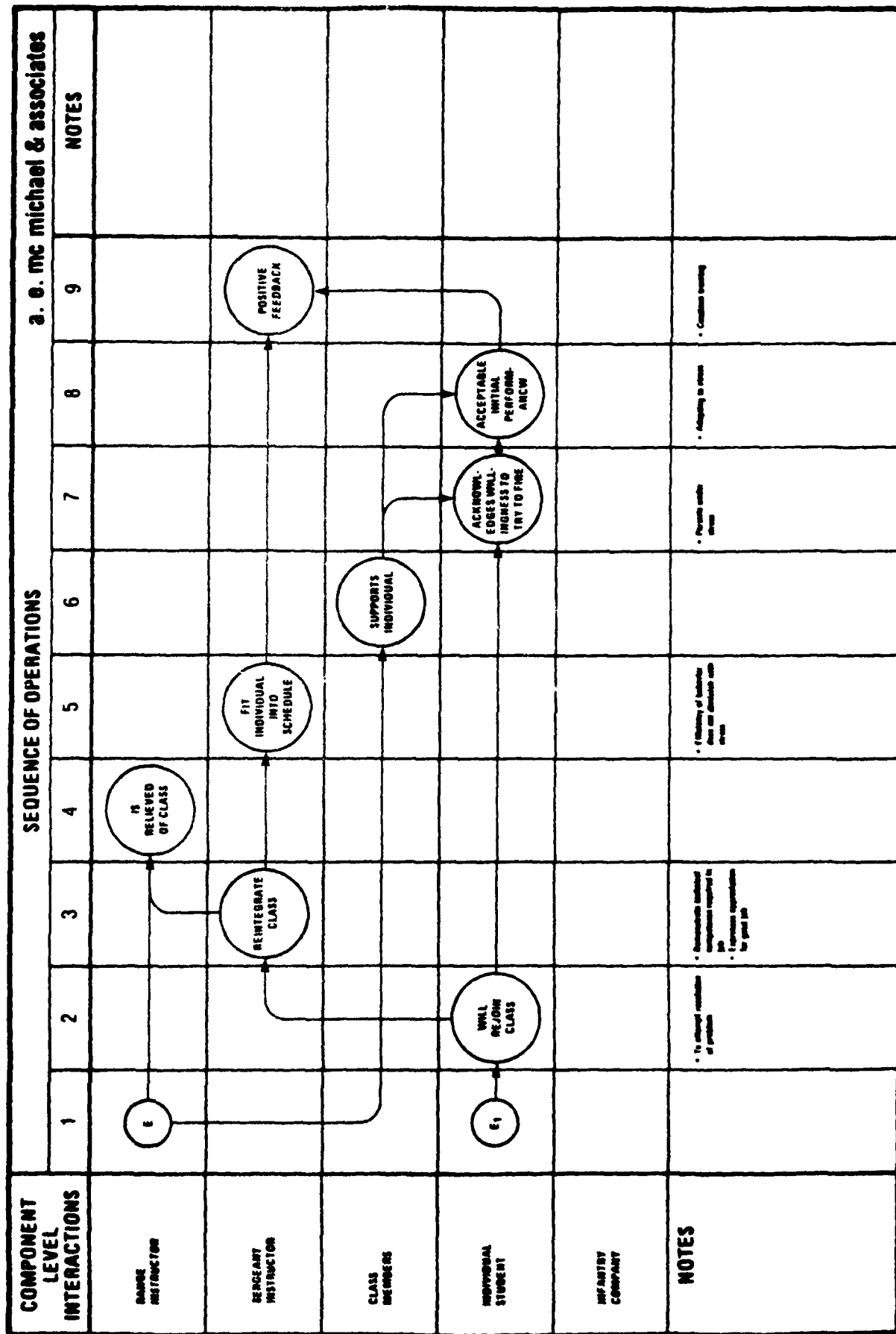


Figure 1-13. Peacetime Scenario, Component Level

scenarios through the use of structured OSDs. We assembled the resulting understandings of these factors, units and components as well as their current deficiencies. We found that we could pool these deficiencies into 20 rough categories which we refined into 15 through consensus of our senior professional team members. We prioritized these categories as a part of our consensus process on the basis of sequential needed and useful Army applications vs needed study to establish an application.

Our final list of alternatives includes:

1. Criteria Development for the Soldier Dimension
2. Soldier Performance in Continuous Operations
3. Leadership Role
4. ARTEP Data Development and Training
5. Criterion-based Performance
6. Soldier Identity and Organizational Climate
7. Psychological Functions in Tactics Development
8. Leadership Evaluation
9. Leadership Training
10. Soldier Dimension Model Development
11. Early Enhancement of Combat in Training
12. Physiology, Biochemistry, Medicine and Health
13. Loss Cutting and Gain Optimizing in Training
14. Force Structure and Anticipatory Design
15. Theory, Systems, and Guidance

Criteria Development for the Soldier Dimension

The development of our Soldier Dimension paradigm advanced our study beyond the boundaries identified in the original tasking. The next step in the process toward quantifiable contributions to mathematical model building is the development of criteria for the identified factors, units, and components. This process of changing the focus of the desired information and guidance for its data collection is shown in the sequence discussed in Models and Modeling (Volume 1). The highest priority is awarded to this study because of its applicability to the U.S. Army Soldier Support Center Concept Paper, 1981, that related the soldier dimension to performance measures.

