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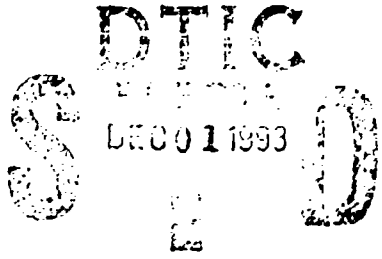
Technical Report 984

Overview of Army Tactical Planning Performance Research

Jon J. Fallesen
U.S. Army Research Institute

September 1993



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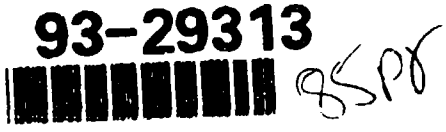

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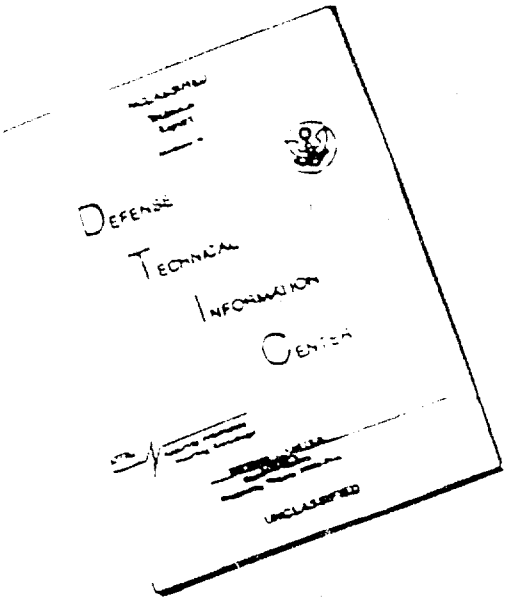

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Essential elements of superior war fighting include tactical planning and battle command. This report reviews research on the human dimension of tactical planning. By aggregating what is known about human styles and capabilities, the Army will be better able to enhance battle command performance.

Available research is reviewed and organized into 10 categories. Individual difference research is reviewed that addresses level of expertise, rank, military-student populations, and cognitive ability. Findings on the estimate procedures include failure to follow procedures, imprecise procedures, inflexibility of procedures, and excessive time demands. Management of the process covers lack of involvement of staff and commander and poor process management. Information exchange discusses problems in information use, presenting plans to the commander, and communicating interpretations. Battle success relates procedural performance to outcome measures.

The other categories address the functions performed in the command and control (C2) cycle. Situation assessment reviews failures to consider factors, verify

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assumptions, assess information quality, interpret information, and make predictions. Formulation of alternatives includes failure to track concepts, generate alternatives, and develop contingencies. Evaluation and comparison of alternatives deals with decision-making approaches, not doing evaluations, and inadequate war gaming. Planning and synchronization covers poor planning. Enacting plans and monitoring relates findings on poor orders dissemination and battlefield tracking.

Technical Report 984

Overview of Army Tactical Planning Performance Research

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FOREWORD

The Fort Leavenworth Field Unit of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) conducts research to enhance command and control (C2) capabilities of the Army. The research focuses on the human dimension of combat: how to develop better leaders by identifying or developing better performance criteria, technical procedures, organizational designs, training programs, information system requirements, and decision aids. Over the past 10 years the Field Unit has provided timely assistance to a wide range of combat and training developments in C2 and combined arms operations. The research has been conducted in laboratory, classroom, garrison, and field settings using naturalistic and field methods, as well as structured interviews and controlled experiments. The research issues addressed by the Field Unit and by other activities form an important collection of findings on human performance. This report concentrates on problems with tactical planning procedures.

This research was conducted under Research Task 1121 entitled "Technologies for Enhancing Command-Staff Organizational Performance."

EDGAR M. JOHNSON
Director

EXECUTIVE SUMMARY

Requirement:

The collection of recent research findings on tactical planning portray an important perspective on problem areas requiring resolution. This report provides a basis for more fully understanding the human dimension of command and control (C2).

Procedure:

Reports on C2 and tactical planning were collected and reviewed for relevance to empirical data on human performance. Reports came from in-house and contracted the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) research, Center for Army Lessons Learned (CALL) materials, and other reports. Research was selected, notable findings were extracted, and specific conclusions were organized along 10 functions. The topics covered by this review include estimate procedures, management of the process, information exchange, situation assessment, formulation of alternatives, evaluation and comparison of alternatives, planning and synchronization, enacting plans and monitoring, individual differences, and battle success.

Findings:

Two to four points are associated with each functional topic covered by this review.

Estimate procedures are not closely followed. Research suggests that there is a disconnect between presentations on doctrine and training and what gets executed--not solely because of poor training--but also because of imprecise and inflexible procedures that typically do not meet the available time for planning.

Management of the process has been observed to suffer from failures to consider all necessary staff areas, inadequate involvement of the commander in the planning process, and lack of control in carrying out procedures.

Information exchange rates have been found to be as low as 17 percent of significant information being shared. It has also been found that briefers often do not communicate what in oact or relevance their information has.

Situation assessment has been shown to correlate positively with course of action selection. Situation assessment weaknesses include failing to consider battlefield factors, verify assumptions, assess information quality, interpret information, and make predictions.

Procedures used for the **formulation of alternatives** sometimes generate weak and incomplete tactical concepts. The concepts that are considered are not always recorded and are not remembered as possible contingency actions. Findings show that multiple alternatives are not always considered. Although a departure from doctrine, naturalistic decision making can speed up planning without any apparent loss of effectiveness.

Not **evaluating and comparing alternatives** is one basic failure in planning. Findings indicate, though, that doctrinal recommendations to compare options concurrently and to avoid making early decisions may not be appropriate. Researching decisions earlier than the time prescribed in the command estimate procedures (CGSC ST 100-9) and using sequential and satisfying evaluation produce equal or better results than those set forth by doctrine.

Planning and synchronization fail because of incomplete planning, insufficient combat power, and poor synchronization of battlefield operating systems and the battlefield framework. Over 60 percent of Battle Command Training Program (BCTP) units have been found to produce unsatisfactory plans.

Enacting plans and monitoring fail from incomplete or late distribution of orders. Orders at division are typically not technically correct. Units below division do not closely monitor the battle, producing conditions for fratricide and unsynchronized application of combat power.

Individual difference research was found to be fairly restricted when judged in terms of the possible number of individual factors. However, an important finding did indicate that better planners try to find how their plans can go wrong.

Battle success was found to relate to better staff, spending more time acquiring and understanding information, better situation understanding, higher quality procedures, and an early decision method.

Utilization of Findings:

Personnel working in the development of combat systems, training systems, and organizational design can benefit from consideration of this collection of performance findings. The report provides a more thorough foundation for identifying operational problems in tactical planning that would benefit from improved materiel, training, procedures, organizations, and leadership development. Instructors of the command estimate process should be aware of the problems documented in this review, and they may wish to use it to focus certain aspects of their instruction. Analysts building and using C2 models should take

into account these findings on the human dimension of combat. C2 researchers should use this overview to further study relationships among the variables and to recognize what variables have not been studied to any great extent.

Specifically, doctrinal principles on the estimate should be reevaluated to portray battle command and the required human tasks from a naturalistic standpoint rather than from a deductive, decision-analytic one. One way to make this shift is to detail how the estimate fits within planning rather than decision making. Guidance to remain unbiased, avoid making early decisions, and avoid comparing courses of action during war gaming should be removed. Guidance should be added on how to make planning procedures more explicit and at the same time more flexible to mission and situational changes.

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OVERVIEW OF ARMY TACTICAL PLANNING PERFORMANCE RESEARCH

INTRODUCTION

The U.S. Army is immersed in command and control (C2) activities in peacetime while maintaining readiness for war and serving as a deterrent to war. In the Army's wartime mission, C2 and tactical planning include determining what needs to be done, planning what and how to accomplish it, and controlling the execution to achieve the desired results. C2 and planning have a central role in the operations of an army. As such, C2 and tactical planning continue to be important topics for research. There are many studies on C2, yet there have been relatively few attempts at comprehensive reviews to establish a body of information on the human dimension in tactical planning. Human performance research consists primarily of one-shot experiments or narrow lines of investigation. This is not a criticism of either the empirical or conceptual writings, because it is on these works that new understandings will be built--and undoubtedly old lessons relearned. But if the Army desires to continue to find and use every possible means to develop and sustain superior war fighting forces, then it must recognize the importance of considering the characteristics and limitations of the human dimension in C2 and tactical planning. It is upon this assumption that this overview of tactical planning performance was built.

This review will also help shape the agenda for continued research. Uncertainties about C2 performance are many. The uncertainties should be addressed head on. Too often, applied research proceeds down a single path, without taking a broad look and trying to resolve conflicting findings or building from compatible findings. Summarizing findings in an overview is important for the combat and training development communities. Developers need to be aware of C2 findings and incorporate them into doctrine, training, organizational designs, leadership principles, and materiel developments. This report illuminates important C2 and planning issues.

An example of uncertainty surrounding C2 is the descriptive and prescriptive models of the C2 or planning process. For a sample of the variety of models, one need only go to FM 101-5 (1984) to find multiple diagrams and tables. Tables in FM 101-5 include the military decision-making process (p. 5-6), commander and staff actions in making and executing decisions (p. 5-7) planning sequence for any operation (p. 6-3), planing time discipline guide (p. 6-7), staff section functions (p. 8-9), staff activities (Appendix A), analysis of the area of operations (Appendix D), and estimates (Appendix E). Adding to the variability in this doctrinal manual are different depictions in other doctrine and training materials. For example in FM 100-15 (1989), different charts are used to depict the corps command and control process (p. 4-14), decision planning (p. 4-22), command and control process (p. 4-23), and corps planning in the crisis action system (p. 8-8). And in CGSC 100-9 there are two related diagrams on the decision-making cycle (p. 1-1) and the tactical decision-making process (p. 1-2). Although these materials are complementary at a conceptual level as they all are addressing C2 procedures, yet they reveal differences in their sequence and content.

This review addresses findings in performance of C2 processes and tactical planning. Variability in performance is addressed, as are departures from doctrine. The purpose of this report is to describe the findings on commander and staff performance in Army tactical C2.

Scope

The scope of the report primarily includes research on Army tactical C2 performance from 1973 to the present. This review does not explicitly cover conceptual or speculative works that are not based on original, empirical data. Exclusion of research that is not empirical is not meant to diminish the value of those works. The non-empirical writings lack the same degree of rigor as the studies that are included. This overview integrates the research findings along propositions of failed performance and, where possible, ventures to provide explanations.

The principal echelon of interest for this review of tactical planning was division, but studies that were "echelon-free" or that dealt with other echelons were included when pertinent.

Background

Several investigators have done reviews related to this one. They include

- Olmstead's paper on battle staff integration (1992);
- Crumley's review of C2 performance measurement research (1989);
- Decker and Riedel's annotated bibliography of decision making (1987);
- Keene, Spiegel, and Michel's review of Army Command Control and Evaluation System (ACCES) findings and methods (1990);
- Johnson, Halpin, and Andrews annotated bibliography of ARI research on C2 (1981).

Olmstead provided a recent review of his research from the late 1960's and 1970's. He reviewed his findings on organizational competence and made recommendations for developing effective battle staffs. Crumley's work focused on the efficiency of training applications and measurement methods. Decker and Riedel covered mostly academic studies of decision making, with few references to Army tactical decision making. Keene et al. focused on measurement and method concerns of a specific measurement technique. The principal findings are included in this overview. Johnson et al. provided an annotated bibliography that covered tactical data systems; information processing and presentation; surveillance, reconnaissance, and target acquisition; command staff simulation and gaming; and technology-based research. Several of the studies from this bibliography are included in this review. Although these reports are useful, they fail to provide an overview of the effects of various factors on C2 performance.

There have been several other efforts that have gone beyond reviewing C2 performance and attempted to apply the findings. Clary, Deckert, Shaw, and Tenney (1990) drafted guidelines on how to design and enhance performance at a command center. Fallesen, Lussier, and Michel (1992) incorporated findings from C2 research into a procedural guide on the C2 process. The guide was written in the form of a training and standards manual and does not include the rationale or research references for its recommendations. Kahan, Worley, and Stasz (1989) reviewed the information needs of a commander. By observing a dozen command posts and conducting interviews, they categorize C2 information according to three types of flows: pipeline (routine), alarms, and trees (hierarchical). Although they propose an interesting model, supporting data from the exercises and interviews are not included.

ARI Fort Leavenworth Field Unit Research. The need for this overview has been growing for several years. Unplanned research--such as that for new command and staff training programs, revision of doctrine on C2 procedures, and recent international conflicts--delayed earlier efforts to perform a comprehensive review. The research program of the Fort Leavenworth Field Unit has been focused on C2, but also has been changing to keep pace with specific needs of research sponsors. The growing body of research led to the recognition that the findings should be organized in one source. The following ARI Fort Leavenworth Field Unit programs from 1987 to the present have shaped the perspective taken on C2 and provides much of the data for this review.

- Naturalistic or recognition primed decision making (RPD). This work identified instances where a decision maker specifies a single option rapidly. The initial option comes from experience and is evaluated to see if it satisfies minimal criteria. If there is not one solution that readily meets criteria, then a process of "progressive deepening" is used to construct a feasible option. RPD is in contrast to a formal, analytic process where multiple options are generated, each evaluated, and then compared to select the best option (Klein, 1989; Klein & Klinger, 1991).

- Group problem solving. This research was performed for the Combined Arms Services Staff School (CAS3) to see whether instructional goals in problem solving were being achieved (Lussier, Solick, & Keene, 1992). A team problem called VARWARS (Lussier, 1990) was created and was extended to explore ways to improve CAS3 instruction (Lussier, 1992).

- C2 evaluation. A recurrent concern has been to determine how well command and staff groups are performing for purposes of training feedback, C2 system evaluation, and organizational design. The concept of an adaptive coping cycle served as the basic model for the method. The method is called the Army Command and Control Evaluation System (ACCES) (Halpin, 1992). The development and application of ACCES provided the opportunity for observation of division and corps staffs during command post exercises (CPX). Other CPXs were observed where ACCES was not used. These included a battle command training program (BCTP) focused rotation (Burkette, 1990) and a Command and General Staff Course (CGSOC) war fighter exercise (WFX) (Fallesen & Michel, 1991).

- Decision aiding. This research was done to explore enhancement technologies for staff planning. It involved a range of activities, including a task analysis of command and staff operations, survey of decision aid concepts (Carter, Archer, & Murray, 1988), development and evaluation of decision aids (Flanagan, McKeown, McDonald, & Fallesen, 1992; Perkins, Flanagan, & Fallesen, 1991; Ross, 1990), and eventual transition of the concepts to field users and tactical C2 systems. This work led to a better understanding of doctrinal prescriptions for C2 and actual C2 performance. Related work involved developing and applying evaluation methods for assessing the validity, usability, and utility of decision aids (Riedel, in preparation).

- Estimate procedures. An experiment was conducted to determine whether structured procedures would help or interfere with tactical decision making (Fallesen, Carter, McKeown, Flanagan, & Perkins, 1992). This experiment along with other observations suggested that there were notable disconnects between how the process was prescribed in doctrinal and training materials and how it was typically performed. Based on this

information, the Center for Army Tactics requested that ARI draft a description of the C2 process for FM 101-5 (Fallesen, Lussier, & Michel, 1992).

• Tactical commanders development course. The Commander of the Combined Arms Command requested feedback from graduates of a newly formed course. Feedback was provided to the course developers to assess effectiveness and to refine the course. The battalion commanders provided high ratings of the course and offered advice for improvement (Lussier & Litavec, 1992).

• Combat stress. With the deployment of US forces to the Persian Gulf, ARI was directed to support the Desert Shield operation with all appropriate research. A major concern was that known C2 performance difficulties would be exacerbated by imminent danger conditions of actual combat. Judgments about C2 problems and solutions were incorporated into advice on how to maintain C2 proficiency under the stress of combat ("Winning in the Desert II: Tactics, Techniques, and Procedures for Maneuver Commanders" Center for Army Lessons Learned, Special Edition No. 90-8, Sep 1990).

• Desert Storm lessons learned. The Center for Army Lessons Learned (CALL) requested ARI assistance in the survey of Operation Desert Storm commanders and staff. Surveys were distributed to all Army commands deployed to Saudi Arabia. The survey resulted in a data base of nearly 2500 responses covering some 40 topics (Halpin & Keene, 1993).