"some of the Human Dimension factors are readily quantifiable...This would seem to suggest a phased approach, taking on the more easily identified, defined/measured, and interrelated factors first, and then... taking on the more nebulous (those more difficult to identify, define, and interrelate). In this way, the interactive model would expand as additional study is executed (p. 7)."

It is anticipated that this study will spawn applications for several of our listed projects. Such a study provides a measurement base for

planners, doctrines, and training evaluation. We recommend support for this study during FY 1983.

Soldier Performance in Continuous Operations

This topic is a direct application from an earlier study, which we reviewed in our study. The draft manual presents a highly readable summary of modern combat with its degrading effects in terms of: sleep loss, work-rest schedules, and attentional features. It identifies leader remedies including: development of cohesion, commitment, and decentralization of command. It speaks cogently and usefully to many of the needs that leaders must stress in preparing for combat, transitioning to combat, and combat. This report establishes a number of areas in which further training, resources, and procedures are necessary. For example, setting priorities for cross-training in terms of criticality and vulnerability is an important leader remedy for degradation. It is easier said than done and more opportunities, practice, and examples are needed. We believe that this study, "Soldier Performance in Continuous Operations," is ready as an immediate application.

Accordingly, we recommend that:

- The final report be expeditiously transformed into one of the major references for officers and NCOs in the combat arms and throughout TRADOC.
- Auxillary training material be prepared for individual and team training of officers and NCOs in the combat arms and combat support organizations.
- Case studies and illustrative scenarios be developed and published so that methodologies for remedies can be readily understood in applied situations.
- Instructions in the guiding principles of the manual elaborated in detail in officer and NCO basic schools.
- Data underlying degradation estimates contained in this manual be documented and validated in combat simulation exercises. These measurements, curves, and correlations then can be used by weapons systems, modelers, designers, and tactical planners for more realistic appreciation of the Soldier Dimension.

Leadership Role

Leadership in the Army is a complex process at all levels. It can be understood only as an interactive process involving a leader, followers, and a situation. No single theoretical approach provides an adequate basis for understanding for all Army leadership roles. As the leader moves up to higher levels in the organization, there is an increasing emphasis on management and a decreasing emphasis on leadership as those terms are defined in Volume 4 of our study.

Company Grade leaders fulfill a linking pin role. They are the critical links between the formal structure of the Army and the majority of Army enlisted personnel. This aspect of the role of Company Grade leaders does not appear to have been fully implemented in the Army. The most effective leaders are those who are balanced in their ability to employ considerations and task oriented leadership style with the full range of power options: reward, referent, coercive, expert, and legitimate. Our culture is going through a period of transition resulting in young people who are probably less authority oriented and more self-directed than in the past.

We recognize that the Army has used task analyses for a number of years and probably has covered all Army leadership positions. In addition to applying these data as training requirements we recommend that:

- All Army training courses involving leadership, be reviewed and modified to include up-to-date information on contemporary leadership theory.
- Training for higher levels of responsibility should reflect the demands of the leadership role for which one is being trained.
- Maximization of the leadership aspect of Company level leader's role in order to have the greatest possible opportunity to personally interact with subordinates and to have at their disposal a wide range of rewards, incentives, and restrictions. This will make full use of reward and referent power which is needed to develop cohesion and commitment.
- Test leader styles using Fiedler's Least Preferred Coworker Scale or some comparable instrument. Use these results to plan the professional training of the young leader with balanced and effective use of the full range of leadership styles and power as the goal.
- In leader training, at all levels, emphasize the recognition of individual differences and how the leader can most effectively respond to them in ways most likely to meet individual needs as well as achieve the Army goals.

One will recognize that these recommendations span a combination of doctrinal applications and research to lead to further applications for the Army, which gives it a high priority.

ARTEP Data Development and Training

Effectiveness of system performance during combat training is the only available criterion for estimates of combat readiness that have any usefulness. The criteria of effectiveness and the degree of training realism must be carefully chosen if combat effectiveness is to be

estimated validly. ARTEPs, FTXs, and to a lesser extent CPXs are the current and most appropriate indices of unit combat effectiveness. This is true to the degree that they simulate potential combat conditions realistically. The Army takes great pains to bring this about, but much can be lost in the translation from print to practice. The same kind of intensive and extensive concentration should be applied to ARTEPs as is now applied to the combatant forces of other nations and these results should be used to enhance the ARTEPs, FTXs, and CPXs.

ARTEPs are designed for formative purposes so that the results can be used to directly enhance individual and team training. ARTEPs involve the evaluation of similar behavioral performance that the OER and SQTs use for summative purposes such as promotions. This is a highly useful division of evaluation purposes and needs to be continually separate. The same skills may be evaluated, but the results are less likely to be contaminated by mixed motives of the evaluator and individual. In this sense ARTEPs have the advantage of already including individual measures of system performance because it is unlikely that a unit will successfully perform an ARTEP if individual skills are lacking.

In many cases we are dealing with nonlinear variables in which the optimum and maximum do not coincide. The relationships between arousal, task difficulty, and individual/team performance is an example. Cohesion, commitment, soldier self-concept, and morale are not trainable in the traditional sense. They seem to evolve out of stable, consistent training experiences almost as by-products. These experiences provide the raw psychological material that allow people to evaluate themselves as individuals and teams as well as decide how to view themselves in relation to others. There is a need for the Army to extend its research in such subtle and important processes. These studies should be continued in such areas as: decreasing personnel turbulence, unit home-basing, soldier-leader contact, individual soldier and team development. For example, we know that soldiers who have shared the trauma of combat respond similarly to others who have that experience in common. They tend to be more cohesive, committed to the team or organizational groups, and may be more committed to the Army. At what point does this relationship break down and to what degree can those situations be optimized? What roles do leaders play in such processes? What role does the Army's emphasis on realism in training play in the development of such factors?

This category of effort is a mixture of early doctrinal application, research, and resulting additional applications in support of the Army's seven goals. Accordingly, we recommend that:

- The Soldier First philosophy be extended to every phase of Army life with a special emphasis on combat readiness
- Such programs as home basing and unit messing obtain a high priority and support within the Army.

- Aspects of soldier identity, cohesion, and organizational commitment be a part of all individual (officer and NCO) evaluation in addition to MOS task skills. The soldier must contribute and his contribution evaluated (separate from ARTEP), rewarded in personally meaningful ways, and on a recurring basis.
- ARTEPs continue to be used by the Army as formative, direct measure of unit performance.
- Realistic field exercises such as ARTEPs be extensively studied and revised in light of these research results. These studies should obtain their data from established training test beds so that the results may be useful for projecting measures of combat effectiveness.

Criterion-based Performance

Criterion-based performance is almost totally dependent upon the refinement of criteria developed for the Soldier Dimension. A wealth of real-time data is available in Army training programs in ARTEPs, FTXs and CPXs, but it is not systematically examined for relationships to performance variables. The refined criteria may assist research teams in analyzing these data and developing more relevant measures. It is probable that the simple act of getting participants together for after action critiques where all participants contribute to evaluations is a sound first step in identifying remedies. Certainly, it is part of orienting a field research team.

This is an important study in the methodological area of how to develop valid behaviorally related performance measures for individuals and teams. Similar problems in industry have been greatly facilitated through the use of expert judgement. The Army has a large population of potential experts in regard to combat and preparations for combat. Experts are determined by relatively subjective standards based on career and contact with combat. It would be useful to more broadly define experts down through mid-level NCO's. The objective is to identify and use proven effective fighters. The study should also compare the judgments of these highly effective officers and NCOs with a sample of ineffective officers and NCOs in blind tests. It is important to find out what distinguishes the quality of decisions as well as any differences in the decision process. The results could have great benefit for the training of effective leaders and sound validating data.

Our recommendations for the development of criterion-based performance for individuals and teams include:

- The use of expert judgment become more systematized and priority be given to the development of individual/team data from current simulated combat training.

- Junior Officers and mid-level NCOs, who are judged to be combat experts, should be identified and used as a Company level training resource.
- That effective and ineffective combat performers be used as data sources in blind tests to validate judgments and clarify leadership training issues.
- Organizations conducting historical analyses of combat include participants from psychology, cultural anthropology, and demography as full time team members.
- Correlational data from the full spectrum of combat simulation be systematically collected for individual and team criterion-based performance in a combat arms test bed for use in low level war game/simulations and weapon systems analyses.

Soldier Identity and Organizational Climate

The development of a person's perception of who he is appears to be a life-long process of continuing adjustment through learning and growth. Two key features are common to all development processes:

1. The individual brings resources to the growth process.
2. The degree of support for the processes provided by the environment, which includes the organization itself.

The Army's task is how to optimize these resources so that a recruit will identify himself as a soldier. The culture of the Army, as expressed in every facet of the organizational environment, may foster or frustrate movement toward the goal of combat readiness.

Organizational culture, at its simplest level, can be viewed in terms of climate. Is the organizational climate warm or cold? Does it promote or inhibit the growth of resources, especially people, in ways beneficial to the organizations? In most cases organizational culture, policies, programs, procedures, and leader/managers each can contribute conflicting messages that make the achievement of organizational goals less likely. The transmitters of organizational culture need to be increasingly characterized by a positive attitude. Soldiers are resources that are to be developed individually and collectively as teams in the training process.

The Army's Officers and NCOs need to emphasize their role as one of service in the defense of the nation without apology. They need to define their purpose more clearly and emphatically in terms of national defense. Their approach should probably be that every soldier performs his tasks for the safety of the nation in which all policies, programs, procedures, and leaders are put in place in the Army to implement this goal. The emphasis is on the readiness to fight rather than on skill training.

salary, or promotion because these are the indirect complements of development and growth as a soldier. There probably is sufficient doctrine in this area, but it must be emphasized more clearly in the day-to-day routine of Army life. Targets of opportunity for the active development of this attitude must be sought that range from the face-to-face contact between soldiers and their leaders to Army participation in natural disaster rescues. The emphasis is to seek opportunities at all levels of the Army for the experience of service especially where threat to life and the nation is involved; so that service amid combat threats will become automatic for individuals and teams.

Inherent in the service emphasis is the attitude of growth. The Army can offer itself as a career option that promotes the soldier identity. The Army can improve the growth of soldiers by injecting into its structure and mechanisms with high expectations of training results coincident with high standards. Each enlistee needs to come into the Army with the expectation that he will be changed into a different person as a result of Army training in order for a soldier identity to develop with pride and motivation. In this way, the Army will become more likely to develop a desired individual concept in each of its soldiers. The most important resources in training are not equipment and funds, but soldiers, time, and the opportunity to effectively use them. It appears to us that the Army needs more for an optimal training program than it has, but it must use more of what it does have.

These considerations say to the soldier, and his self concept, that his effective performance leading to survival on the battlefield is critical to victory and the Army is going to do the best job it can to prepare the soldier for battle. Part of the luxury afforded an Army in peacetime is the opportunity to train soldiers to execute independent action that will further organizational goals in combat. Providing rationales for actions tells the soldier he is expected to make judgments that are beneficial to the organization. He is not merely expected to be a robot in executing actions. Soldiers need to be told that their thinking and problem solving abilities are important to their effective actions. This is a critical element in developing a soldier's self-concept and in achieving combat readiness in the context of high technology warfare.