Most recently four new efforts have been undertaken to develop a deeper understanding of battle command. These projects include (a) distinguishing the factors of tactical decision making expertise, (b) determining the extent to which battlefield pattern recognition can be trained, (c) analyzing officer's ability to forecast tactical maneuvers accurately, and (d) identifying cognitive skills used in tactical situation assessment. Except for early findings on expertise, the emerging findings are not covered in this review.

METHOD

Literature Search Methods

Several literature search methods were used. Literature was collected for related projects over about a five year period. Literature searches used the search services of MATRIS (manpower and training research information system), DTIC (defense technical information center), and CSERIAC (crew systems ergonomics information analysis center). Search topics included those identified in Table 1.

Table 1.
Summary of Formal Literature Searches

Topic	Service	Date	Results
C2 decision making	DTIC	Feb 1983	208 research work unit summaries (1963-1983)
Decision aids	DTIC	May 1986	234 technical reports (1975-1986)
Decision making in organizations and combat	MATRIS	Nov 1989	5 studies and 31 research work unit summaries (1983-1989)
C2 evaluation	MATRIS	May 1990	1 study and 22 research work unit summaries (1981-1990)
Battlefield assessment and tactical reasoning	MATRIS	May 1990	14 studies and 33 research work unit summaries (1980-1990)
Situational awareness	CSERIAC	Jan 1991	415 reports and 4 research work unit summaries

The acquired literature was selected for applicability to C2 performance. Very few of the references were found to provide empirical data on behavioral issues of C2. The major source of literature was from the collection of technical reports in the ARI Fort Leavenworth Field Unit library. The selected reports were summarized into annotated bibliographies and the categorical table entries found at Appendix A. Summaries were matched to the list of functional areas to generate trends of the types of problems found. The findings are reported and summarized in the following sections.

Format

Several organizing formats were considered for summarizing the research. One type was the type of environment in which the data were collected. Another format considered was to use the kind of performance error that was observed as an organizing principle. Both of these organizations were rejected for one that corresponds to the types of C2 functions. An organization by C2 functions corresponded to general considerations of current procedures. The choice of a functional organization is not meant to be prescriptive or ideal; as the review will

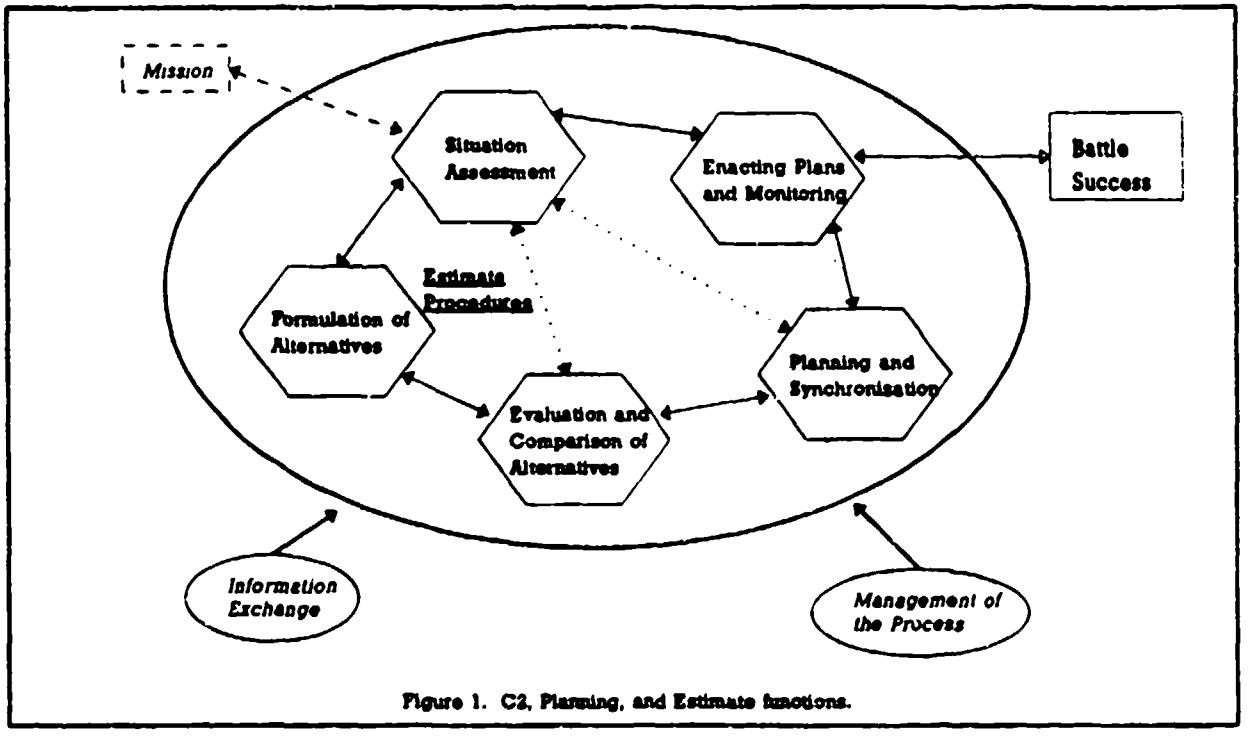

Figure 1. C2, Planning, and Estimate functions.

show, there are problems with the current definition and structure of C2 functions.

The functions used in this review include management of the process, information exchange, situation assessment, formulation of alternatives, evaluation of alternatives, planning and synchronization, enacting plans and monitoring (see Figure 1). A section on Estimate procedures provides an overview and introduction to these functions. Associated with the C2 functions is their relationship to outcomes or battle success. Individual differences are also addressed since there were several studies that covered personnel characteristics. The topical outline for the review is shown in Table 2. All the reports reviewed address tactical command and staff operations.

Olmstead (1992) produced a similar list of pitfalls based on organizational psychology work by Schein. Olmstead's adapted list addresses five failings in an organization.

1. Failure to sense changes in the environment. Incorrectly interpreting what is happening.

2. Failure to communicate all relevant information to those parts of the organization which can act upon it or use it.

3. Failure of the battle staff to insure that all personnel and subordinate units make the changes indicated by new information or changed plans.

4. Failure to consider the impact of changes upon all parts of the unit.

5. Failure to obtain information about the effects of change.

Table 2.
C2 Performance Problems and Issues

Estimate Procedures Failure to follow procedures. Imprecise procedures. Inflexibility of estimate procedures. Excessive time demand.	Evaluation and Comparison of Alternatives Failure to evaluate. Serial evaluation of options. Reaching early decisions. Inadequate war gaming.
Management of the Process Failure to include required staff (poor coordination). Inadequate Commander involvement. Poor management of the process.	Planning and Synchronization Incomplete planning. Poor planning.
Information Exchange Failure to exchange information. Failure to present plans to commander. Failure to communicate interpretations.	Enacting Plans and Monitoring [illegible]or orders dissemination. [illegible]ilure to track the battlefield.
Situation Assessment Failure to consider factors. Failure to verify assumptions. Failure to assess information quality. Failure to interpret information. Failure to make predictions.	[illegible]ndividual Differences Differences in expertise. Differences by rank. Differences by military - student. Differences by cognitive ability.
Formulation of Alternatives Failure to track concepts. Generation of single alternatives. Inadequate concepts and contingencies.	Battle Success Staff characteristics related to effectiveness. Understanding related to effectiveness. Quality of procedures related to effectiveness.

Olmstead's list of failures has direct relationship to the problems identified in this report. The first failure is related to problems with situation assessment. The second and third failures concern problems of information exchange and orders distribution. The fourth failure is related to contingency planning, but more specifically addresses the difficulties of changing current actions based on plan changes. The fifth failure deals with problems of monitoring.

Each major report that is reviewed is summarized in a table in Appendix A. The table identifies the reference for the report, the task that the participants were performing, the method of data collection and analysis, number and type of participants, the issue or purpose of the research, and selected findings. The basis of assessment of the reported research is described under methods in the table. For example, one type of assessment is the author's interpretation. The observations also might represent self-assessments, such as a commander's comments about what the unit did or did not do well. The basis of assessment might be relative frequencies or proportions of observed events. Some of the experimental conditions used controlled comparisons of different conditions and some used expert judgment. In the other cases the authors' interpretation of the data is the sole source of the assessment.

Findings compiled by the Center for Army Lessons Learned (CALL) are included in the reviewed research. These findings come from four analyses. One set is made up of observations principally from the National Training Center. A CALL analyst searched the ALLMIS data base in the fall of 1989 for entries from April 1986 through May 1989. The intent was to identify systemic C2 problems on the issues of intent, decision making, Estimates, and battle staffs. ARI researchers extracted 33 relevant lessons from this subset of ALLMIS observations (see Appendix B). Also a CALL observer used an ARI-developed collection scheme during an NTC rotation for systematic observation of the Estimate process (CALL observer, personal communication, 1990; referenced henceforth as "CALL, 1990"). A third summary of related observations was developed by CALL analysts in September 1992. This comprehensive analysis identified performance trends of the combat training centers (brigades and below) for 1991 and 1992 (see Appendix C). The fourth set was a similar analysis from the CALL Battle Command Training Program data base on 20 division and corps war fighter exercises (WFX) (see Appendix D).

FINDINGS

Estimate Procedures

The Estimate process is a critical underpinning to C2 operations. It makes up a considerable part of the military decision making process (FM 101-5, CGSC ST 100-9). It originated in the early 1800s in the Prussian Army. The Prussians realized that they needed a systematic and logical approach to military problems. No longer did they want to leave success to the rare chance of tactical genius. The US Army adopted what was then called the "applicatory system" in the early 1900s. The "Estimate of the Situation" evolved at the Infantry and Cavalry School at Fort Leavenworth to direct students' attention to factors that should be routinely considered for tactical problems. Michel (1990) reviewed the history of the Estimate and tracked how it has changed in each doctrinal version from 1932 to 1984.

The current Estimate process goes beyond focusing attention and has become a formal method to arrive at the Estimate product and decision. The format of the Estimate product corresponds to each step in the sequence, and includes sections on the mission, the situation and course of action, analysis of courses of action, comparison of courses of action, and decision (recommendation) (see Table 3). Most steps are associated with paragraphs in the written Estimate. FM 101-5 describes what to include in a paragraph before proceeding to the next step.

Table 3.
Paragraphs in the Commander's Estimate of the Situation (from FM 101-5)

1. Mission
2. The Situation and Course of Action
   a. Considerations affecting the possible courses of action.
      (1) Characteristics of the area of operations.
         (a) Weather.
         (b) Terrain.
         (c) Other pertinent factors.
      (2) Enemy situation.
         (a) Dispositions.
         (b) Composition.
         (c) Strength.
            - committed forces
            - reinforcements
            - artillery
            - air and nuclear, biological, and chemical capabilities
         (d) Recent and present significant activities.
         (e) Peculiarities and weaknesses.
      (3) Own situation.
      (4) Relative combat power.
   b. Enemy capabilities.
   c. Own courses of action.
3. Analysis of Courses of Action
4. Comparison of Courses of Action
5. Decision (Recommendation)

The Estimate process has been of concern to the training, operational, and research communities. Concern arises because of its complexity, the variability surrounding how it should be followed, and anecdotal reports of failures to execute it as it is described in doctrinal training materials. This section reports on failures identified from more objective research than subjective sources.

Failure to follow procedures. Observations of training exercises, controlled experiments, and historical analysis of combat indicate notable deviations from how doctrine implies that the Estimate is done. The studies described in this section are some of the general indications of the failures. More specific instances are described in following sections.

Observations from the national training center (NTC) indicate that the Estimate process is not followed. Observations recorded in the Army Lessons Learned Management Information System (ALLMIS) record that the Estimate process as described in training and doctrinal materials is not followed. CALL observations (Appendix B) indicate that the staff planning process was not used, there was no recognizable planning process in a rotation, and the planners only went through an execution checklist instead of planning.

Three missions by a battalion task force were closely examined (CALL, 1990). It was found that the staff never followed the decision making process and never produced a standard Estimate. Formal Estimates were not developed, and most of the planning for each course of action was done by a single individual. The 1991-1992 summary of CTC observations indicated that 76 percent of staffs did not conduct parallel planning (Appendix C).

Fallesen, Carter, et al. (1992) found that when Estimate procedures were unspecified trained staff officers in their study did not follow the process. The teams in the unspecified condition left out steps, performed steps less analytically, and vacillated among steps.

Geva (1988a, 1988b) analyzed accounts of the Yom Kippur War. The procedures used by Israeli commanders for consideration of alternative courses of action deviated from a normative decision model.

Imprecise procedures. Sometimes the failures to follow procedures have been dismissed as instances where commanders and staffs are not sufficiently trained. There are more systematically reported cases indicating that the procedures themselves are imprecise and do not allow conformance to the demands of the operational situations.

Lussier and Litavec (1992) interviewed 48 graduates and nongraduates of the Tactical Commander's Development Course (TCDC) to obtain feedback for the course designers. The commanders reported that the application of the Estimate is not standard and not appropriate.

> *"The commanders, for the most part, find the doctrinal staff estimate and decision making process to be of limited applicability at battalion level."* (p 36-37)

Observations from training exercises correspond to the commanders' assessments. CALL observations from NTC (Appendix B) indicate that staff planning procedures are weak. There are no standard techniques for certain steps. Burkette (1990) reported conclusions from a division level Battle Command Training Program (BCTP) war fighter. The commander did not believe in the doctrinal Estimate process as presented in Chapter 5, FM 101 5 or in CGSC Student Text 100-9. The commander's apparent view was that those descriptions of the process

are too formal and require too much time under tactical conditions.

Another problem is the lack of cohesive procedures for staffs. Procedures for interactive tasks should promote working on problems under common goals. Fallesen and Michel (1991) observed a CPX conducted by BCTP for the Command and General Staff Officer Course (CGSOC). All the CGSOC students participated, portraying the headquarter staffs of one corps, three divisions, and a separate brigade. Fallesen and Michel found there were no specified or implied procedures for transitioning plans from the plans cell to the operations cell and on to the tactical operations center (TAC).

There are some counter indications that the procedures are not problematical. Halpin and Keene (1993) reported on a survey of US Army Desert Storm commanders and staffs. Their findings suggest there is not an overwhelming problem with Estimate procedures. Eighty-four percent (1396 out of 1667 responding to the question) indicated that the current Estimate process was adequate. However, the large amount of time available to plan the initial attack and the abundance of staff personnel may have been novel conditions not likely in most future situations. Some of the comments indicated there were notable deviations from the Estimate's application that the respondents apparently ignored when judging the Estimate's adequacy. For example, one battalion commander indicated that a plan was built by himself with a subset of staff and that only one course of action was war gamed. Another battalion commander indicated that the process worked well during planning, but once execution started he analyzed the situation and decided with little input from the staff. Some staff personnel indicated that frequent, last-minute changes in orders from higher headquarters prevented any time to follow any kind of Estimate procedures at all.

Lussier and Litavec corroborate there are deviations in how the Estimate is done,

> *"Almost all commanders were adamant that the Army's decision making process was too ponderous for use in limited time situations, and to attempt to use this process in those situations was a mistake. The process was workable and beneficial in the Desert Shield preparation phase; however once Desert Storm began, it was not. Most commanders indicate that not only was the staff estimate and decision making process not used, but neither were operations orders in general -- only commander's intent and fragmentary orders. The same conclusion is drawn by commanders with CTC [combat training centers] experience. The 'Leavenworth' process, as they call it, is good for teaching purposes only. One commander called orders preparation an NTCism!*
>
> *"Commanders distinguish two situations: limited time situations, with only a few hours of planning time available, and execution situations, where mission planning is occurring at the same time as execution. In the latter case, the changing tactical environment makes the doctrinal decision making process even less applicable. Most commanders believe that they are not given much doctrinal help in doing that truncation; each must develop his own techniques and planning processes."* (p 16)

Procedures have been observed as incomplete for describing the actual interactions among staff elements. Commanders themselves report the failings of the procedures.

Inflexibility of Estimate procedures. Another slant to the lack of explicit, workable, and tested Estimate procedures is the lack of flexibility or adaptation to changing situations and requirements.

Fallesen and Michel report an observation from one of the students who role played a Division Chief of Staff. He reported that the Estimate is not flexible to changes occurring in the middle of the process.

> *"Procedures for the estimate are not specified for how to deal with changes received in status or mission. There is no stated way to factor in new information or changes in goals. (This is a useful insight into problems which have been observed in many other exercises: the estimate is a good process, if planners can start with it and go, but it is not clear how to proceed when situation and mission changes occur.) A more systematized means of warning orders may reduce some of the turmoil caused by frequent changes. Developing more detail on how to adapt the steps to changes is even more important to show that the estimate can be flexible."* (p 6)

Olmstead, Christensen, and Lackey (1973) emphasized the importance of having flexibility in organizational processes.

> *"The ability of an organization to respond flexibly to changes in its operational environments is related to its Competence. . . .In many organizations, Competence is less than adequate because little systematic attention is given to the quality of process execution. Instead, attempts to improve effectiveness take the form of increased emphasis upon regulated and formal responses that control variability and, thus, insure reliability in performance. There is a preference for the certainty of standardized procedures with their clearly demarcated and logically related stages. Accordingly, organizational processes, which are less tangible and more ambiguous, may not receive the attention their importance warrants."*
>
> *"Formal procedures are imperative for the effective functioning of any organization, and the results of this study do not argue for neglecting them. However, over-reliance upon standardized responses leads to organizational rigidity. Effectiveness in the fast-changing environments of today requires high levels of flexibility, a quality that is essential in uncertainty situations and that has its source in what has been called in this study Organizational Competence."* (p 66-67)

Excessive time demand. As a formal, systematic, and logical process, the Estimate typically demands more time to perform the process than is afforded by the situation. When time is too short to do an entire Estimate, there is uncertainty about how to tailor the process to the time available. Compounding the problem is that it is not clear at the beginning of any step how long and involved that step might be. Any step is bounded only by the commander's or planner's knowledge and imagination. The issue for abbreviation of Estimate procedures is to determine how to tailor adequate analyses into the time available.

In an experiment comparing amounts of time to analyze three courses of action, Leddo, Chinnis, Cohen, and Marvin (in preparation) found that division planners with unlimited time performed better than planners given 45 minutes. Unlimited time planners (those with no time stress) consulted more sources of information, spent more time on information that was relevant to resolving uncertainty, and used more analysis methods. The study showed that additional time was used to do more thorough analyses. Unlimited time is not very common in tactical situations.

Only six percent of the respondents in the Desert Storm survey indicated that they did not

abbreviate the Estimate process (Halpin & Keene). Explanations for not abbreviating the process from those six percent indicated that the process was not used during execution and so there was no need to abbreviate it.

Fallesen and Michel reported that a full Estimate was never used in any of the cases where an Estimate was observed in the CGSOC exercise. There were no common procedures for abbreviating the Estimate. The staff just left out whatever was convenient to leave out or that was too hard to do. In several cases, planning went from development of the concepts (less combat power estimates and force arrays) to feasibility analysis to synchronization matrix completion. Little or no war gaming was ever done.

Burkette also found that the Estimate process was not used by the division he studied, partly because it required too much time. In one instance an officer was seen trying to adjust a time line for actions that had already been missed. Eventually the officer realized that another action had been missed even before completing the first revision. This poor use of time may be partly responsible for not being able to follow the complete Estimate process. The division never achieved full synchronization because the staff was never able to finish a planning cycle. The division was also jeopardized because they never realized planning needs nor identified time windows to plan for. A CALL observation (Appendix B) also identifies the importance of planning for future operations while conducting current operations.

Other CALL observations (Appendix B) indicate that sufficient time to follow the doctrinal Estimate is a problem at brigade. Planning time discipline (1/3 of the planning time for use by own echelon and 2/3 left for subordinates) must be addressed in detail, and it must consider the time required for rehearsals.

In the Desert Storm survey report, ideas are given on how to abbreviate the process. Techniques that were suggested included focusing on the stated and implied tasks and METT-T (mission, enemy, own troops, terrain and weather, and time available); limiting the options for war gaming; eliminating event templating; and using the most familiar and flexible formation.

Lussier and Litavec also found ways to abbreviate the Estimate process in the battalion commanders' suggestions.

> *"In the case of limited time planning, commanders generally adjust by giving much more focused guidance to begin staff planning. One commander recommended starting by giving the staff a course of action to look at -- the staff must make a yes/no/change recommendation. Another eliminated staff estimates -- the staff looks for stoppers only. Another commander had his S-3, S-2, FSO, and engineer with him when he received the brigade order. They did a quick mission analysis and IPB, developed a course of action and briefed the brigade commander immediately to catch major disconnects. Then, as the staff began to plan, the commander went to his company commanders to start preparing positions and obstacles, maximizing preparation time. Other commanders said they must just bite the bullet and decide quickly. They emphasized that the important thing is how well planned and executed the mission is, not which course of action is chosen. . . . Increased decision making time directly reduces planning time, rehearsal time and subordinate planning and preparation time. These latter activities have much higher payoff than the possibility of arriving at an incrementally better course of action.*
>
> *"While increased focus and guidance is one key to truncating the planning process, most*

commanders feel that this is generally an army weakness; commanders do not know how to give good staff guidance. It is not enough to tell commanders they must give more focused guidance; they need to be given deliberate specific techniques by TCDC." (p 17)

In this material from Lussier and Litavec there are several indications that procedures are not as important as the knowledge that the commanders have. Are they experienced enough to decide early? Do they know what is most critical to give pointed guidance? Lussier and Litavec go on and address the importance of forecasting and having well-known, response sets.

"If planning is being done during execution in a changing environment, the decision making process must be abbreviated even further. This is a problem, commanders admit, with which they generally have not coped well. Often they do not look out ahead at all but deal with events as they happen. They decide and execute or use a crisis-action decision cycle. The key to success here, the commanders agree, is a set of well rehearsed battle drills." (p 18)

The battalion commanders who were interviewed wanted more specifics on decision points, named areas of interest (NAI), target area of interest (TAI), engagement area (EA) calculus, and predicting the number of vehicles that would be in an EA. In response to these recommendations, TCDC instructors felt that new procedures are not needed in time-constrained situations. They felt each step of the Estimate needs to be performed and that steps are done more quickly.

Summary. The TCDC instructors' response represents a traditional viewpoint that the current procedures are acceptable; that they just need to be performed faster. What is missing from the argument to do all steps quicker is determining how the complex analyses can be done quicker, while maintaining sufficient accuracy and completeness of considerations. If the process can be speedier without leaving anything out in time-constrained situations, then why cannot the sped up process be used when there are not severe time constraints? The time savings could be used to create a tactical edge or make sure that subordinates have sufficient time for preparation. These are compelling benefits that might be achieved through development and testing abbreviated procedures.

Some traditionalists concede that the Estimate needs to be fine-tuned without changing its basic elements. Other backers of current Estimate procedures believe that better training is needed so procedures can be followed better. If a procedure is not followed, it is of questionable use. Either it is difficult to train and retain or planners find their choice of naturalistic procedures more efficient. The overwhelming evidence from the studies reviewed here is that change is required. The extent to which the change is characterized as a wholesale change in the Estimate or a fine-tuning is immaterial. Rather than dismissing the limitations as failings of speed, training, or soldier competence, what is more important is that effective and efficient procedures be determined. The following sections address the process in more detail to support a fuller understanding of the issues.

Management of the Process

Multiple tasks and multiple workers require management. Regardless of how expert the individuals are or how well meaning they are, there is still need for coordination of their tasks. Making sure that the staff and subordinate commanders share an understanding of the goals and procedures to reach the goals is a required function. When procedures break down or when separate functions go unsynchronized, time lines can be missed, effort can be duplicated unnecessarily, or products can fail to achieve their desired result. Failings in the management of the management of the process do occur.

Failure to include required staff (poor coordination). Staffs are organized according to staff specialties. The specialties should all be included so plans are thoroughly developed and there is an efficient use of resources.

Several CALL observations (Appendix B) indicate problems with incorporating all necessary staff elements into the planning process. Engineers and fire support officers are left out. Some of the brigade staff has been omitted. Other observations indicate problems with staff coordination and characterize it as "haphazard."

The 1992 CALL analysis indicates that 68 percent of fire support missions are conducted without a clear understanding of commander's intent. The report from the CMTC is that the IPB was not conducted to standard because the S2 was the only one involved.

Castro, Hicks, Ervin, and Halpin (1992) applied ACCES to a division CPX. They reported that although the observed division staff was experienced, they had problems working together on course of action analysis.

Inadequate Commander involvement. Current doctrine establishes an unclear role for the commander. The commander performs his own Estimate separate from the staff's. To achieve an Estimate focused on the proper concerns, the commander should provide either clear staff guidance or be involved as the staff develops the Estimate.

Again several CALL observations (Appendix B) document the lack of commander involvement in the process. Observation #13 indicates that a Battalion Commander was not involved in the war gaming process. Observation #16 indicates the lack of a direct support Battalion Commander during war gaming and planning activities. Observation #14 notes that a Battalion Commander did not give a restated mission. CALL observation #2 expresses the concern that poor procedures and poor planning requires the commander to spend time making the fixes.

Metlay, Liebling, Silverstein, Halatyn, Zimberg, and Richter (1985) developed a coding scheme for describing command and staff behaviors. Videotapes of five battalion command groups were analyzed on both the first and last days of their CPX. In the ten exercises four of the ten commanders were judged to be only minimally involved in the process.

A CALL observer for an NTC rotation reported an opposite case where the Commander did nearly all the planning alone (CALL, 1990).

Poor management of the process. Since there is not unlimited time to plan and conduct military operations, they are constrained by time. To accomplish the required planning within

the available time and staff resources, planning needs to occur for scheduling planning actions. Whether a tailored or default schedule is followed, the conduct of the process must be orchestrated to insure that it is completed.

Thordsen, Galushka, Klein, Young, and Brezovic (1989) observed a battalion level CPX and did extensive content analysis on a selected five hour segment of planning. The planning session involved the selection and placement of obstacles. Thordsen et al. found that frequent transitions occurred between planning segments. For 12 goals that the planners worked on, there was only one that was worked straight through without interruption or switching to another goal. The researchers identified 64 major transitions between topics of discussion, indicating that the planners were switching topics about every five minutes. Nearly one-third of all transitions were prompted by out-of-context questions and statements. Less than 10 percent of the transitions were the result of deliberate and natural resolution to a segment.

> *"One implication of this finding is that in a group decision environment such as this one there is a great deal of accidental shifting from one focus to another. The person managing this process must be skilled in order to keep it from becoming chaotic. . . . There is a need for military planners to be trained in the management of the planning process. The management of the process is as critical as the actual planning itself."* (p 39)

CALL observation #10 (Appendix B) is related to the lack of control over the process. This observation identified a situation where the executive officer did not orchestrate the staff planning process. Other evidence of poor management comes from laboratory research (Lussier, Solick, & Keene, 1992).

> *"Most groups tested in our sample performed poorly in identifying subproblems and potential solution procedures, in developing alternate courses of action, and in time management."* (p 17)

Thordsen, Klein, Michel, and Sullivan (1991) observed a planning exercise at CGSOC. The primary purpose was to test a theory about "recognition primed decision making" and to use the findings to provide rapid feedback in the classroom. During the testing, they had several opportunities for insight into the conduct of the planning process.

> *"Time management: A lot of planning was taking place very close to deadlines. For example, they planned a counter attack where the key attacking force had to be moving within 30 minutes to have any chance of hitting the threat's flank. It is very easy to be overtaken by events when the planning cell is not looking far enough ahead. This can be tricky, because the natural inclination is to wait until you have all the information necessary to create a relatively risk free plan. . . ."* (p 13)

Fallesen, Carter, et al. observed that the teams in their course of action experiment had poor task organization skills. None of the team members had worked together as pairs in similar roles before. Yet nine of the 14 teams made no conscious effort to organize and coordinate work.

Summary. Although these are selected instances out of many cases, they indicate that problems occur with all aspects of management and conduct of the process. There is strong

evidence that the Estimate process as described in training and doctrinal materials typically is not followed closely. There are independent sources that join to indicate the need for abbreviated and tailored procedures to match time available, mission changes, and other situational changes. There are multiple indications that the procedures that are used are not managed well. Reasons are probably inflexible procedures and the lack of management.

The next sections will discuss in depth problems with other aspects of the Estimate and planning process. The final review section will address what affect these problems have on outcomes and force success.

Information Exchange

Communications are a vital part of the command and staff process. Communications occur to manage the conduct of the work, to exchange battlefield information, and to sustain morale.

Failure to exchange information. Monitoring and coordination require the exchange of information. The collection, analysis, distribution, and management of information are continuous staff requirements. Formal information requirements are established according to a commander's preferred style, the mission, and the situation.

Kaplan (1980) conducted a study on the rates of staff information exchange and recall. In a battalion CPX, he asked experts to identify critical information elements. The CPX training audience was tested on recall of the information after the exercise. All critical information was actually handled by one or more staff personnel. Testing the training audience allowed the determination of who had received and recalled the information. The battalion as a whole remembered 81 percent of the information sampled. They recalled only 63 percent of information received from other battalion staff members. The six lowest communication dyads transmitted from 17 to 37 percent of the information. Although there are no standards of what an acceptable level of information exchange is, 19 percent of *significant* information not recalled is arguably too poor. Such a proportion would very likely lead to critical failures.

Thordsen, Galushka, Klein, Young, and Brezovic (1989) observed a battalion level CPX and did extensive content analysis on a selected five hour segment of planning. The planning session involved the selection and placement of obstacles. The planners did not actively seek information that they needed. Ninety-three percent of the information was from only three sources that were in the same area as the planners. Out of 164 items of information dealt with by the planners, only 31 percent of the information was sought actively. The planners did not use information from the S2 although they repeatedly stated that they needed more enemy intelligence.

NTC observations (Appendix C) indicate that once S2s receive information there is little sharing. Intelligence reporting in particular is often inaccurate, incomplete, and untimely.

Castro et al. found that C2 deteriorated as the exercise progressed because of late or incomplete friendly and enemy status reports.

Failure to present plans to commander. The tactical decision making process requires the presentation of courses of action and plans to the commander. Metlay et al. found that formal plans were not presented to the commander for approval in any of the 10 CPXs that they studied.

Failure to communicate interpretations. Incompleteness of information is another aspect of communications problems. Exchange of information can be considered faulty if the information has not been adequately aggregated or interpreted

Metlay et al. found that during situation briefings only 43 percent of the briefers (33 of 76) made any kind of inferences about information being briefed and only 8 percent (6 of 76) presented conclusions.

Kristiansen (D. Kristiansen, personal communication, May 1988) observed a CPX and

reported the following about the failure to present interpretations of briefed information,

> *"The Commander was constantly asking questions about 'what does this mean for us, what can I do about that, what do you mean by that?' For example, at one point the commander was told that [the] Corps would run out of tank main gun ammo in 1.5 days. The briefer then started to go on to a new point. The commander stopped and asked him who in [the] Corps would run out, where were they, what could he do to get some ammo to them, could he 'rob Peter to pay Paul'. No one had answers. It was as though their job was to report the information, not analyze it and come up with alternatives."* (p 1)

Keene, Michel, and Spiegel (1990) reviewed data across seven applications of the ACCES method. They reported that scores for understanding completeness and prediction completeness were relatively low. This was interpreted to mean that the understandings and predictions were not completely or fully briefed. The absence of conclusions and statements of what information means at briefings also would suggest that the interpretations may not be made.

Summary. There are clearly instances were information exchange falls below desirable levels. Staffs must perform a balancing act to communicate completely, yet not overwhelm the commander and each other with excessive information. One strategy for efficient communication is to avoid presenting all the facts and instead provide interpretations and conclusions. This is addressed in more detail in the next section on situation assessment.

Situation Assessment

Michel and Riedel investigated information usage during the development of tactical concepts. They found a general sequence of information usage to develop an understanding.

> *"The typical participant first looked at the mission requirements and commander's guidance plus the status of his own forces. He then studied the terrain and the enemy forces. He then went back to look at supporting data, taking them in order, beginning with personnel. Finally, he returned to the operations and/or intelligence data to confirm information important to the concept he was developing."* (p 23)

The pattern of information illustrates a macro-level of processing for situation assessment. In the Michel and Riedel experiment patterns of information use were identified. The patterns imply preferences for how planners might build an understanding of the problem they are to solve. Tactical understandings are loaded with implied assessments and uncertainties.

People naturally feel more comfortable dealing with what they know, than with making inferences beyond what the data or facts indicate. Even making a classification of an observed event can have a good deal of uncertainty associated with it. However, for military operations, assessments and inferences are a critical requirement. Military forces cannot wait until actual events indicate what the enemy intends to do. Military analysts are trained to assess information and make inferences about intent. Because of the lack of certainty and deliberate deception on the part of opposing sides, interpretations hold the possibility for errors. An objective, analytic method imposes caution and the avoidance of "jumping to conclusions" or over generalizing. But as the following research indicates the greater errors may occur when interpretations and predictions are avoided altogether.

Failure to consider factors. Failure to consider the correct facts and factors and failure to consider them in sufficient detail are likely causes for failure in outcomes. Factors are considered to include categories of tactical information such as logistics, terrain, combat power, deception, and deep attack.