Leaders must have more experience, control, and responsibility for manipulation of the reward of pay, promotion, and similar benefits in order to implement and enhance organizational climate. The organization must provide the necessary resources to leaders in order to bring about behavioral improvement. Leaders need training in learning and reinforcement principles with the latitude to vary consequences as individual situations arise. Knowing your men means more than having information about them and communicating with them. It also means supplying the social and organizational consequences to strengthen desired behaviors and weaken undesired behaviors required by individual situations. Such consequences will result from Army policies that allow responsible command latitude and programs that train Army leaders in the use of behavior change techniques.

A return to more stable leader-follower relationships seems imperative because leaders are the links between individuals and the organization. There are gains that accrue from overlearning such as a reduction in personnel turbulence. People need predictable social relationships beyond organizational structure. Transients have little reason to invest the effort required when relationships are guaranteed to be short lived. Turbulence also tells a soldier that he is an easily replaceable and expendable thing. It is unrealistic to regard oneself as a soldier, if being a soldier has so little significance to the Army. The performance of people under stress is benefitted by one's ability to draw on a meaningful identity as a soldier.

Our recommendations in this area of mixed applications and study opportunities of substantial priority are:

- Recruitment programs need to be directed toward positive goals such as meaningful work on a professional team rather than learning a skill with which to get out of the Army.
- The Army should investigate how to create situations in which the soldier can exercise personal choice in regard to his future. The Army can use these opportunities to remind the soldier that preservation of this value is one major reason for his service.
- A growth promoting organizational climate be developed by:
 1. Training leaders at all levels in methods of behavior change, transactional analysis, and rational counseling.
 2. Increasing leader latitude for the provision of appropriate consequences of behavior.
 3. Setting high expectations for individual/team training, and emphasizing improvement through training of phased difficulty.
 4. Adjusting structures and ranks to reduce leader turbulence and enhance leader-follower relationship.
 5. Demonstrate, by all of its actions, that soldiers are regarded as valuable resources under development.
 6. Systematic test-retest programs be initiated to overcome the negative aspects of low intake skill scores and coupled with individual guidance.

- The retention of skilled soldiers be a continuing goal of the Army at all levels, especially in leader-soldier interactions, because it must not be a positive attitude that only surfaces at the time of re-enlistment. Studies of how positive attitudes can lead to greater Army productivity are also needed.
- Errors during training be regarded as opportunities for facilitating soldier growth through behavior modification.
- The development of creative bonus programs become a standard procedure for high performing soldiers with critical combat skills.

Psychological Functions in Tactical Development

The nature of complex weapons systems will increasingly change warfare not only because these systems offer new opportunities in strategy and tactics, but also because they place new demands on users. Traditionally, combat demands on the soldier have increased in physically-loaded actions. Soldiers have been trained to act and not to think. High technology weapons systems requires the same attention to physical capabilities and places additional requirements on the soldier's abilities to outthink an adversary even in the absence of command. The soldier must be carefully prepared for this newer cognitively-loaded role.

Behavioral psychology, with its reliance on individual cognitive skills in learning and motivation, essentially states: decide where the individual/team should be in terms of objectively defined behaviors, determine where the individual/team is at present relevant to these targets, and change individual/teams one step at a time by rewarding any improvement in progress on a frequent and systematic basis. Then the retention of complex skilled behaviors must be maintained through continued practice and reinforcement. These behaviors lead to the development of even more complex and diverse skills for individuals and teams. "Learning never ends" is not a mere slogan, but an accurate requirement specification of a dynamic reality. The Army already applies much of this philosophy in its training programs in ways that are frequently intentional, sometimes intuitive, and as a necessity. The Army can benefit from systematizing its application of the principles of cognitive behavioral psychology.

This category results in recommendations that include a mix of doctrinal application, in-house advance development, and some exploratory research studies:

- We are aware that the Army, objectively defines all skill areas (MOS) and we support a further identification of those changing skills likely to be critical/vulnerable in modern combat. These should be updated as new weapons systems are made operationally ready.

- That units be trained to adapt to projected combat pressures through cross-training and practice under simulation of likely combat attritions. These exercises should also emphasize the role of each soldier as a leader who can rationally take the initiative as circumstances dictate.
- Additionally, we suggest training in rational decision-making processes.
- The cognitive behavioral processes of phasing and shaping training, knowledge of results, objectively graphed criteria, and reinforcement of any improvement be systematically reinforced across all levels of Army training.
- The use of mnemonics and stress prevention techniques recommended in "Soldier Performance in Continuous Operations" be used to improve the cognitive functioning of individuals/teams under combat stress.
- The Army has the resources to carry out further research in mnemonics and rational decision-making to enhance these processes by using other types of mental encoding. Training likely to emanate from these research efforts need to be directed toward the soldier's ability to answer the questions "What do I do next?" under conditions of combat stress.
- There is a need for further research in cognitive skills associated with specific Army tasks skills for the purpose of developing objective measurement and predictive values.
- Army research activities should be responsible for the development of conferences and publications in concert with civilian researchers at the cutting edge of human cognition research.

Leadership Evaluation

The categories now used to evaluate leaders and the leader behaviors taught by the Army touch on all major facets of leadership as that process is presently understood. The categories used to evaluate NCOs we judged to be slightly more adequate in behavioral terms than those used for officers. Leader evaluation can be made more objective and quantifiable by stating the categories of leader activity to be evaluated in behavioral terms. A wide variety of evaluation procedures and tools can be used to evaluate leader behavior.

We are aware that Department of the Army, Deputy Chief of Staff for Personnel and the Army Research Institute for the Behavioral and Social Services probably have continuing review and research responsibilities for this category of effort. To insure further progress we recommend that:

- A review of all evaluation forms now used for leader evaluation, for selection and training purposes, be conducted in terms of the categories reported in Volume 4 as well as any others deemed important by the Army.
- Specification of particular behaviors to be evaluated in each category of leader activity be used and more objectively measured.
- Using the techniques recommended in Volume 4 or some modification of them, specify more ways to evaluate each behavior included in the leader evaluation procedure and institute its implementation.

Leadership Training

Our review of the scientific-technical and Army documents confirm that all leaders at all levels can improve with leadership training. Leaders whose styles are not balanced or who do not understand the nature and uses of leader power can, through training, improve their abilities in the areas in which they tend to be weakest and continue to build on their strengths. These leadership skills are effectively developed on-the-job and in realistic kinds of settings. Effective leader training encourages new and innovative approaches to problems. A basic understanding of leadership and advanced refinement of leadership techniques can be acquired through academic experience.

There are a number of doctrinal applications from this category that include:

- Insure continuous availability of professional development training for Army leaders at all levels. These might be similar in structure to the American Management Association's training seminars and study for Chief Executive Officers down through middle management to junior executive training.
- Base each leader's training on a current profile of strengths and weaknesses obtained from tests, evaluations, and professional judgment. Leader self evaluations of training needs should be incorporated in making training decisions.
- Recognize that newly appointed leaders, 3-5 years experience, are leaders-in-training. Include opportunities for observing and evaluating specific aspects of the leader's role in field activities (non-ARTEP) and during periods of routine activity.
- Provide opportunities for and encourage innovative approaches to problems by young leaders, officer and NCO. Special emphasis in evaluating these efforts need to be on initiative and willingness

to try a new approach rather than whether the attempt was successful. Successful innovation should be commended for both effort and success.

- In addition to studies in contemporary theories of leadership, leadership courses need to be reviewed and modified to include:
 1. Information regarding the kinds of power and styles available to leaders and the conditions in which each of these are likely to succeed or fail.
 2. Information regarding the kinds of goals a military leader must attempt to achieve and the various effective ways to accomplish them. School solutions do not do this.
 3. Information regarding the situational factors a leader must take into account in determining how to deal most effectively with a situation.
 4. The use of various leadership techniques in role playing simulations, non-ARTEP field exercises, or as a part of a regular assignment with observation of outcome and feedback to individual leaders.

Soldier Dimension Model Development

Our Soldier Dimension paradigm is a conceptual statement or model that may be developed into a mathematical model when correlations from field tests are collected and calculated. TRASANA is already working in the modeling area and is the most likely organization to be actively involved in the modeling process. This project is given a lower priority because of the need for a series of intervening applications and studies to be completed before a credible mathematical model can be seriously undertaken. We recommend that the Army does not attempt to use our paradigm as if it were a mathematical model before data are collected and correlations calculated. We also recommend that studies be conducted to validate, within the Army framework, those variables in our Soldier Dimensions paradigm.

Early Enhancement of Combat in Training

In combat it is the novice or replacement who is most likely to become a casualty. While battle is the ultimate test it should not be the ultimate school. The Army's emphasis on realism and train-to-the-test ARTEP simulations are valuable tools for increasing survival, but most frequently occur at later stages of training. These simulations recognize a simple truth that winning is the product of fighting, that dead soldiers don't fight and that staying alive is an outcome of experience.

Training in the skills of combat survival are critical, but we believe that more can be done to enhance soldier effectiveness earlier in

training and at cognitive, emotional, and behavioral levels. Enlistees are unprepared for the mental resources and combat skills. The layman is getting closer to combat in international news reporting on television, movies, TV serials, and some "lessons learned" documentaries. The reality of finding oneself in combat can be a total surprise to the uninitiated even though one may have been trained for it.

Early in training trainees should be exposed to videotape or film sessions of combat. The sessions need to be designed to drive home increasingly different points about the media representations of combat and how they match up with actual combat. Ideally, each critique would be led by combat veterans either active duty or retired. The trainee must know, and have repeatedly clarified for him, what his ultimate role is expected to be. The clarification should start early in training and be relatable to the trainees' past experience. The soldier needs to express his thoughts and feelings about combat in supportive discussions to optimize the motivating effect of cognitive dissonance. This process will make him more likely to internalize the new information that differs from his existing beliefs. This kind of training not only enhances survivability, but will make the trainee more likely to develop a soldier identity, to approach ARTEPs, PTXs, and similar training with a more professional attitude. He will see his relationships to other soldiers in more personal terms and be more resilient in the face of combat trauma.

Individual soldiers training in the characteristics of likely adversaries should receive more detailed attention, frequent visibility in the curriculum, and an emphasis on valid portrayal. Strengths, weaknesses, and characteristics in doubt as well as demographic and geopolitical factors need to be clearly presented with rationale tied to training. Attacking weak points and coping with enemy strength needs to begin early in training, on a personal level, and have consistent reinforcement if our troops are to be expected to out think their adversaries.