Krumm, Robins and Ryan (1973) did some exploratory research to determine predictor variables for tactical decision performance. Test participants had to write a defense plan for a division sector against an expected enemy attack. Krumm et al. found that four predictors correlated highly with a standard solution developed by CGSC instructors. The predictors were experience, ability, process pattern, and facts. Experience consisted of the recency of attendance at the staff college, length of time in mechanized units, and number of exercises. Ability was a combination of staff college class standing and the college's rating of expression ability. Process pattern related to the sequence, frequency, and speed of information use. Significant facts were the number of facts that were defined to distinguish between the best and worst performers. Krumm et al. confirmed that the usage of facts has a significant relationship to tactical planning. A nonlinear relationship was found between the total significant facts possessed. Officers with low numbers of facts and those with considerable numbers scored significantly lower than officers with moderate size data bases. High scorers were in the range of 80-90 facts.

Fallesen, Carter, et al., studied course of action analysis and had doctrinal subject matter experts identify the appropriate facts required in a division planning problem. The experiment participants did not identify 78 percent of the expert-identified facts. The overlooked facts included adjacent unit actions, missions, and timing; changes in boundaries; enemy main and

secondary efforts; terrain restrictions; cross country mobility; engineer capabilities (bridging); and standard logistical loads. This oversight appears to be quite large. The more telling finding was that the participants who did not attend to the enemy second echelon and bridging assets were also those who did not select the correct option. Also the teams scored only an average of 54 percent correct on a situation awareness test, meaning that almost half of what was deemed as important about the situation was not recalled.

Additional research on situational factors indicates there is incomplete consideration of the enemy (Shaw and Powell, 1989), that enemy doctrine is neglected (Appendix B), and that enemy capabilities are underestimated (Castro et al.).

Failure to verify assumptions. Assumptions are used to replace necessary but missing facts or facts that are likely to change because of future changes.

Fallesen and Michel found that the staff was uncertain about assumptions, but they made no explicit plans to resolve the uncertainty.

> *"The Corps commanding general (CG) and other players sometimes challenged whether assumptions were true. Typically this was left as a rhetorical question without follow-up action to reach closure (for example, establishing a priority information requirement [PIR]) or any special contingency planning. Challenging an assumption is worthwhile only if it leads to further consideration about other possible actions or identification of an option which is robust to multiple (and possibly opposing) assumptions."* (p 5)

It would have also been appropriate for the staff to identify and track special information. Shaw and Powell noted in the division they observed there was a failure to plan deliberate observation of enemy reactions. In a study of confirmation bias, Tolcott, Marvin, and Lehner (1989) found that more experienced intelligence analysts predicted events that would confirm expectations.

Failure to assess information quality. The quality of tactical information is not assured. Part of the routine processing of information should judge the quality and consistency of information.

Shaw and Powell noted that lack of consideration was given to the quality of the information with which the staff dealt.

Failure to interpret information. Doctrine requires that the staff is to keep the commander informed, but to avoid burdening him with information. The staff should serve the commander by analyzing details and communicating the essential information, conclusions, and recommendations. This is to be done as often as necessary to keep up with the developing situation.

Gieselman and Samet (1980) performed an experiment to develop guidelines for summarizing tactical intelligence data. They had Army officers read a description of a tactical scenario about a border crossing and attack. The participants produced a summary of the activity and intent. The summaries were evaluated by five knowledgeable military analysts. Summaries that were rated poor also integrated information poorly. The experimenters concluded that situation understanding is not just reporting what something is, but identifying what it means.

Brezovic, Klein, and Thordsen (1990) found the Armored Platoon leader students were unable to imagine hypothetical situations, such as enemy actions and relationships between friendly and enemy tactics.

As indicated above in Information Exchange, there are several reports of briefers failing to report interpretations (D. Kristiansen personal communication; Metlay et al.) These are likely to be cases not just where interpretations were not being briefed but where the interpretations were not made. Appropriate proportions are not known for what the optimal percentages of understanding declarations should be. Adequate interpretations should arguably be near 100 percent in providing inferences and conclusions rather than 41 and 8 percent, respectively (as found by Metlay et al.).

Failure to make predictions. Beyond interpretations of what the information means, commanders and staffs need to make predictions. Doctrine requires predicting what may occur as part of the planning process.

In the CGSOC WFX, there was greater concentration on execution and action, than on making predictions for the future and determining what planning and preparations were needed based on those predictions (Fallesen and Michel). Castro et al. also report that the division headquarters that they observed frequently did not predict enemy reactions nor estimate the probability of mission accomplishment.

Fallesen, Carter, et al. also observed errors when predictions were made. Eight teams made estimates about primary equipment losses. Seven of the eight differed from the experts in concluding that the advantage favored one course of action over the other. Fallesen, Carter, et al. concluded, based on direct observation and the planners own reports, that planners do not have any good basis on which to make predictions.

> *"War gaming and comparison were the most difficult steps in the experimental task. Participants generally lacked the knowledge and experience to make battle projections. They reported that neither doctrine or instruction provides adequate guidance for making war gaming projections. Many of the necessary data bases are lacking, especially in the area of attrition. More comprehensive data bases are available for measures associated with time and distance of movement, but there is often little time for planners to access and assimilate this information manually to allow application to the current situation."* (p 88)

Participants' average confidence rating in their estimates was "not very confident" (represented as a 2 on a 5 point scale of confidence).

The 1992 CALL summary of NTC observations (Appendix C) reported a tendency by the S2s for broad, general descriptions of the threat that offer no real contribution to mission analysis and course of action development. Across about 20 BCTP war fighter exercises (Appendix D), 75 percent of the units did not make correct predictions of the outcome of close operations.

Summary. Fallesen, Carter, et al. found an indication that a better understanding of the situation did lead to selection of a better course of action. Failures to consider facts, verify information, interpret information, and make predictions are common.

These failures might be speculated to occur because of the complex nature of the task, the indeterminate nature of goal and outcome states, and the uncertainty surrounding battlefield information. People do not like to be wrong, so they avoid making predictions about uncertain futures. As they project further and further into the future, they realize that assumptions and predictions are less and less certain. They might try avoiding making predictions altogether.

Formulation of Alternatives

Traditional decision making theory deals with picking an option that maximizes outcome while minimizing costs. Naturalistic decision making focuses on selecting a feasible option that satisfies important criteria. If the options are not already identified or are not fixed, then, under either theory, the formulation process is fundamental. In tactical operations, options are seldom fixed and static. Concept of operations and scheme of maneuver may be configured in bounded ways, but the purpose of the mission and the desired end state will usually vary from one situation to another. Actions must be carefully considered to have a chance of attaining the force's goals. The construction of a concept to meet the mission requirements is one of the most important aspects of the command and staff process.

Failure to track concepts. In most tactical operations many different plans and variations in plans are possible. A common oversight is to fail to record or track what was considered. Recall is problematical in these operational environments. To need to remember the nuances of a concept that might have been considered two days before with little sleep and enormous numbers of events intervening is too much to expect. Concepts should be recorded because the staff may want to verify that certain concepts were considered but found to be infeasible or because the concept may become feasible at some later time. Record keeping of possible actions and other considerations is not done well.

> *"The staffs discussed many different concepts, but there was no systematic way of recording or tracking what was considered--for what plan, for what set of assumptions, for what phase or time period, etc. On one occasion, plans were discussed at the Corps main situation map (during a Corps CG's huddle with primary staff officers and commanders), but there was no one responsible for capturing (in hard copy form) what was said. For the planners who would eventually work the concept in detail there was no good means of documenting this command information. No representative from Corps plans was present."* (Fallesen & Michel, p 7)

At battalion level similar problems have been observed (Appendix B). CALL observation #23 reports that many war gaming options were not recorded and were later lost. Observation #24 also indicates that options were not recorded.

Generation of single alternatives. The tactical decision making model of the Estimate process indicates that multiple options should be generated, and that options should be distinct from one another. Findings have shown that multiple options are often not generated, and that the options are not always unique. When three courses of action are produced, they are sometimes called the "best," the "look-alike," and the "throw-away." These findings indicate failures when compared to doctrine. However, a better process or a better result may be generated when the same time used for considering multiple options is used to more thoroughly consider and plan a single option.

Thordsen et al. (1989) analyzed a battalion level obstacle planning situation and found that most decisions involved automatic or serial consideration of options. Klein (1989) calls this behavior recognition primed decision making (RPD). Twenty-six out of twenty-seven decision situations were classified as RPD. They concluded that multiple options were not considered as a matter of course nor were they compelled to conform to the traditional decision analytic model. Planners considered alternatives out of necessity if the first alternative proved infeasible.

At an NTC rotation (Appendix B) it was observed that only one course of action was developed. At a more recent NTC rotation, a CALL observer found that two options were considered in the first two missions, and a single option considered in the third mission (CALL, 1990). Only one **feasible** course of action was considered in each mission.

Powell and Schmidt (1989) were interested in identifying a model to characterize the high-level control that expert planners exert over their process. They had two Colonels who were students at the Army War College assume the roles of Corps Commander and G3 to develop a plan. They found that at most the experts developed two alternative plans, with the second a revision to the first. The students were aware that by developing a second course of action similar to the first they were violating guidance given to them.

Geva found from his analysis of the Yom Kippur War that more than one alternative was generated, but the first one raised was adopted as the decision. Michel and Riedel also found that the selected course of action was the initial one developed in all the cases they observed.

Lussier, Solick, and Keene (1992) did several experiments with group problem solving for the Combined Arms Services Staff School (CAS3). They developed an evaluation and training problem called VARWARS. Though not tactical in nature, it involves interdependent actions by separate teams (Lussier, 1990). In one of the early experiments they found

> *"Neither entrants nor graduates followed the [problem solving] method taught, as only one group proposed more than one adequate alternative, and that group failed to complete the process by analyzing both alternatives. The primary process of problem solving employed by both types of groups was to develop a single solution, modifying it as necessary and rejecting it only if it became completely unworkable."* (p 10)

Castro et al. found that a single course of action was considered in three of seven planning cycles at division main and the other four planning cycles each had only two courses of action considered.

Thordsen et al. speculate that generating and evaluating a single course of action is a more natural process and is preferred in many different decision situations that they have studied. When multiple options are generated by staffs, it appears that the staffs sometimes do not believe that producing multiple options is beneficial. The effort that goes into concepts that are never seriously considered is wasted and compounds the problem of completing the Estimate on time.

Inadequate concepts and contingencies. At least one concept has to be good enough to use as the basis for more detailed planning. Concepts generated in BCTP exercises have been characterized as unimaginative and incomplete. Contingency plans are especially important when there is uncertainty or current concepts are vague or risky, but contingency planning is often forgotten or ignored. The studies cited here provide support for the informal observations about concepts.

Castro et al. found that nearly 40 percent (9 of 23) of courses of action were incompletely specified. Consideration of mission accomplishment and enemy reaction were elements most frequently missing from the course of action. CALL observation #21 (Appendix B) reports that staffs have trouble with planning fires, placing obstacles in depth, sighting obstacles, and use of terrain.

The 1992 CALL summary on Brigade and below operations (Appendix C) indicated that maneuver commanders hesitate to use forces at their disposal to weight the main effort. Air defense did not achieve commander's intent 62 percent of the time, and 68 percent of the fire support missions were conducted without a clear understanding of the maneuver commander's intent.

Doctrine describes planning as the preparation for all reasonable contingencies. Contingency plans can be alternate courses of action prepared in advance to address different possible events. Although there is a doctrinal requirement to plan and prepare for contingencies, frequently this is not done. No branches or sequels for contingency planning were considered in one specially observed NTC rotation (CALL, 1990). CALL observation #25 (Appendix B) records that detailed contingency planning was needed. Seventy-five percent of the division and corps undergoing war fighter exercises (Appendix D) did not develop sequels. Fifty-three percent of the units did not use IPB products to develop contingency plans.

Fallesen and Michel found that the lack of contingency planning was a sign of failure to make plans more robust considering the lack of certainty about enemy intentions. The lack of forward-looking contingency plans in turn caused frequent changes in current plans. The reactive nature of operations kept planning cycles from being established across echelons.

Serfaty, Entin, MacMillan, and Deckert (1990) hypothesized that contingency planning will not occur if surprises are not expected nor will it occur if the uncertainty is too large. With large uncertainties the alternatives are too many and the typical strategy is to wait to see what will happen.

Summary. Findings show that multiple alternatives are not always considered. Following a naturalistic or satisficing model may allow arriving at a plan more quickly and one that is as effective or robust for the given mission requirements. Regardless of the number of alternatives what is more important is that concepts are often weak and incomplete. The concepts are not always tracked purposefully, hindering them from being easily retrieved and used as contingency plans.

Evaluation and Comparison of Alternatives

Doctrine indicates that the decision about courses of action is made during the Commander's Estimate based on feasible courses of action and recommendations presented in the staff's Estimate. Doctrine on the Estimate process does not constrain how the selection is made other than to say that the Commander uses his judgment. Training materials indicate that the analysis of courses of action is done by war gaming. Several recommendations are made about war gaming. The analyst should (a) remain unbiased, (b) assess the feasibility of the course of action, (c) avoid comparing one course of action with another (during war gaming), and (d) not make premature decisions. War gaming results from each course of action are then compared. The training materials indicate that any technique can be used that allows a recommendation to be made. Decision matrices are one suggested technique for the comparisons. The issues with war gaming and comparison of alternatives overlap.

Failure to evaluate. One possible error is the failure to do any kind of evaluation or assessment, even when there is only a single course of action. Training materials require that concepts or courses of action be continuously considered for feasibility. One explanation for failing to evaluate is the assumption that what is planned will be executed by the subordinate forces and what is executed will succeed. A success orientation can be taken to extremes and lead to unwise decisions.

Fallesen and Michel noticed there was a tendency to assume success for what friendly forces were planning to do and that the enemy was going to do exactly what was assumed. The assumption of success was probably unwarranted given the failure to make estimates, predictions, and contingency plans and the eventual difficulty in accomplishing their mission.

> *"The students gave very little thought to how the initial plans could go wrong. They were never observed considering branches in either enemy actions or their own actions."* (p 5)

Shaw and Powell also observed this at a division's field exercise. They found that the unit did not address their own probability of success. Castro et al. reported an identical finding for a different division exercise. And more generally, Lussier et al. (1992) found that the problem solvers did not check for errors.

Serial evaluation of options. Training currently directs that options be compared concurrently after each has been war gamed individually. Options cannot be compared unless multiple options are generated (see above regarding failures to generate multiple options). Options cannot be compared concurrently unless they are all generated before any single option is evaluated. Indications of failure to compare options concurrently are presented, but there is considerable question whether concurrent option comparison as recommended by doctrine is universally applicable.

Thordsen et al. (1989) found that besides 96 percent of the decisions being generated serially there was no concurrent deliberation. None of the following types of comparison strategies were used: multi-attribute weighing of options, decision analysis, or Bayesian strategies.

Brezovic, Klein, and Thordsen (1990) studied armored platoon leader training and identified 57 decision points. The students were found to deliberate during option selection in about half of the decision situations.

Thordsen et al. (1991) report what is used in place of concurrent comparison of options,

> *"We found the planners tended to employ a process where they would evaluate an option or idea by gradually examining deeper and deeper branches of the idea for workability. Eventually they reach a point where the idea is either accepted, rejected or left hanging due to some distraction. If it is rejected the decision maker either moves on to a totally different option or idea or goes back up the deepening chain to a point (theoretically) above the source of the flaw and then follows another branch."* (p 2)

Concurrent comparison of options did not take place in the classroom exercise.

Geva also found this true in actual combat situations. In only one instance across three settings were alternatives ever compared before deciding.

> *"In all other cases, the first raised alternative was adopted as the decision. Other alternatives emerged subsequently, either when the original alternative was reported or perceived unfeasible."* (p 32)

In a case where alternatives were given to planners, Fallesen, Carter, et al. found that all four of the teams who were not required to follow structured procedures tried to compare options concurrently. The comparisons were not as formalized as in the structured cases. The planners made comparisons repeatedly throughout their analysis process and compared different features and attributes. It was as if they were searching for the critical features or attributes on which the comparisons would show a difference. Lussier, Solick, and Keene (1992) also found that their VARWARS problem solvers had trouble identifying and using comparison criteria.

Fallesen, Carter, et al. reported on some of the problems of using the doctrinally prescribed decision analytic method of comparison.

> *"Procedures for comparison of COAs were based on a linear model that generated aggregate scores for both objective and subjective factors (Steps 8 and 9). The utility of such a model should be questioned. The river crossing operation for COA N is an example of how the interaction effect of many factors can be a key factor in the decision. The factors of terrain (a river), environment (night), friendly operations (a river crossing), and enemy considerations (a dug-in defensive position) combined to create a difficult and complex operation. The complexity of this situation makes it that much harder to predict battle outcomes. And once quantitative projections were made, it was easy for the predictions of a single event to get "washed out" when it was rolled up with other events to produce an aggregate score.*
>
> *"Using a decision analytic approach, as complicated as a weighted, multi-attribute utility matrix or as simple as summary columns of pluses and minuses, can be misleading for complex, dynamic tactical problems."* (p 86-87)

In a naturalistic process, options do not have to be evaluated individually and then compared concurrently. Individual evaluation and concurrent comparison of options may not allow the planner the flexibility to address the most important aspects of the problem in the most efficient process. Using a satisficing or planning model, the commander and staff have greater latitude to focus on the most important aspects of the problem. Their experience should

lead them to assess the appropriate parameters carefully and thoroughly.

Reaching early decisions. Training materials (CGSC ST 100-9) assert that arriving at premature conclusions is undesirable. The following studies involve the extent that decisions were made before the completion of options, independent evaluations on each option, and finally the comparison and selection among options. The studies address the frequency that early decisions occur and how the process and quality of the decision may be impacted.

Tolcott, Marvin, and Lehner (1989) had military analysts predict the most likely enemy avenue of approach. The analysts were given additional information and were asked to reconsider and update their prediction.

> *"Regardless of the initial hypothesis, confidence was generally high and tended to increase as the situation evolved. Confirming evidence was sought, and was weighted significantly higher than disconfirming information. Contradictory evidence was usually recognized as disconfirming, but was weighted lower than supportive evidence, was often regarded as neutral, and sometimes as deliberately deceptive. . . . base rates were largely ignored in dealing with uncertainties. Analysts appeared to model the situation based on early information, and to account for new information in terms of consistency with this model."* (p 606)

Tolcott et al. found that commitment to a prediction persisted even in the face of conflicting information.

Fallesen, Carter, et al. found that early judgments about the adequacy and relative effectiveness of courses of action did not affect the outcome (see Figure 2).

> *"At least one member in each of the ten teams following structured steps came to a conclusion before comparison of COAs (step 8)* [see the line labeled "Start of step 8 per instructions" in Figure 2]. *Also at least one member of five of these teams (SA03, CB02, CA05, CB10, CB14) switched conclusions before their final decision. Four of these five teams switched to the correct COA and one team (CB10) to [the incorrect] COA.*
>
> *"There was no significant correlation between a team's justification ranking and the percentage of elapsed time for a decision (Spearman's correlation = .29, $\hat{\alpha}$=.16).*
>
> *"These results indicate that reaching an early conclusion does not impair the ability to make a correct conclusion. Also there did not appear to be any primacy bias; participants changed their mind for the better in 4 out of 5 cases."* (p 54)

In the most systematic study of concurrent option comparison, Lussier (1992) conducted a series of experiments and reported the following.

> *"Problem solving groups were induced to use one of three methods: concurrent option comparison, the naturalistic process, and an 'Early Decision' method characterized by striving to quickly select a candidate solution. Researchers wanted to discover whether groups could be induced to use the doctrinal concurrent comparison method in VARWARS and if its use would promote better solutions.*

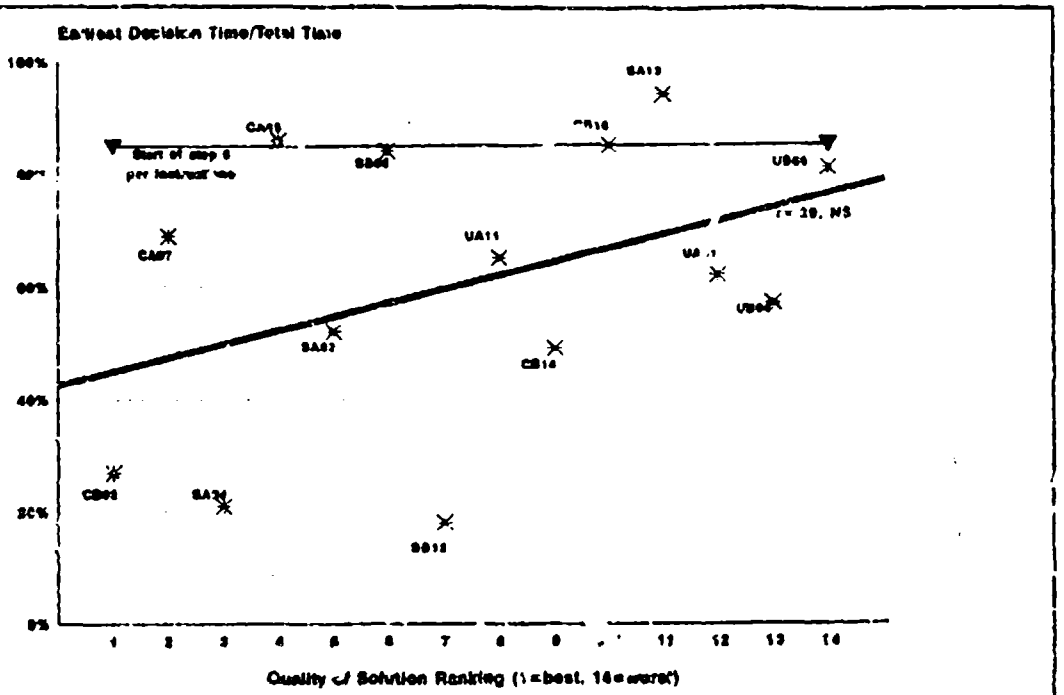

Figure 2. Percent of time for teams to reach initial COA preference.
(Adapted from Fallesen et al., 1997.)

"Experiment 1 showed that the likelihood of using the concurrent method could be increased somewhat but that this did not improve solution quality. In Experiment 2 the Early Decision method was found to produce much better solutions than either the naturalistic or concurrent problem solving methods. Situations that may favor use of the Early Decision method are those involving 'planning' problems in which the solutions are fairly detailed or complex plans of action, as opposed to 'decision-making' problems in which the options are generally easily specifiable. Use of the Early Decision method should also be favored in situations where errors play a significant role in determining the outcome, such as when planning and problem solving tasks are distributed among team members. When there is a desire to limit problem solving time and effort, then Early Decision may also be a good choice." (p vii-viii)

Lussier showed that for the VARWARS resource allocation problem that an early decision method is better than naturalistic or concurrent option generation. His findings emphasize what is too often overlooked in discussions of tactical decision making: the selection of an option is not the end of the task, but the beginning of more detailed planning when further deliberations are made. The solution concept is not the end, detailed planning and refinement of the plan must follow to make it work. He points out that concurrent comparison of options is appropriate for some types of problems and for some situations, but cautions that it should not be applied to all situations regardless of available time, certainty, and risk.

Making early decisions about courses of action are contrary to a formal, analytical process, but making decisions early has been shown not to impact solutions adversely in one study and to promote better solutions in another.

On the other hand making predictions about enemy actions have been subject to a primacy bias. These opposing findings may be due to the differences between tasks. There may be more self-doubt about decisions that involve predictions of opposing force actions than about selection of own courses of action. When determining own actions, planners are likely to feel that they have the chance of success with various options (all courses of action are supposed to be feasible ones).

Common sense should prevail in planning tasks when it is not natural to defer conclusions to some arbitrary time or step. Withholding judgment in a judgmental task is paradoxical. This is not the same as keeping an open mind about different possible futures.

Inadequate war gaming. War gaming is used to refer to visualizing tactical events, determining what will occur, what the reactions by the enemy are likely to be, and what counteractions are open to own forces. In general, war gaming involves predictions about the occurrence and outcome of actions. Doctrinal training materials describe three primary techniques for war gaming: the box, belt, and avenue-in-depth approaches. These techniques basically partition the spatial aspect of a battlefield, directing attention to smaller and possibly better understood events. The critical event (pre-event, event, and consolidation) approach advocates the recording of outcomes (these could be in quantities of battle losses, logistics consumption, time duration, etc.). Problems with war gaming are reported in the following research summaries.

One problem with war gaming is not doing it. Burkette reports that the division staff, in his study, displayed little evidence of war gaming courses of action against enemy capabilities. NTC observation #26 (Appendix B) indicated there was very little war gaming, and the observations from another NTC rotation (CALL, 1990) indicated there was no observable process of war gaming.

In the CGSC exercise with divisions and corps, Fallesen and Michel reported that

> *"There was very little detailed war gaming. War gaming did not involve quantitative estimates of relative combat power, identification of critical events, and projection of engagement results. Only one instance of a war gaming technique (avenue-in-depth) was observed and this was general in nature. Other planning involved g consideration of actions but not any in-depth consideration of results from those ."* (p 9)

Another problem with war gaming is the failure to see the battle from the enemy's perspective. The 1992 CALL analysis (Appendix C) indicated that S2s rarely play the enemy during war gaming and that staffs doing war gaming did not foresee events into the future or in sufficient detail.

In another case, Fallesen and Michel reported a problem using war gaming methods that were not comparable.

> *"At Corps, two teams were used each to complete a synchronization matrix on one concept with the purpose, in part, to further consider which was the better COA. The two teams did not coordinate in advance how each one would do the matrix, so while one team was doing synchronization at [projections of battle events for] 4 hour intervals, the other was doing it at 12 hour intervals. One started at H hour, the other started about H-24 hours. Where the two efforts ended up for comparison was not observed,*

but the mismatches of different bases of comparison is evident." (p 6)

Summary. Research indicates that two doctrinally based recommendations for evaluation and comparison of courses of action may not be appropriate. The two recommendations are to avoid making premature conclusions and performing a concurrent comparison of options. Reaching early decisions and using satisficing techniques or serial evaluation have been shown to provide equal or better results. Faster, more direct, and more thoroughly-considered decisions are possible. Failing to evaluate the concepts critically is a real problem caused by overconfidence, a success orientation, or failure to war game.

Planning and Synchronization

Depending on the procedures used, time available, and certainty, the plan may or may not be well defined when a decision for a course of action is made. In either case more detailed planning usually continues, including synchronization of forces in time and space and the eventual dissemination of orders. Planning incompleteness, effectiveness of plans, and synchronization are of interest in this section.

Keene, Michel, and Spiegel found that across the seven applications of ACCES that were reviewed, plans had two good characteristics. Plans were consistent with commander's intent and resilient to monitoring errors. (Monitoring errors were high in own force and enemy units' location and status.)

Incomplete planning. The dynamics and time constraints under which tactical planning is typically done are at odds with having thoroughly formulated plans. Indications of incomplete planning are presented in this section.

CALL observation #28 (Appendix B) reports that plans were ever-changing partial solutions. Burkette also reports that the division he observed never finished a planning cycle and therefore suffered from incomplete synchronization.

Other instances of poor synchronization have been documented as CALL observation #30 (Appendix B). This indicated that full synchronization was not achieved. Observation #29 indicated that the unit did not have a technique for synchronization of the seven battlefield operating systems.

Poor planning. The ACCES method defines plan quality as the extent to which plan elements remain in effect unchanged for the intended period of the plan (Keene et al.). Of the ACCES scores reviewed by Keene et al., the average plan quality for six divisions was 72 percent with scores ranging from 40 to 98 percent. On the average 28 percent of plan elements (missions, assets, boundaries, and schedules) were changed or abandoned before their intended duration. Plan quality was later changed in ACCES to be called planning effectiveness. A more recent application of ACCES (Castro et al.) showed planning effectiveness to be 59 percent (19 of 32 plan elements remained in effect). The most frequent element requiring change was task organizations. The change was caused by needing to increase the combat power against stronger-than-anticipated enemy forces. Also elements were changed when reserve movement was hampered by obstacles, destroyed bridges, and congestion.

Problems with plans are not unique to maneuver systems. The 1992 summary on brigade and below units (Appendix C) indicated that 73 percent of reconnaissance and surveillance plans were uncoordinated, unmanaged, and unfocused. Seventy percent of the fire support plans did not support the commander's scheme of maneuver. Planning was ineffective for FASCAM, FARP, CSS, and field artillery support. Faulty evacuation plans lead to 21 percent of the simulated casualties dying because of their wounds. Plans did not synchronize maneuver breach operations and integration of obstacles into engagement areas.

Earlier CALL observations (Appendix B) also showed poor planning. The ALLMIS records indicate there was poor mobility/counter-mobility/survivability (M/CM/S) planning in a battalion exercise, that deception was not considered, and that poor reconstitution planning occurred during a BCTP exercise.

Summary. The 1992 summary of BCTP lessons learned (Appendix D) indicated that 64 percent of the units had plans that were unsatisfactory. Seventy-six percent of the staffs did not develop viable plans. Poor plans are caused by incomplete consideration of battlefield operating systems, poor use of combat power, and inadequate synchronization.

Enacting Plans and Monitoring

Once plans are completed, they should be communicated as either operations plans or as operations orders. Because of the excessive time typically required to plan, orders can be produced later than needed. Also there can be difficulty in providing orders to subordinates. Monitoring is comparable to situation assessment but is included here as a separate function. Monitoring is more focused on determining whether a specific operation is going according to prediction and plan. Monitoring is done to gauge the progress of the operation and to control it.

Poor orders dissemination. Orders dissemination has been a problem cited in two different training environments. CALL observation #33 (Appendix B) indicates that orders information was incompletely distributed during a joint readiness training center (JRTC) rotation. Castro et al. reported that only 20 percent of the orders that a division headquarters issued were timely enough to allow full implementation. Seventy-eight percent of the division- and corps-disseminated orders were not technically correct (Appendix D). FRAGO's were incorrect in 73 percent of the division and corps units.

Failure to track the battlefield. The 1992 analysis of NTC, JRTC, and CMTC trends reported that 59 percent of brigade, battalion task forces, and company/teams did not track the battle quickly and accurately. The failure to do so created conditions for fratricide and being unaware of available combat power.

Summary. Orders at division are typically not technically correct. There are some indications that they are not completely distributed or are distributed too late. At lower echelons, units do not closely monitor the battle, causing the conditions for fratricide and unsynchronized application of combat power.

Individual Differences

Individual differences make up an important area of psychology. Individual difference research explicitly recognizes that humans are individuals with characteristics that make them different from one another. Individual differences may or may not affect competence or performance outcomes. Individual differences may affect processes such as using graphical over textual information or analyzing information from a global or detailed viewpoint. Individual differences may have no affect on either performance outcomes or processes but may be exhibited as differences in preferences, values, or attitudes. Experiential-related individual differences can include factors such as age, rank, educational background, and career choice. Other individual differences have to do with personality, cognitive abilities, and any other characteristic used to differentiate among people.

Individual differences are of concern to organizations which develop and deliver instruction (Ragan et al., 1979). There has also been consideration of individual styles and preferences to make decision aids adaptive to the styles, capabilities, and preferences of its users (Rouse, 1988). Although individual differences are often of interest in educational and aiding applications, the use of individual differences has been problematical because of the lack of an ability to gauge and accommodate differences. A pedagogy that is based on similarities in knowledge and performance objectives is usually preferred to one based on accommodating differences.

Individual difference studies are difficult to do because (a) they typically require large samples to determine trends on uncertain (exploratory), variable, and interactive attributes and (b) there is only a small portion of performance variability that is explained. Even though the implementation of knowledge of individual differences is not straightforward, individual differences remain a critical aspect of a fuller understanding of tactical planning behavior.

Differences in expertise. Military tactical expertise is of interest for understanding how to develop junior officers into future high performing commanders. An individual difference approach suggests there are measurable differences in levels of expertise. The differences may be in the knowledge, the styles of using information, or special reasoning abilities for seeing relationships that are unapparent to others.

MacMillan, Entin, and Serfaty (in press) had three super experts rate 26 military officers' performance on tactical planning tasks. Two domain-inexperienced observers also coded various behaviors proposed to distinguish the quality of planning performance. Correlations were used to associate the observers' coding of behaviors with the super experts ratings of expertise. In comparison to less expert performers, the experts

- Generated more detailed courses of action.
- Focused immediately on critical unknowns.
- Better understood the complexity of the situation.
- Better understood the sequencing of events.
- Had more concern about outcome risks.
- Identified more potential problems.
- Anticipated changes in the tactical situation.
- Planned contingency operations.

Although these results are preliminary, they are important because they illustrate that

differences determined by super experts can be seen by novices who follow specific methods of observation.

Differences by rank. Examination of differences in rank allows a contrast on an easily measured difference. Such contrasts also contribute to the potential of defining expertise.