Our recommendation regarding this category of doctrinal applications include:

- The Army examine every stage of training, especially Basic Training, for the purpose of developing cognitive and emotional familiarity with combat through successive approximation methods.
- That early training in combat familiarity start with existing notions from the enlistee's media experience. These notions need to be constructively challenged in the format of group discussions.
- Data on the personal combat experiences of soldiers in military history be organized for the purpose of enhancing combat familiarity discussions. Further, that examples particular to a unit's history be used to encourage soldier identity development.

- That combat veterans be used to lead discussions and critiques early in training. If none are available, retired veteran volunteers would be very useful. If this alternative is not used, unit leaders should be trained in combat familiarization techniques by combat veterans to achieve credibility.
- These discussions emphasize active participation by the enlistees.
- Combat familiarity training for skill, cognitive, and emotional readiness become an intrinsic part of the individual soldier's continuing professional development.
- A continuing research be conducted into the strengths and weaknesses of Army-Air Force personnel, tactics, and material resources of the nations of the world. These research products, not necessarily highly classified intelligence documents, will contribute to combat familiarity training. Such information might be profiled in a series of DA Pamphlets, "Armed Forces of the World." These profiles of capabilities, tactics, values, and trends need to be continually updated for inclusion into individual soldier/leader training.
- The Army continue to develop recreational sports that develops a combat orientation.

Physiology, Biochemistry, Medicine, and Health

We recognize that the Army Surgeon General's responsibilities and contributions to state of wellness among operational forces are very broad and backed by an intensive research program. We described the research progress in a few overlapping areas applicable to human biochemical functioning in Volume 3. These fields are rapidly developing in both research data and theory. Those agencies of the Army concerned with nutrition, health, physical development, biomedicine, and psychophysiology need to intensively pursue these developments. It is a difficult intellectual task to apply the results of basic research in an integrated and innovative way, but the lag times inherent in publishing research reports in the traditional way does not permit optimal circulation or implementation.

We believe the Army can benefit greatly by coordinating searches among overlapping areas of bio-psychological function in such a way that it can use the information that is being developed as it is in the process of accumulation. Specialists throughout Army Agencies need to meet, analyze available information, identify data utility on a regular basis, and need to include civilian research representatives in a continuing information exchange.

Our recommendations can be accomplished within the Army and its Surgeon General with cognizant research organizations participation and includes:

- The Army Surgeon General establish a body that will serve to integrate knowledge of all aspect of health and performance. This study/analysis group search for futuristic applications of research projects that are the result of coordinated and systematic integrations of diverse expertise.
- The Army seek to optimally integrate rapidly developing theory and research in human biochemistry as well as related fields. The objective is to implement in a timely manner applications in nutrition, preventive medicine, and hygiene. Emphasis needs to be placed on advanced research that is most likely to bear on psychological aspects of combat performance such as: alertness, attention, memory, and cognitive decision making.
- The findings of such an expert panel publish a continuing series of concept papers that are directed toward the objective of implementation of this information in doctrine applications.

The Soldier Support Center might serve as an interested monitor of these research activities and a coordinator of their applications.

Loss Cutting and Gain Optimizing in Training

An important feature of the Army's manpower problem is that society is not producing 18 year olds in sufficient quantities who are capable of operating and maintaining the increasingly sophisticated weapon and material systems in existing and potential inventories. Two options appear to be available:

1. Emphasize recruitment programs with appropriate incentives targetted to the trained more mature civilian population.
2. Invest a substantially greater effort in the training of 18 year olds for specific military skills and more general individual skills.

These two options are not mutually exclusive and both can be implemented, but neither approach is inexpensive. The Army can adopt both alternatives by altering its structure and the flow of personnel through them.

Differentially skilled enlistees would enter training at levels commensurate with existing abilities as determined by testing. Those of lower exhibited ability are slated to train for less intellectually challenging jobs similar to current practice, but for a different reason. It is not only necessary to train behavioral skills, but also the characteristics of the thinking processes related to those skills. Soldiers will have increasing responsibilities in the effective waging of war means

that they need also to be trained in the rationales, logic, and styles of thinking that foster action through understanding. Soldiers will be more effective if they not only know the how of tactics for their weapon system, but also the why. Otherwise, they will generalize skills only partially, fail to discriminate some opportunities for action, and lack the ability to develop or carry out contingency plans with initiative and confidence. This is an area in which many other national forces are likely to be inferior and it is to our advantage to pursue this type of training.

One way of managing the dynamics of change is to take a growth-with-conservation-of-capital approach. Rather than maximizing gains in a specific way, predetermined economic goals are established that promote diversification over time as a way of maximizing resources/capabilities. Many successful investors use such an approach to achieve their objectives. In the Army's case those personnel, policies, programs or regulations that are identified as likely to become a burden to the Army are to be cut out early according to predetermined standards that are widely communicated to people throughout the Army. Then the money that would have been spent on the training of personnel who fall short of the standards can be used to promote and diversify the abilities of those who excel. The cost of training each soldier would be tied to individual performance and the percentage return, in terms of developed capabilities, can serve as a predetermined standard for retention or discharge.

Inherent in such a process for the soldier are learning principles such as knowledge of results and rewarding improvement. The soldier is systematically offered opportunities at the start of his career to improve himself. Scorers below an acceptable bandwidth are discharged and organizational resources are applied to the more promising performers. Such a program provides the Army with both a weeding out and moving up mechanism in a systematic progressive fashion. It also supports the development of soldier identity because it is directed to growth in cognitive as well as task skills and is more likely to enhance individual pride in being a soldier. It is the intent of such training and progressive evaluation to prepare the soldier for a career, not just a skill for the term of the soldier's enlistment.