Andriole, Black, Hopple, and Thompson (1987) reported a study with colonels and lieutenant colonels. Three colonels worked together as a group to develop plans for a corps operation. Three lieutenant colonels then repeated the task. Andriole et al. reported that the colonels were more risk averse than the lieutenant colonels. The colonels had more certainty about enemy intentions, and they were more deliberate. They were more devoted to doctrine, but they had less confidence in their solutions. Lieutenant colonels were less likely to look for how their tactical concepts could go wrong, which may explain their greater confidence. (Note that Andriole et al. do not present quantitative data and make no statement about the statistical or practical significance of the apparent differences.)

Michel and Riedel (1988) found that instructors who also happened to be of higher rank (namely, lieutenant colonel) than students (majors) used information in different patterns, but there was no differential effect on performance outcome. Instructors and students had to analyze tactical information and to generate a concept of operations for division level offensive and defensive scenarios. Michel and Riedel also found there was no relationship between an instrument measuring global-analytic functioning (as measured by the Embedded Figures Test) and patterns of information usage. Michel and Riedel report there were large qualitative differences in how the problem was approached, but these differences did not alter the quality of the tactical concepts.

Differences by military - students. A contrast of military and student test participants also has implications for expertise. College students do not have the same experience or training and are typically younger than military officers. Students might be considered a pure instance of the novice category of military expertise. Several studies looked at the differences between Army officers and college students.

Hamm (1991) found no difference between college students and military officers in their judgments of relative importance. They had similar estimates of the importance of various facts in a helicopter crash problem. On the average the students estimated that the probability of success was higher than what the officers estimated. The difference was attributed to incidental training that the officers receive on considering what might go wrong.

Badre (1979) presented maps with tactical symbols to individual military officers and college students. Military officers represented experts and the students novices. The ability to recall unit type, color (used to code enemy and friendly units), and location was measured. Units were either placed in structured, semi-structured, or unstructured patterns. Badre found no significant differences in recall between the two groups. His findings differ with the famous Chase and Simon (1973) findings that reported that chess experts and novices differ in how they deal with patterns of chess pieces. Badre's work suggests that patterns of military symbols are sufficiently straight forward not to depend on domain-specific instruction. The tactical patterns and symbols themselves must contain inherent meaning that is easy to classify into categories, before we can expect to see much differentiation.

Differences by cognitive ability. Ability differences that lead to better performance are important to identify. By knowing whether there are specific abilities that correlate with performance or that impact process differences, instructional or training programs can be better targeted at real training needs. Also officers with unique aptitudes can be better matched to positions that benefit from their skills.

Fallesen, Carter, Perkins, Michel, Flanagan, and McKeown (1992) had pairs of officers analyze two courses of action and then justify their choice on tactical merits. The teams participated in one of three different groups. One group had no procedures specified. A second group followed a set of structured procedures. The third group followed structured procedures and had computer support available. Participants in the three groups were similar on several variables: type of branch they represented, command and staff experience, and computer experience.

Participants from the unspecified and structured groups were given nine and five subtests respectively from a battery of basic cognitive tasks (Complex Cognitive Assessment Battery [CCAB], Analytical Assessments, 1987). Three of the nine CCAB subtests had significant correlations with dependent task measures. A subtest called route planning, which is purported to measure the cognitive construct of "planning," correlated significantly with a measure of awareness of the tactical situation (better route planning, better situation awareness). Two other subtests correlated significantly with the outcome measure of solution justification (the higher the subtest scores, the better the justification). One of the subtests, called mark numbers, measures the cognitive constructs of "attention to detail" and "quantitative reasoning." The other subtest, called information purchase, measures "situation assessment" and "decision making" (as psychological constructs). The significant correlations suggest that certain cognitive constructs correspond to skills required for the tactical planning tasks of situation assessment and decision justification.

Summary. There appears to be a recurring trend across these individual difference studies that better planners were more likely to look for how plans could go wrong. There is an interesting contrast between the finding of no difference between military officers and college students with tactical symbols, and the finding of differences between these groups on other tactical tasks. This suggests there are basic aspects of tactical planning that require no particular special knowledge, but there are special requirements that do need to be trained.

Research is becoming more focused on individual characteristics of tactical and senior decision makers. In previous tactical planning research, individual characteristics were examined to categorize variability, while the current trend is a more deliberate approach to identify individual characteristics that could be responsible for high performance levels. Some examples of this change in focus are ARI studies. Research by Michel and Serfaty (1993) is trying to determine what command decision making expertise is and what characteristics promote expert performance. Jacobs (1993) is surveying both uniformed and civilian military senior executives to identify individual factors of expertise. A basic research project on tactical forecasting (R. E. Solick, personal communication, December 1992) is measuring individual characteristics to explore differences dues to cognitive styles.

There are relatively few studies that have addressed individual characteristics of officers in command and staff tasks. This is not surprising since qualities of personnel are often perceived as a sensitive area. This is unfortunate since style differences do not necessarily relate to more or less competence. Variation may represent just innate or preferred differences in information

processing, personality, or social styles. It would be surprising if lack of interest on individual differences continues. As the military builds toward a smaller Army, there should be increased effort to use personnel in the most optimal matter by developing, selecting, and assigning them to positions in the best manner possible.

Battle Success

The style and quality of how procedures are performed has been shown to have considerable variation. This variation in the procedures has led to different effects on battle outcomes. Many of the studies reviewed above did not attempt to relate the procedural performance with outcome performance. In these cases, there was not sufficient execution of plans to determine how they would turn out. In some of the cases, experts judged plan quality based on the likelihood of successful implementation. The type of relationships among process and battle outcomes are explored.

Staff characteristics related to effectiveness. There was an indication that individual differences are related to outcomes.

Carter, Lockhart, and Patton (1984) found that battle outcome was significantly related to several subjective factors of command group behavior. Battle outcomes had significant correlations with staff competence, functional integrity, and professional quality. Staff competence was defined as the degree to which the staff exhibited the knowledge, training, and experience in the performance of assigned tasks. Functional integrity was the adherence to the performance of assigned staff functions, and not infringing upon other staff member's functions. Professional quality was the degree to which the staff conformed to established Army doctrine, policies, and procedures.

Understanding related to effectiveness. A link with effectiveness was made above in the section on situation assessment. The following research summaries provide additional information on a relationship between understanding and outcome.

Ruscoe and Cary (1984) applied living systems theory to better understand "dynamic interdependent systems in the Army." They conducted surveys of six US Army armor battalions (741 key staff and 100 enlisted personnel) and assessed the relative efficiencies of information processing capabilities. They found that battalions spending more time acquiring and understanding information were also those who were independently scored as more effective. Effectiveness was scored based on personnel actions, strength levels, qualification results, and soldiers' feelings about their unit.

Fallesen, Carter, et al. found that unspecified procedures led to poorer understanding. Low understanding led to lower quality of solution (scored by the rationale for the decision). Structured process led to a deeper understanding and more likely better answer.

Quality of procedures related to effectiveness. Several studies showed no relationship between the experimental variables under investigation and outcome measures. These are the studies by Michel and Riedel and by Carter et al. (1984). Studies by Olmstead et al., CALL, Castro et al., and Lussier et al. (1992) did find a relationship among procedures and effectiveness.

Michel and Riedel (1988) found that different patterns of information usage did not have much impact on what tactical concepts were developed. Some planners preferred more detailed information and others preferred summary reports. The planners who relied on different formats of information and used information in different sequences generated similar concepts.

Carter et al. (4) reported on the observation of five battalion CPXs. They analyzed the

frequency of behaviors and had experts make judgments about qualitative variables. They found no significant correlation between staff processes and battle outcome. In addition Olmstead, Christensen, and Lackey (1973) found that the frequency in which procedures were invoked did not have a significant relationship to outcome.

Olmstead et al. found that the quality of performance of the procedures did lead to greater effectiveness. Olmstead found that less effective battalions had significantly lower process performance (correlation of .71) (from Project Cardinal Point; Olmstead, Elder, & Forsyth, 1978 cited in Olmstead, 1992).

A CALL observer (CALL, 1990) recorded that the failure of a Battalion Task Force to follow the planning process produced poor plans. The plans failed very early.

Castro et al. found that the limitations in the C2 process of the division they reported on hampered the success of the division or its subordinate units.

> *"Only 10% of the plans implemented survived for their intended time durations. . . . Contributing to this lack of stability was the fact that the division included no contingencies in the plans it developed during the exercise. . . . The division initially assumed the offensive, but was twice forced onto the defensive."* (p v)

Lussier (1992) found that requiring the students to use a concurrent comparison method did not improve solution quality. When an early decision method was used, much better solutions were produced. In other VARWARS research, Lussier, Solick, and Keene (1992) found that poor performance was induced by poor numerical estimates, insufficient analysis, ignoring analysis criteria, and failure to check for errors.

Summary. More competent and professional officers had more success in planning battles. Battalions who spent more time acquiring and understanding information were also those that were more effective. Better understanding by staff officers led to better solutions. Patterns of usage of tactical information do not relate significantly to battle success. Frequency of staff procedures also does not relate significantly to battle success, but units with higher quality of procedures did have greater success. Non-doctrinal procedures, such as an early decision method, also can lead to better solutions.

CONCLUSIONS

The findings consistently indicate there are disconnects between how the planning and Estimate process is prescribed in doctrine and training materials and how it is practiced. The sources included many types of environments:

- Actual combat decision making in the Israeli Defense Force (Geva, 1988a & 1988b).
- Surveys of Desert Storm commanders and staffs (Halpin & Keene, 1993).
- CALL (Appendixes C, D, and E) and ARI (Castro et al., 1992; Keene, et al., 1990) observations at NTC and BCTP.
- Interviews with battalion commanders who were TCDC graduates (Lussier & Litavec, 1992).
- Controlled laboratory or classroom studies that simulated tasks from the process (e.g., Andriole, et al., 1987; Fallesen, Carter, et al., 1992; Fallesen & Michel, 1991; Gieselman & Samet, 1980; Lussier, 1992; Michel & Riedel, 1988).

One concern readers might have with the results summarized here is the negative tone set with focusing on failures and problems. This perspective has been formed from the position that the way to enhanced quality is by understanding failures and acting to correct them. There is no solid indication represented here of the magnitude or frequency of the problems. But the problems that are identified here are not just rare occurrences or anomalies. There have been enough studies with a variety of methods and different environments to warrant that these issues be given serious attention.

In one controlled study (Fallesen, Carter, et al., 1992) it was determined that following a structured Estimate process led to more thorough understanding of the situation and to a more reasoned course of action selection. When the planners were not guided through the process, the process varied quite widely. However, the decision analytic process used in Estimate-enforced procedures was inefficient because there were no meaningful differences in war gaming measures (due to high variability, low confidence, lack of war gaming projections, and interactive factors). The selection of the preferred course of action was not aided by doctrinal guidance to delay making a decision until some arbitrary time or step in the process. Decisions about the concept are not driven by systematic procedures but by the goals, constraints, and knowledge of the situation. Planners need to converge on feasible solutions by ruling out alternatives and minimizing dangers.

The quality of procedures--not their frequency--was found to relate significantly to better outcomes. But as Olmstead has pointed out the flexibility of the procedures is important to adapt to the requirements of the situation. The individual experiences and knowledge of staff and the commander appear to be more critical to the outcome than adhering to a standard process. Procedures are needed since tactical planning is done in an organizational context. Procedures are one means to orchestrate the staff.

Since the organizations should not rely on routine, inflexible procedures and because of the complex and time-constrained nature of the problem, the process must be managed and applied in real time. Common variations to doctrine include failing to include required staff, lack of

commander involvement, uncontrolled shifting among tasks, and poor time management.

There are some important high level functions that transcend step-wise procedures. Maintaining an insightful, thorough, and continual understanding of the situation is one such function. Considering the correct factors in the right amount (neither too few or too many) with a propensity to verify assumptions, and the quality of information help establish a sound situation understanding. Interpretation of information and predictions are important to the extension of information and the understanding of complex and future (tentative) relationships.

To have an adequate understanding of the situation, the commander and staff must share information. Several accounts of poor performance have been tied to simple failures of coordination. This does not mean that all information should be shared, but information should be interpreted and filtered according to the needs of the mission and in consonance with the commander's intent.

The trend appears to be that better performers are more likely to look for how actions could go wrong in a prospective operation. There is also some indication that basic cognitive abilities are related to better tactical planning performance.

Besides the failures found in tactical planning, there is some doctrinal and training advice that seems undesirable or unproductive. If doctrine recognizes the need to have planning procedures that are more flexible, then those tasks, knowledge, and aptitudes that make a true difference in planning efficiency and effectiveness should be isolated from those things that do not predispose commanders and staffs to excel.

Advice to "remain unbiased" is somewhat empty. The decision making task is judgmental so it is impossible to be exclusively objective. For this guidance to be useful there needs to be detailed recommendations about what to do about biases. A decision analytic procedure is used to structure decision making and make it less prone to biases. However, the characteristics of decision analysis do not fit well with the complexity of tactical planning. The criteria are interdependent and are usually more complex than depicted by linear, additive models.

Getting rid of guidance which is uninformative would allow more emphasis on those aspects of the task that do matter. A better approach is to take a broad perspective on the development of the plan. Such a perspective would focus on considering the potential impact of as many factors as possible on the plan. Thoroughness and completeness of planning would also involve more emphasis on making optimal use of the staff. All staff specialties should be included to identify dangers and opportunities. This would include increased use of an enemy's perspective and planning to handle multiple reactions. Severe time demands conflict with increasing staff coordination on the plan. The solution may not lie in identifying some ideal procedures for the staff group to follow to resolve this issue. Instead the solution may involve identifying detailed synchronization and interactions among battlefield functional areas. Once identified these can be emphasized to a greater extent in cross-specialty education and training.

Another suspect guideline is to "avoid comparing one course of action with another during war gaming." The selection of a concept should not be regulated to a linear sequence of steps. To restrict the comparison of options to a step after separate evaluations have occurred would hinder the deep consideration of comparable attributes. In fact options are developed based on features that are distinguishable so one course of action is unique from another.

The concern with "drawing premature conclusions" is there would not be consideration of alternatives and outcomes. Advising planners not to make premature conclusions and having a sequential process suggests that if all the steps are followed then a good or satisfactory plan results. But one of two things are likely to occur. Either planners can become fixated on one course of action and spend most of their time working with that option or they spend so much time considering the merits of one course of action over another (or trying to distinguish among equally good options) that they run out of time to perform detailed planning.

The most efficient means may be to change the characterization of the task from tactical decision making or selecting a course of action to **planning**. Decision making is theoretically considered to be choosing among existing options. This is incongruous with a tactical planning representation where the focus is on formulating a workable plan and controlling it so it works. (Besides, if options already exist, they may not be desirable because they are likely to be readily apparent to the enemy.) The more focused the task can be on generating a feasible plan, the more likely the plan will succeed. Representing the task goal as planning instead of decision making does not suggest that decision making is not done. Planning switches the focus from methods to **optimize the selection** of a concept to **formulation of a fully workable plan** for executing the concept. Planning involves many inferences and decisions along the way, but a decision is not formalized as major process events or goals of the Estimate. Instead the focus is on complete feasible plans matching the goals of the mission and constraints of resources and the situation. The focus is on identifying what has to be accomplished, what limitations exist, what will happen in the future, and how to synchronize the force to execute the mission.

A shift from the teaching of tactical decision making procedures and the decisions commanders make to synchronized, coordinated planning procedures should encourage both subtle and remarkable enhancements to performance according to the research reviewed in this report.

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APPENDIX A

Research Summaries

Reference	Andriole, Black, Hopple, & Thompson, 1987
Task	Simulated task of generating and evaluating Corps plans.
Method	Think aloud protocols and observation. Qualitative assessment by author.
Subjects	Army War College, 3 COLs and 3 LTCs
Issue	To gain a better understanding of tactical planning and differences between ranks.
Findings	Colonels (COL) were more risk averse than lieutenant colonels (LTC). COLs have more certainty regarding adversary intentions. COLs were more deliberate (more options, more dimensions of value). COLs expressed considerably less confidence in their solution. COLs used a 'devil's advocate' role, while LTCs avoided structured challenges. COLs were more devoted to doctrine, perhaps a reflection of greater familiarity.

Reference	Badre, 1976
Task	Simulated task of tactical symbol recall.
Method	Controlled comparison: duration of recall for unit type, color, and location.
Subjects	12 military officers and 12 college students
Issue	To determine if differences exist in recall of structured, semi-structured, and unstructured patterns of symbols between experts and novices.
Findings	Tactically meaningful relations emerged as the elements of both expert and novice recall.