In concert with recommendations offered in other categories, we recommend that:

- The Army study methods of making Basic Training an integral part of a selection-for-a-career process in which "making the grade" cognitively as well as physically is a motivating factor.
- Extensive task analysis in the cognitive domain be undertaken to provide objective indices of performance in addition to current task skills.

- Where the expectancy for substantial change through fundamental growth do not exist in the enlistee, it must be communicated by Army leaders, the nature of training, and evaluation programs.
- Economically based cut-out points be determined for termination of low performers at all levels.
- Research be conducted to determine whether initial and/or subsequent enlistment periods ought to be of longer duration as part of the effort to emphasize Army service as a career.
- Research determine whether increasing the retirement age should be mandated or optional in order to preserve soldier resources.

Force Structure and Anticipatory Design

The demands of high technology relevant to modern combat and the lack of trainable personnel have created a need for the Army to restructure its forces in anticipation of future missions. The Delta Force foresees the need for a select, decentralized, highly trained, highly skilled vehicle-based fighting force. The age of smart weapons is but the onset of a robotics revolution on the battlefield. These weapons are not yet ready, but they are rapidly approaching. Strategy and tactics will see a need for both a traditional fighting and one or more high technology fighting forces. It seems unlikely that soldiers and their leaders can be trained to do both. Instead, some will fight in the present high technology scenarios while others will be involved in the ultratechnology of the future likely to characterize tomorrow's major conflicts.

The job for the Army is to anticipate, as it is doing with the Delta Force and related projects, the likely alternatives of the future and prepare now to meet them. It is not sufficient to plan specific counter threats to meet each threat. The Army needs to decide how it would prefer to fight future wars and put in place the means to do it. This approach requires individual characteristic definitions that may be equally as important predictors of success such as: physique, health, intelligence, and social motivation. If trends in operational computerization and robotics are to be carried to a reasonable extent, their human controllers ought to be selected and prepared soon.

The force restructuring can be seen as driven by technology developments and would require training and personnel policy re-design to be successful. One force might be a relatively small one consisting of elite, multiply trained fighters serviced by highly skilled technicians and equipped with ultra advanced weapon systems. Another force might be subdivided according to currently developing technology becoming operational over the next decade. This force would include the requirements for a Rapid Deployment Force, special purpose units, and consist of elite fighters with skilled technicians. The remaining majority of the Army, including Army Reserve and National Guard units, would be more traditionally trained for combat. Even in this part of the Army,

technology dictates that support personnel might still outnumber combat personnel. One can see how several levels of personnel requirements are driven by weapon system requirements rather than by expected manpower projections. Such force re-structuring would also produce personnel policy changes such as having some soldier's spend their entire careers in one or a few jobs within a single organization or force.

Our recommendations in this category reflect a mix of studies and applications:

- The Army analyze future job categories in terms of the bandwidth of entry standards that are likely to allow a person to function capably and offer specific vacancies with full disclosure to those marginal candidates at their entry into the Army.
- A continuing Army study of the use of motivational and emotional indices of individual performance in addition to those in current use to determine if predictive validity can be enhanced for operational performance in the near/far future.
- The selection and subsequent training for ultratechnology and current technology ought to be oriented to special training for combat preparedness of individual soldiers. This is likely to be facilitated because technological innovation will continue to result in fewer men on a battlefield.
- Differential pay, rank, command structure, unit stability, and related processes need to be designed as incentive factors for soldiers in each advanced and current forces.
- That the training of the majority of the Army units serve as screening processes in the selection of elite force soldiers where appropriate entry standards are not met initially.

Theory, Systems, and Guidance

A need currently exists for the systematization of research information from the life sciences and behavioral and social sciences as they relate to the interests of the Army. Currently, this process is partially formalized within research spheres of influence of the Surgeon General, ARI, and other Army laboratories. There is a need to amplify, complement Army research organizations and systematically fostering allied research in the civilian sector. The research technology of the other services has resulted in significant contributions of these sciences in the civilian sector because air and naval technologies have implications for society as a whole. The application of research in these sciences to Army systems is likely to have as much significance as behavioral research has had in pilot selection, pilot error, signal detection, system management, and communications in air and naval systems. The last extensive complication of such research can be traced to the four volume work in the series, "Studies in Social Psychology in World War II." There is a need

for professional researchers associated with the Army, government and private sectors, to organize the relevant research beyond data bank approaches for the purposes of developing integrated theories and identifying future research areas.

We do not believe that a comprehensive theory of human functioning will be achieved in science in the near future. The Army would do well to construct an arrangement of human characteristics that has some face validity and utility for guiding research decisions in Army issues. One theoretical schema from system analysis does approach comprehensiveness, namely, living systems theory and is a promising tool for Army soldier/team analysis in training simulations and combat. Our taxonomy and classification allows one to integrate and differentiate substantial amounts of data. Like living systems theory the virtue of our approach is that it has face validity, is based on widely accepted scientific-technical theories and data, and explicitly accounts for the nature of the presenting situation as well as individual and group performance.

We know and value the broad extent of existing Army research organizations and our recommendations are directed toward developing an energetic, interactive network of interdependent research organizations addressing operational Army problems:

- The Army needs to actively guide its research by developing an integrated system of soldier/team performance. Research priorities can be more clearly established according to the ways in which significant individual/team characteristics fit into the larger picture of individual/team performance. These priorities will tend to show up points of overlap in research.
- The Army use our system and living systems theory as a basis for initiating an Army taxonomy and classification system that will promote the integration of existing diverse data for the purpose of facilitating decisions about future research priorities in soldier performance.
- Existing soldier research be reviewed, organized, and published according to appropriate formats and topic areas in order to disseminate these data and stimulate greater interaction with researchers in universities, private, and public behavioral research agencies. For example, "The American soldier 1970-1980."
- That the Army sponsor a high quality, annual symposium in individual/group processes as applicable to Army issues. This might be accomplished by the Army developing target symposia on special issues that are most promising in their contribution to soldier and unit combat effectiveness. These might even develop into a broadly based research professional society focusing on Army uses for research products. One partial precedent for such

a body is the Society of Military Psychologists, a division of the American Psychological Association.

- The Army, in concert with the other services, encourage and support the development of a limited number of graduate level programs to better prepare future life-behavioral-social science researchers for contributing to solutions of military issues. For example, an institution might be supported in the offering of a doctoral degree in Military Psychology.

Best Case Alternative

These 15 categories of recommended alternatives have several key recommendations attached to each category, and have implications for many more. Our unwieldy original list of alternatives has been made more useful in this process of prioritization. We have found it possible to sequence these 15 categories of doctrinal applications and research studies along four programmatic dimensions within a normal 5 year budget cycle. The sequence has been set to benefit from application/research output of one category to the next. Our programmatic dimensions include:

- Quantification Refinement, Figure 1-14.
- Doctrinal Application, Figure 1-15
- Training, Figure 1-16
- Research Coordination (in house), Figure 1-17

The Quantification Refinement projects, Figure 1-14 and Training projects, Figure 1-16, are predominately study leading to application and appear to have resource conflict problems. This is not the case because only the former category is devoted to studies while the latter category is a mix of study-application. Doctrinal Application projects, Figure 1-15 and Research Coordination projects, Figure 1-17, are all proposed for completion within Army resources and doctrinal applications or in-house studies. The needed resources of people, money, materials and time for the completion of these projects in Figure 1-14 through 1-17 represent our best guesstimates based upon the expert judgment of our Project Manager whose military research management experience spans 30 years of Navy and contractor research. These judgments then are the best case alternative recommended to the Army.

Recommended Action Priorities

The projects representing our best case alternative recommended to the Army, Figure 1-14 through 1-17, cover 60 months/5 years. This span of time has been characterized by budget definitions of:

- Short-term projects, 1-12 months
- Mid-term projects, 12-36/1-36 months
- Long-term projects, 36-60/1-60 months

[illegible]

Figure 1-14 QUANTIFICATION REFINEMENT PROJECTS

NO.	ITEM	MONTHS											
		0	6	12	18	24	30	36	42	48	54	60	
	Alternative Category												
12	Physiology, Biochemistry, Medicine & Health		Δ										
7	Psychological Functions in Tactical Development				Δ								
8	Leadership Evaluation				Δ								
15	Theory, System, and Guidance									Δ			

Figure 1-17 RESEARCH COORDINATION PROJECTS

Short-Term Projects

The majority of the 15 project categories, 66 percent, are included as short-term projects:

1. Criterion Development
2. Criterion Based Performance
3. Soldier/Performance in Continuous Operations
4. Early Enhancement of Combat in Training
5. Loss/Gain Optimizing
6. Leadership Role
7. Leadership Training
8. Physiology, Biochemistry, Medicine, and Health
9. Psychological Functions in Tactical Development
10. Leadership Evaluation

These projects are believed to be achievable within a 12 month calendar period phased within the 60 month block and reflect a mix of studies (1 and 2), application (3 through 5), application-study (6 and 7), and research coordination projects (8 through 10).

Mid-Term Projects

The remaining projects all fall within our definition of mid-term efforts with a similar mix of project types as in the short-term ones:

1. Soldier Dimension Model Development
2. Force Structure and Anticipatory Design
3. ARTEP Data Development
4. Soldier Identity and Organizational Climate
5. Theory, System, and Guidance

All of these projects have current Army proponents, but need a consistent or sustaining interest from the Soldier Support Center to achieve Soldier Dimension goals.

Long-Term Projects

We have not recommended any long-term projects because in our experience, in both military and civilian programs, the successful long-term efforts are addressed, managed, and implemented as a mix of short-term and mid-term projects. Budgetary and other resource constraints mitigate against long-term projects. These considerations are seldom overcome in weapon system development even with the most favorable organizational priorities that are unreachable for behavioral and social science projections.

Study Achievements

We are pleased to present our study of the Soldier Dimension in Battle for such a varied and distinguished readership. Managing the

soldier dimension is imperative for the Army in general and the US Army Soldier Support Center specifically. Early in our study we acknowledged that there is a technique gap that exists between the scientific-technical literature, its quantification, and its implementation. Our four volume study has provided methodologies for synthesizing these data, organized, evaluated, and provided a Soldier Dimension paradigm that shows promise in predicting system performance accurately at the Company level. We identified the data and military utility of existing Army system measures in Volume 2. We developed an advanced taxonomy and classification schema that allows greater specificity and integration of individual and group performance characteristics in Volume 3. We showed the current status, in theory and practice, of leader/manager actions with a balanced approach to leadership training that shows great application in the Army, Volume 4. We provided these volumes because we knew that the dedicated researcher will want to delve deeply into the details of our analysis and discussion of a topic. Volume 1 represents the best summary of each of our detail volumes and the study outcomes with our recommendations for further positive impact in the Soldier Dimension.

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