Reference	Brezovic, Klein, & Thordsen, 1990
Task	Armored platoon leader training exercises.
Method	A researcher observed while Armored Officer Basic students and instructor went through field training of vehicle movement and force on force tactics. Interviews were conducted afterwards about critical decisions.
Subjects	21 students and 9 instructors. The second lieutenants consisted of 6 ROTC graduates, 6 reserve component officers, and 9 USMA graduates.
Issue	To identify the types of decision strategies used by individuals with varying levels of experience. The interviews allowed direct contrasts between the experienced trainers and the new students for the analysis of situations and factors affecting the decisions.
Findings	A total of 57 decision points were identified and probed. The students were found to deliberate during option selection in approximately half of the decisions observed. The students also reported relying on analogues to select options in close to half of the decisions, but the use of analogues was found to range from helpful to disruptive in resolving decision situations. Poor performance by the students was consistent with their inability to imagine hypothetical situations, such as enemy actions, and the relationship between friendly and enemy tactics. The findings suggest that performance errors were due not to a limited ability to monitor situational cues but to the misinterpretation of the cues.

Reference	Burkette, 1990
Task	C2 focused rotation, BCTP war fighter exercise.
Method	Observations were collected from questionnaires completed by BCTP observer/controllers, opposing forces (OPFOR) operators, and focused rotation team observers.
Subjects	Division commander and staff in exercise.
Issue	To examine the division's C2 initiatives and C2 execution from a doctrinal perspective
Findings	The division never fully appreciated the planning time needs or windows. The division staff displayed little evidence of war gaming courses of action against enemy capabilities. One staff officer was seen trying to adjust the time line for actions that were already over come by events, only to realize that additional actions were missed before the first revision was completed. The division never achieved full synchronization because the staff was never able to finish a planning cycle. The commander did not believe in the doctrinal estimate process as presented in Chapter 5, FM 101-5 or in CGSC ST 100-9. His view was that the process is too formal and requires too much time under tactical conditions.

Reference	Carter, Lockhart & Patton, 1984
Task	Battalion command post exercises (CPX).
Method	Observation and recording of information exchange about command post personnel. Assessment by frequency of behaviors and experts judgment of soft variables.
Subjects	5 battalion command groups of 14 to 25 personnel each.
Issue	To attempt to relate command group effectiveness to behavior.
Findings	There was no significant correlation between staff processes and battle outcome. Battle outcome was significantly related to staff competence, functional integrity by staff position, and professional quality.

Reference	Castro, Hicks, Ervin, & Halpin, 1992
Task	Division command post exercise (CPX).
Method	[illegible]tion of ACCES during a 5 day division CPX.
Subjects	Division staff with two maneuver brigade headquarters organic to the division and a separate reserve component 'round out' brigade headquarters.
Issue	To assess the ACCES method.
Findings	The C2 processes did not support the division and its subordinate units to the extent required for success. The division staff was experienced but had some problems working together to analyze course of action and develop plans that provided the flexibility necessary to succeed against enemy reactions. As the exercise progressed, C2 continued to deteriorate, at least partially because of late or incomplete friendly and enemy status reports on which the staff depended for planning and analysis. Only 20% of the directives were issued early enough to be fully implemented at the intended time. On some occasions the division underestimated the enemy's combat capability when planning for an attack. Task organizations had to be changed often to bring sufficient power to bear against a stronger-than-anticipated enemy force. There were 23 COAs considered by the division that were utilized in preparing plans issued. Many COA analyses lacked at least one required element. Estimates of the probability of mission accomplishment and predictions of enemy reaction were most frequently missing. Apparently did not effectively use enemy situation assessments in the development of plans. Projections were far enough into the future but assessments were consistently incomplete. No more than two COAs were considered in the development of division plans.

Reference	Fallesen, Carter, Perkins, Michel, Flanagan, & McKeown, 1992
Task	Analyze two tactical courses of action for a mechanized division, select and justify one.
Method	Controlled comparisons of three conditions: unspecified procedures, structured procedures, computer-supported. Assessment by comparison of conditions, relative proportions, and expert judgment.
Subjects	14 pairs of Army officers were assigned to one of the conditions.
Issue	To relate cognitive abilities of planners to process and outcome performance.
Findings	One (route planning) of the 9 CCAB subtests correlated significantly with a pre-situation awareness measure (better route planning, better situation awareness). Two other subtests (mark numbers and information purchase) correlated significantly with the outcome measure on solution justification (higher subtest scores, the better the solution justification). Groups were equivalent in comparisons of type of branch they represented, command and staff experience, and computer experience.

Reference	Fallesen, Carter, Perkins, Michel, Flanagan, & McKeown 1992
Task	Analyze two tactical courses of action for a mechanized division, select and justify one.
Method	Controlled comparisons of three conditions: unspecified procedures, structured procedures, and computer-supported. Assessment by comparison of conditions, relative proportions, and expert judgment.
Subjects	14 pairs of Army officers were assigned to one of three experimental conditions.
Issue	To identify whether structured procedures lead to better process or decision performance, whether computer-supported performance was better than structured performance; planners' capabilities to follow procedures. Identify what procedures the unspecified teams would follow.
Findings	The structured process led to a deeper understanding and more likely better answer. The procedures appeared to force the structured (manual and computer-supported) teams to do a detailed enough analysis to make logical conclusions about the relative feasibility of the two COAs. Teams correctly identified only 22% of the expert-identified facts. Participants scored an average of only 54% correct on a multiple choice test of situation awareness. Five of seven participants, who answered incorrectly to a key question on where the Fulda River was fordable, were on the poorest scoring teams. The decision analytic method for selecting COAs is suspect. Process steps are performed poorly and variably. Means to perform some steps are unresolved. The structured process led to a deeper understanding and more likely better answer. The structured and computer-supported treatments led to significantly better justifications for COA selection than did the unspecified condition. Unspecified teams did not perform the task as those teams who were required to follow the procedural Estimate guidance. Unspecified teams left out steps, did not perform steps in as objective a manner as the structured teams, and repeated steps. Unspecified teams tended to refer more to standard Estimate training materials, apparently seeking procedural guidance. The use of structured procedures in both the structured and computer-supported conditions identified shortfalls in the Estimate process. To reduce the chance of biased analysis, the standard Estimate training materials recommend that a COA not be selected until al all COAs are independently evaluated and then compared. Thirteen of fourteen teams came to an early conclusion before what the Estimate indicates is the appropriate point. No penalty resulted to those teams making an early selection.

Reference	Fallesen & Michel, 1991
Task	CGSC Warrior Exercise - BCTP warfighter exercise.
Method	Observation of planning process of corps, divisions, and brigade staffs. Assessment by authors.
Subjects	Command and General Staff Officer Course (CGSOC) class.
Issue	To observe how command and staff procedures are managed, how commanders "see the battlefield," and how course of action planning is done, using issues from C2 focused rotation.
Findings	There was a success orientation, the focus was on action, not on predicting outcomes. Assumptions were challenged but nothing was done to resolve assumptions. The staffs were uncertain about procedures for planning handover/transition. There was no quantitative war gaming. There were no procedures for abbreviated estimate. The estimate process is inflexible when changes in the situation or mission occur. There was inadequate record-keeping and tracking of concepts during planning.

Reference	CALL (CALL observer, personal communication, 1990)
Task	NTC rotation.
Method	Observation of planning process of a battalion staff using a data collection instrument on the estimate process. Assessment by author.
Subjects	One battalion staff at NTC on 3 missions.
Issue	To test a data collection instrument, which addressed whether field performance of the estimate matches training and doctrinal descriptions.
Findings	Processes differed substantially between battalion execution and descriptions for training and doctrine. The observed processes led to poor battle outcomes.

Reference	Geva, 1988a & 1988b
Task	Retrospective review of three combat decision situations during the 2nd and 3rd days of the Yom Kippur War at the Suez Canal region.
Method	Historical analysis and retrospective interviews for 4 decision situations. Behaviros were coded into decision context, decision problem, social setting, time pressure, organizational pressure, combat consequences, information processing, and actual outcomes. Assessments by author.
Subjects	Information was collected from reports by commanders directly involved in the events (division and battalion commanders) and other printed sources. (Also one of the investigators was a company commander during the events.)
Issue	To explore ways to analyze tactical decisions.
Findings	There were variations in procedures or occurrence of consideration of alternative courses of action. In three cases there were indications of more than one alternative course of action. Only in the second case the alternatives were compared prior to casting the decision. In all other cases, the first raised alternative was adopted as the decision. Alternatives emerged later, either when the original alternative was reported or perceived unfeasible.

Reference	Gieselman & Samet, 1980
Task	Participants read a description of a tactical scenario and 30 enemy situation messages about a border crossing and attack, and then produced a summary.
Method	Participants' summaries were evaluated by 5 knowledgeable military analysts. Experts categorized the summaries as either good or poor.
Subjects	16 Army staff officers from infantry, armor, and field artillery branches with a minimum rank of major.
Issue	To assist in the development of guidelines for summarizing tactical intelligence data.
Findings	One major difference between good and poor summaries was the dynamic portrayal of the enemy situation. Whereas the good summarizers discussed unit movement behind the border in terms of reinforcements for engaged enemy units, the poor summarizers discussed enemy movement in terms of proximity to the border. The summaries rated poor contained less emphasis on unit movement and less meaningful information integration. There were two major inferences: probable point of main thrusts and location of second echelon. Guidelines should recommend stating what the intelligence means in terms of the enemy situation; summaries should be organized by zone, sector, or area of enemy concentration; reliability of the information should be estimated; and what key information is not known should be stated explicitly.

Reference	Halpin & Keene, 1993
Task	Respondents completed one of three forms of a survey.
Method	A total of 2,463 usable surveys were returned. Assessments were made by relative proportions of responses.
Subjects	Respondents included 6 general officers, 34 colonels, 170 lieutenant colonels, and 11 sergeant majors from 12 divisions or separate brigades and 62 corps or echelon-above-corps elements.
Issue	To collect data from participants in Operations Desert Shield and Storm.
Findings	84% (1396/1667) responded that "yes" they felt that the current estimate process was adeq[illegible]; 6% indicated that they did not or did not need to abbreviate the estimate. Some of these indicated that they didn't have time to conduct an estimate after passing the line of departure and that commanders decided without staff input. 85% of staff personnel (1459/1717) felt that the orders gave them adequate time to prepare for operations.

Reference	Hamm, 1991
Task	Participants read a description in which a commander had to respond to a situation. Two situations were used, one about a response to a crashed helicopter, the other about an attack across a river.
Method	The situation descriptions were varied between participants to manipulate the probability of mission success. (The enemy was said to be at 50%, 70%, or 90% strength.) Also the tone of the descriptions was varied by changing the description of the situation and the character's feelings and remarks.
Subjects	294 students of Command and General Staff College and 154 undergraduate college students.
Issue	To test the expressions of probability and relative importance of various factors that potentially determine the outcome of battles and to compare student and military groups on probability assessments.
Findings	Judgments of probability of mission success were not sensitive to different enemy strengths. College students judged probability of success higher than military officers, perhaps because of military officers being trained to be critical of how plans can fail.

Reference	Kaplan, 1980
Task	Battalion command post exercise (CPX).
Method	Battalion staff were briefed by their brigade counterparts and then worked for 3 to 4 hours to develop plans to present to their company commanders. Significant items of information were formulated into a recall test. Assessment by relative proportions and expert identification of importance.
Subjects	13 battalion groups each participated in performing CPX tasks.
Issue	To identify the amount of information that was recalled and presumably acquired.
Findings	A substantial amount of information was lost in the process of communication and remembering. The battalion remembered 81% of the information presented to them. They recalled only 63% of information available from other battalion staff. Recall on the 6 poorest channels varied from 17 to 37%.

Reference	Keene, Michel & Spiegel, 1990
Task	6 division and 1 corps command post exercises (CPX).
Method	Data from seven ACCES applications were used to compute means and variability. Measures were assessed for consistency.
Subjects	Commanders and staffs from 6 division and one corps CPX.
Issue	To review data across applications of ACCES, determine patterns and trends, and assess ACCES measures.
Findings	The mean plan cycle time (time that the need for a decision was perceived and actual dissemination of the decision) for divisions was 36 minutes. Understanding time was 13 hours. All divisions had high scores on Plan Consistency, the degree to which the Commander's guidance was incorporated into the operations plan. Scores were generally high on Plan Lead Time Adequacy, the frequency with which to adhere to the doctrinal 1/3 - 2/3 rule for dissemination of orders. Plans were generally unaffected by the unit's monitoring errors. Understanding completeness and prediction completeness were relatively low. This means that the understanding and predictions were not completely or fully briefed.

Reference	Kristiansen (D. Kristiansen, personal communication May 1988)
Task	Echelon above corps (EAC) command post exercise (CPX).
Method	Observation. Assessment by commander.
Subjects	Theater battle staff and commanders.
Issue	To determine how feedback during after action reviews could be improved.
Findings	The Commander was constantly asking questions about 'what does this mean for us, what can I do about that, what do you mean by that?' For example, at one point the commander was told that [the] Corps would run out of tank main gun ammo in 1.5 days. The briefer then started to go on to a new point. The commander stopped and asked him who in [the] Corps would run out, where were they, what could he do to get some ammo to them, could he 'rob Peter to pay Paul'. No one had answers. It was as though their job was to report the information, not analyze it and come up with alternatives.

Reference	Krumm, Robins, & Ryan, 1973
Task	A division operations officer was required to write a defense plan for a division sector against the attack of two enemy divisions.
Method	Scoring standards were based on lesson plans from CGSC. Assessments by frequency of occurrence of behaviors.
Subjects	20 senior field grade officers all with combat experience in World War II, Korea, or Vietnam.
Issue	To develop and evaluate a method for scoring the tactical decision making process.
Findings	Measures of the decision making behaviors were highly correlated with the criterion score. The combination of four predictors, experience, ability, information use pattern, and significant facts had a correlation of .86 with the standard solution.

Reference	Leddo, Chinnis, Cohen, & Marvin, in publication
Task	Analyze 3 courses of action for a mechanized division and make a final recommendation.
Method	Officers performed the task separately. 7 officers were given 45 minutes for their analysis and the other 6 were given unlimited time. Information was collected on the information used, analysis methods, and final choice. Assessment was by comparison of conditions.
Subjects	13 LTCs from CGSC.
Issue	To identify differences due to time stress.
Findings	The available time led to different processes. No stress planners consulted more sources of information, spent more time on information that was relevant to resolving uncertainty, and used more analysis methods.

Reference	Lussier, 1992
Task	VARWARS group resource allocation problem.
Method	Experiment 1: 12 member class sections were assigned to one of four conditions: no-help, low-help (written description about the six step problem solving process), medium-help (same written descriptions plus detail on how to apply the process), and high-help (same written and process descriptions plus content specific information for the VARWARS problem). Experiment 2: All groups had to select a course of action early within a set time.
Subjects	Combined Arms Services Staff School (CAS3) students. Exp 1: 19 class sections in each of the no-help, medium-help, and high-help conditions. 16 groups in the low-help condition. Exp. 2: 33 groups.
Issue	Exp. 1 addressed whether controlled use of the concurrent option comparison method improved solution quality. Exp. 2 addressed whether a structured Early Decision process improved solution quality above the concurrent or other natural methods.
Findings	Exp. 1 showed that the likelihood of using the concurrent method could be increased somewhat but that this did not improve solution quality. In Exp. 2 the Early Decision method was found to produce much better solutions than either the naturalistic or concurrent problem solving methods. Recommendations are made to match the method to the demands of the situation. Factors determining whether an early decision method should be used include the relationship between the choice and the outcome, availability of good solutions, possibilities of mistakes in implementation, level of expertise, ability to discriminate among choices, and time and effort constraints.

Reference	Lussier & Litavec, 1992
Task	Respondents completed surveys and answered interview questions.
Method	Surveys and interviews of Battalion Commanders who did and did not attend the Tactical Commanders Development Course. Assessments based on ratings by commanders and authors' appraisals of interviews.
Subjects	48 battalion and squadron commanders returning from NTC, JRTC, or Desert Storm. 25 were TCDC graduates.
Issue	To assess the relative adequacy of TCDC and find improvements.
Findings	Respondents felt that the military decision making process is good only for teaching. The application of the process is not standard. There is insufficient guidance about how to tailor the process.

Reference	Lussier, Solick, & Keene, 1992
Task	VARWARS is a group planning and resource allocation problem where a group divides into teams to work on aspects of acquiring, staffing, and scheduling for use of a hypothetical training device.
Method	VARWARS is objectively scored based on the efficiencies of purchase, staffing, and scheduling decisions. Ratings are made of processes. Exp. 1 compared entrants with graduates. Exp. 2 assessed the performance of students halfway through the course. Exp. 3 compared mixed to intact groups.
Subjects	Exp. 1 had 11 entrance and 11 graduate groups. Exp. 2 used 6 groups. Exp. 3 used 6 intact and 6 mixed groups.
Issue	To develop a test to measure group problem solving abilities and to compare performance of CAS3 entrants with graduates.
Findings	Graduates did not use the problem solving methods taught and performed worse than entrants. Midcourse groups did not perform significantly different from the entrants or graduates. Mixed groups performed better than the intact groups. On process performance most groups performed poorly in identifying subproblems and solution procedures, in developing alternate courses of action, and in time management. Generally, they developed poor estimates, performed insufficient analyses, ignored critical analysis criteria, and failed to check for errors.

Reference	MacMillan, Entin, & Serfaty, in publication
Task	Three of four division tactical scenarios set in the Persian Gulf were presented to subjects who had to develop a tactical plan, intent, and messages for subordinate and lateral commanders. They were allowed to ask questions and asked to provide rationale for their plans.
Method	Three super experts (retired general officers) judged the quality of the written materials and the video-taped processes and non-domain expert observers coded various behaviors proposed to differentiate among levels of expertise. Correlations between expert judges and observers were computed.
Subjects	26 military officers participated acting as division or brigade commanders.
Issue	To demonstrate that command decision making expertise can be recognized by domain experts; differences in expertise can be identified under conditions not fully replicating the real world; observers can recognize behaviors predicted by a mental-model theory about expertise.
Findings	Experts generated initial COAs that were more detailed. Experts focused immediately on critical unknowns and asked the right questions to develop the COAs. Experts built and used a richer mental model (took account of sequencing and timing of events, more likely to use maps as a visualization tool, perceived the initial tactical situation as more complex, realized that inadequacies of time and information to solve the problem, sees more complexity in the situation). Experts were more likely to mention their concern about outcome risks. Experts identified more potential problems. Experts were less confident about the outcomes. Experts had contingencies in their plans. Experts planned for changes in the tactical situation.

Reference	Metlay, Liebling, Silverstein, Halatyn, Zimberg, & Richter, 1985
Task	Battalion command post exercise (CPX).
Method	Coding of behaviors viewed from videotapes. Assessment by relative proportions of the frequency of behaviors.
Subjects	Five battalion command groups on the first and last days of five day exercise.
Issue	To test a staff behavior coding scheme and to identify the frequency of behaviors. 32 behaviors were identified that discriminated among performance.
Findings	Four of 10 commanders had low involvement. Five of 10 commanders discussed their estimate, mission concept, and presented decisions. None of the 10 staffs presented formal plans to the commander for approval. During OPORD briefings 97% of the briefers presented facts, 76% referred to mission objectives, 41% made predictions and inferences, and only 8% presented conclusions.

Reference	Michel & Riedel, 1988
Task	Simulated task of division tactical course of action development and evaluation.
Method	Controlled comparison: between instructors and students in patterns of information use.
Subjects	8 CGSC instructors (lieutenant colonels) and 8 students (majors).
Issue	To test for differences in patterns of information use and courses of action between experts (instructors) and novices (students). To investigate the effects of expertise, cognitive style, and mission on the information used and to see how it contributes to the decision making process.
Findings	Different patterns of information use did not lead to different solutions. The variable process led to no differences in decision. Instructors used less information than did the students and the information used by instructors consisted of more summary information and less detailed information. The typical participants first looked at the mission requirements and commander's guidance plus the status of own forces. He then studied terrain and the enemy forces. He then went back to look at supporting data, taking them in order, beginning with personnel. Finally, he returned to the operations or intelligence data to confirm information important to the concept he was developing.

Reference	Olmstead, Christensen, & Lackey, 1973
Task	8 hour role simulation of a light infantry battalion command post engaged in combat operations.
Method	The content of communications was analyzed for quality of process performance and the organization was evaluated for military effectiveness. Assessment by authors. (Project FORGE)
Subjects	10 12-man groups of Vietnam experienced Army officers, from first lieutenant to senior major.
Issue	To better understand the human element in C2 activities and their contributions to organizational responsiveness, flexibility, and effectiveness.
Findings	There was an average of 1377 contacts across groups. Organizational effectiveness requires high levels of flexibility in procedures. Frequency of procedures was not as important as the quality of procedure or individual competence. Formal procedures were imperative or effective functioning, but over-reliance upon standardized responses led to rigidity; effectiveness required high levels of flexibility.

Reference	Olmstead, Elder, & Forsyth, 1978 (cited in Olmstead, 1992)
Task	Command post exercise (CPX) using Pegasus battle simulation. (Project Cardinal Point)
Method	Battalions performed a different module each day for four days. Competence scores could vary from 28 to 112 points. Organizational competence was defined as the adequacy with which an organization performs critical processes.
Subjects	2 battalions operated simultaneously on 5 occassions, and other times 2 other battalions operated separately.
Issue	To verify relationship between combat outcomes and process performance found in Project Forge.
Findings	Less effective battalions had significantly lower process performance. Process performance correlated .71, $\alpha < .01$, with combat effectiveness. Results of Project Forge were verified and validated the competence model of battle staff performance.

Reference	Powell & Schmidt, 1989
Task	Simulated planning exercise by players assuming the roles of corps commander and G3.
Method	Verbal protocols. Assessment by authors.
Subjects	Two Colonels who were students at the Army War College.
Issue	To identify a model that characterizes the high-level control cycle of expert planners.
Findings	The experts were observed developing - at most - two alternative plans. The second alternative was a revision to the first plan; a result of backtracking. The second plan violated guidance the participants were given; they recognized this. One striking aspect of the protocol for this planning problem was the interleaving of the task of subproblem formulation with the tasks of subproblem decomposition, plan critiquing, and plan repair.

Reference	Ruscoe & Cary, 1984
Task	Surveys.
Method	Surveys were based on living systems theory. Comparisons were by battalions' effectiveness ratings (based on personnel actions, strength levels, qualification results, and soldiers' feelings).
Subjects	100 E1-E6 and 741 staff personnel from 6 US Army armor battalions.
Issue	To develop an understanding of dynamic interdependent systems in the Army and to measure the relative efficiencies of information-processing capabilities of armor battalions.
Findings	The more effective battalions tended to devote a greater proportion of their time to 'input transducing', less effective battalions spent more time 'encoding' and 'output transducing'. The more freely information flowed within the chain of command, the more effective the battalion. The commanders of the high effectiveness units allowed their staffs to make many routine decisions under their supervision while the commanders of the less effective units often made many of the decisions within their units.

Reference	Shaw & Powell, 1989
Task	Cascade Polar command post exercise (CPX).
Method	Observation and assessment by authors.
Subjects	Division staff.
Issue	To observe command post behaviors.
Findings	The observed planning procedures were variable. Failures in planning included: rarely looked at battle from enemy perspective - what they would learn, rarely computed probability of own success, rarely planned observation of enemy response, and rarely assessed prediction quality about enemy.

Reference	Thordsen, Galushka, Klein, Young, & Brezovic, 1989
Task	ARTBASS battalion command post exercise (CPX) at Fort Hood.
Method	Observation, audio recording, mapping, and coding of recognition primed decision making (RPD) type behaviors. Assessments by frequency of occurrence of behaviors.
Subjects	Subset of command group.
Issue	To determine the extent that RPD occurs. Identify other lax planning behaviors.
Findings	There was a lack of management of the planning process. Information acquisition was more passive than active. 26 of 27 decisions did not follow a doctrinal process of generating and concurrently evaluating multiple options.

Reference	Thordsen, Klein, Michel & Sullivan, 1991
Task	CGSOC A399 course elective exercise.
Method	Rapid application of the progressive deepening charting method. Assessments by authors.
Subjects	CGSOC A399 students.
Issue	To determine whether RPD behaviors can be observed and recorded rapidly for classroom feedback.
Findings	Concurrent comparison of options did not take place. Most deliberation of options was serial. Other weaknesses were observed in the staff process.

Reference	Tolcott, Marvin, & Lehner, 1989
Task	Intelligence specialists were given information relating to an evolving combat situation and had to indicate the most likely enemy avenue of approach and reconsider their decision after updates.
Method	Updates contained 3 items supporting a northern AOA, 3 supported a southern AOA, and 9 were neutral. 4 teams were each assigned 3 scenarios, whereby enemy forces le- :d to the north, south, or center.
Subjects	Subjects consisted of 18 captains and 3 first sergeants who were Army Intelligence School students.
Issue	To determine the cognitive behavior of intelligence analysis, the effects of early decisions on the interpretation and utilization of subsequent information.
Findings	Regardless of the specialists' initial hypothesis of main enemy approach from north, south, or center, confidence was generally high and tended to increase as the situation evolved. Confirming evidence was sought, and was weighted significantly higher than disconfirming information. Contradictory evidence was usually recognized as disconfirming, but was weighted lower than supportive evidence, was often regarded as neutral, and sometimes as deliberately deceptive. Analysts with more experience predicted confirmatory events; their occurrence had a strong positive effect while their nonoccurrence led to further expectations and, later, lowering of confidence. Familiar ("available") classes of information played a large role in decisions; graphic/intuitive approaches were more common than tabular/analytic ones. Base rates were largely ignored in dealing with uncertainties. Analysts appeared to model the situation based on early information, and to account for new information in terms of consistency with this model.

APPENDIX B

Selected C2 Army Lessons Learned Management Information System (ALLMIS) Observations (1986-1989)

Selected C2 Army Lessons Learned Management Information System (ALLMIS) Observations (1986-1989)

Obs No.	Year of record	Location of observation	Echelon(s)	Summary of Finding
Management of the Process				
1	1986	NTC rotation	Bde - Bn TF	Staff interaction was often haphazard.
2	1987	NTC	Bde - Co	Poor planning requires Commander to make fixes.
3	1987	NTC Bde	Bde - Bn TF	Staff planning process was not used.
4	1988	NTC rotation	Bde - Co	Planners merely executed checklists, there was no planning.
5	1988	NTC rotation	Bn TF	Weak staff planning procedures.
6	1988	NTC rotation	Bde - BN TF	Need staff matrix for staff coordination.
7	1988	NTC rotation	Bde - Co	Not enough time to perform all planning steps, need abbreviated process.
8	1989	NTC rotation	Bn TF	Engineers and fire support officer are not included early in planning.
9	1989	NTC rotation	Bn TF	No standard technique for synchronization of the 7 battlefield operating systems.
10	1989	NTC rotation	EAC - BN TF	Executive officer did not orchestrate.
11	1989	NTC rotation	EAC - Bn TF	Did not follow a doctrinally recognizable planning process.
12	1989	NTC rotation	Bde - Bn TF	Brigade used war gaming but not all staff was involved.
13	1989	NTC rotation	Bde - Bn TF	Battalion Commander did not war game; result was surprise by enemy actions.
14	1989	NTC rotation	Bde - Bn TF	The Commander did not give a restated mission.
15	1989	NTC rotation	Bde - Co	Planning time discipline (1/3) must be addressed in detail and applied to rehearsals and execution.
16	1989	NTC	Bde - Bn TF	DS Battalion Commander was not present during war gaming and planning.
17	1989	NTC rotation	Bde - Bn TF	Need to deal with present and future operations simultaneously.
Analysis/Situation Assessment				
18	1987	IST visits	Div - Bde	Staff neglects OPFOR doctrine and METT-T analysis.
19	1989	NTC rotation	EAC - Bn TF	S3 worked with only limited input.
20	1989	NTC rotation	EAC - Bn TF	Poor terrain analysis.

Generation of alternatives				
21	1987	NTC	Bn TF	Staffs routinely have problems with fires coordination, depth and sighting of obstacles, and use of terrain.
22	1989	NTC	Bn TF - Co	Courses of action were considered, but only one was developed.
23	1989		Bn TF	Many war gaming options were not recorded and were subsequently lost.
24	1989	NTC rotation	EAC - Bn TF	Options not recorded; should use decision support template.
25	1989	NTC rotation	Bde - Bn TF	Detailed contingency planning and control graphics are needed.
Evaluation and comparison of alternatives				
26	1989	NTC rotation	EAC - Bn TF	Very limited war gaming.
Plans, Synchronization, and Orders				
27	1989	NTC	Bn TF - Co	Deception not considered.
28	1988		EAC - Bde	Plans were ever-changing partial solutions. Key functional requirements were underestimated.
29	1989	NTC rotation	Bn TF	No standard technique for synchronization of 7 battlefield operating systems.
30	1989	NTC rotation	Bde - Bn TF	Full synchronization was not achieved, had individual matrices.
31	1989	BCTP	EAC - Div	Poor reconstitution planning.
32	1989	NTC rotation	Bn TF	Obstacles are sighted before Commander's intent is known.
33	1988	JRTC rotation	Bn TF - Co	Incomplete dissemination of orders information.

APPENDIX C

Performance Trends From Combat Training Centers

Performance Trends from Combat Training Centers
Compiled by CALL in 1992

	Battlefield Operating System	Locations	Percent of obs.	Findings
1	Maneuver	NTC JRTC CMTC	66	of company and teams did no direct fire planning.
2	Fire support	NTC	68	of missions are conducted without a clear understanding of the maneuver commander's intent for fire support; intent statement may not be clear.
3	Fire support	NTC JRTC CMTC	79	of task forces do not conduct thorough fire support rehearsals.
4	Fire support	NTC	70	of the fire support plans do not support the maneuver commander's scheme of maneuver.
5	Air defense	CMTC	62	of ADA assets do not achieve the commander's intent.
6	Air defense		90	of the units do not template enemy air avenues of approach.
7	Command and control	NTC JRTC CMTC	59	of brigades, battalion task forces, and company/teams do not track the battle timely and accurately, creating predisposing conditions for fratricide and not knowing available combat power.
8	Command and control	NTC JRTC CMTC	•	Maneuver commanders often hesitate to use forces at their disposal to weigh the designated main effort.
9	Command and control	NTC JRTC CMTC	•	The ability of task force staffs to foresee events on the battlefield, through war gaming, is not understood or completed in sufficient detail.
10	Intelligence	NTC JRTC CMTC	73	of the reconnaissance and surveillance plans are uncoordinated, unmanaged, and unfocused.
11	Intelligence	NTC JRTC CMTC	•	Intelligence reporting is often inaccurate, incomplete, and untimely.
12	Intelligence	NTC	•	S2s have a tendency to describe the threat in broad, general terms that makes no tactical contribution to mission analysis or course of action development. They do not describe details of how the enemy would fight upon contact.
13	Intelligence	CMTC	•	IPB is not conducted to standard because the S2 is usually the only staff officer actively involved in its development.
14	Intelligence	NTC JRTC CMTC	•	Once combat information is received there is little sharing.

15	Intelligence	NTC	•	S2s rarely play the uncooperative enemy during war gaming sessions and rehearsals.
16	Mobility and survivability	NTC CMTC	•	Combined arms breach operations are poorly planned, rehearsed and executed.
17	Mobility and survivability	NTC JRTC	•	Obstacles are not integrated effectively into engagement area development to achieve the maneuver commander's intent.
18	Mobility and survivability	NTC JRTC	•	Engineer assets are not effectively used during rotations.
19	Mobility and survivability	NTC JRTC	•	FASCAM planning is ineffective. Intent and execution criteria are not established in synchronization, orders, or decision support matrix.
20	Mobility and survivability		66	of engineer company commanders cannot properly conduct battlefield assessments.
21	Combat service support	NTC JRTC CMTC	21	of the casualties die of their wounds because of faulty evacuation plans.
22	Combat service support	NTC	•	Planning for FARPs has been substandard. Units do not allow sufficient time for planning and do not consider personnel and equipment limitations.
23	Combat service support	NTC JRTC CMTC	•	CSS is rarely considered when staffs develop a field artillery support plan.

• Percentages are not available.

APPENDIX D

Performance Trends From Battle Command Training Program

Performance Trends From Battle Command Training Program
Compiled by CALL in 1992

C2 Processes	Percent	Findings
Planning	75	of units incorrectly predicted the outcome of close operations.
Planning	75	of units did not develop concepts for future operations.
Planning	64	of unit plans were unsatisfactory.
Directing	73	of units did not issue correct fragmentary orders.
Directing	78	of unit orders were technically incorrect.
Controlling	58	of commanders and staff were not present at key points on the battlefield.
Controlling	53	of units did not use IPB products to develop contingency plans.
Coordinatin	76	of staffs did not develop viable plans nor conduct parallel planning.

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